Status and sustainable use of mahogany in Central America

Report of a Nicaraguan study and a regional coordination workshop

FAUNA & FLORA International
Conserving wildlife since 1903

Global Trees Campaign

Gobierno Bolaños ¡Nueva Era!

Instituto Nacional Forestal
INAFOR

MARENA
Ministerio del Ambiente y los Recursos Naturales Nicaragua

defra
Department for Environment Food and Rural Affairs

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From the American People

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Fauna & Flora International (FFI), founded in 1903 and the world's first international conservation organization, acts to conserve threatened species and ecosystems worldwide, choosing solutions that are sustainable, are based on sound science and take account of human needs.

The Global Trees Campaign is a joint initiative developed by FFI and the UNEP World Conservation Monitoring Centre in partnership with a wide range of other organizations around the world. The aim of the Campaign is to save the world's most threatened trees and the habitats in which they grow through the provision of information, delivery of conservation action and support for sustainable use.

Sponsors

The project *Current situation and harmonization of procedures for the sustainable use of mahogany* Swietenia macrophylla *in Central America* was supported by the Flagship Species Fund of DEFRA (the UK Government Department for Environment, Food and Rural Affairs). Additional support for the regional workshop was provided by the US Agency for International Development, and for publication of this report by the telephone recycling scheme run by Foneback in conjunction with Vodafone, also through the Flagship Species Fund. Generous support from all these organizations is gratefully acknowledged.

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Contents

List of acronyms

AAC	Annual Allowable Cut
AFE-COHDEFOR	Forest Administration of the Honduran State Corporation for Forest Development (Honduras)
ANAM	National Environment Authority (Panama)
CATIE	Tropical Agricultural Research and Higher Education Center
CCAD	Central American Commission for Environment and Development
CEDOC	Documentation Centre (Nicaragua)
CELOS	Surinam Agricultural Research Centre
CETREX	Export Promotion Centre (Nicaragua)
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CONAFOR	National Forestry Commission (Mexico)
CONAP	National Council for Protected Areas (Guatemala)
CoP	Conference of the Parties
DBH	Diameter at Breast Height
DGA	General Directorate of Customs (Nicaragua)
DIGEPESCA	Directorate General of Fisheries and Aquaculture (Honduras)
DOF	Official Journal of the Federation (Mexico)
FAO	Food and Agriculture Organization of the United Nations
FSC	Forest Stewardship Council
GFMP	General Forest Management Plan (Nicaragua)
INAFOR	National Forest Authority (Nicaragua)
INRENA	National Institute for Renewable Resources (Peru)
INRENARE	Institute for Renewable Natural Resources (Panama)
INTECFOR	National Technical Forestry Institute (Nicaragua)
IRENA	Institute for Natural Resources and Environment (Nicaragua)
ITTO	International Tropical Timber Organization
LGDFS	General Law for Sustainable Forest Development (Mexico)
MAGFOR	Ministry of Agriculture, Livestock and Forestry (Nicaragua)
MARENA	Ministry of Environment and Natural Resources (Nicaragua)
MCD	Minimum Cutting Diameter
MIFIC	Ministry of Finance and Trade (Nicaragua)
MMP	Minimum Management Plan (Nicaragua)
NAWEG	North American Wildlife Enforcement Group
NDF	Non-detriment Finding
NGO	Non-governmental Organization
NHLA	National Hardwood Lumber Association (USA)
PROFEPA	Federal Environment Protection Office (Mexico)
PROFOR	Program on Forests (International)
RAAN	Northern Atlantic Autonomous Region (Nicaragua)
RAAS	Southern Atlantic Autonomous Region (Nicaragua)
SAG	Agriculture and Livestock Secretariat (Honduras)
SEMARNAT	Environment and Natural Resources Secretariat (Mexico)
SIG	Geographic Information System
SINIA	National System of Environmental Information of Nicaragua
SIRCOF	System of Registration and Control of Forest Operations (Nicaragua)
TRAFFIC	Trade Records Analysis of Flora and Fauna in Commerce
WWF	World Wide Fund for Nature

Executive summary

In 2002 mahogany *Swietenia macrophylla* was listed on Appendix II of CITES. Under this listing, producing countries are required to verify that any mahogany for export has been obtained legally and in a manner that is non-detrimental to the survival of the species. This is done through making a non-detriment finding prior to issuing an export licence. In order to assist in implementation of the Appendix II listing, the International Tropical Timber Organization organized a workshop in Peru in 2004, with the aim of encouraging and informing practical action in respect to the formulation of non-detriment findings for mahogany, focusing on the three largest mahogany producers: Bolivia, Brazil and Peru.

Building on the success of this workshop, the Government of Nicaragua (the fourth largest mahogany producer) and Fauna & Flora International developed a project to promote the sustainable management of mahogany in Central America. The project, which was supported by the Flagship Species Fund of the UK Department for Environment, Food and Rural Affairs, the US Agency for International Development and the Vodafone Foneback scheme, comprised two components: (i) a detailed diagnostic study of the status of mahogany in Nicaragua and its sustainable management, and (ii) organization of a regional workshop to evaluate the status of mahogany in each country and to establish a base for the regional harmonization of procedures and the development of combined actions for the sustainable use of the species.

This report, which has been compiled and edited by Fauna & Flora International, presents a synthesis of the diagnostic study of mahogany in Nicaragua, and a summary of the information presented and discussions held at the regional workshop.

Within Nicaragua, it is clear that mahogany is declining both in its natural range and in the volumes available for commercial use. The species has almost disappeared from open hardwood forest throughout the country, and is very reduced in closed forest in three departments within its former range (Matagalpa, Jinotega and Rio San Juan). In the areas where it does still occur, there is a concentration of volume in trees of lower diameter and a general deficiency of large trees. Mahogany harvesting in Nicaragua is carried out in areas managed under approved General Forest Management Plans or (for areas under 50 ha) Minimum Management Plans. Illegal logging is a significant problem, apparently often carried out in areas managed under Minimum Management Plans where the requirements are less strict.

Recommendations from the Nicaraguan study include carrying out a forest inventory in mahogany-containing areas as soon as possible, in order to establish sustainable harvesting quotas at the regional and municipal levels. A simple methodology for determining an annual logging quota, as a basis for development of a non-detriment finding, is proposed in the study. Other recommendations include examining the possibilities of increasing the national minimum cutting diameter for the species and of authorizing mahogany harvesting only in areas under General Forest Management Plans. Added-value processing for mahogany products needs to be encouraged, and the commercial utilization of a wider range of species supported, in order to increase the revenue gained from sustainable forest management.

The regional workshop, which was held in Managua, Nicaragua on 23-24 November 2004, included presentations from several mahogany range states in Central America on the status of the species nationally and the procedures in place that regulate its use. Working group discussions focused on four themes: (i) forest management and inventories, (ii) capacity building, (iii) communication and coordination, and (iv) regional harmonization. There was a great deal of support for further regional harmonization and collaboration, and the development of a regional workplan with annual regional coordination meetings was proposed. The methodology put forward in the Nicaraguan study for a rapid assessment of mahogany stocks and development of an annual logging quota was welcomed and other countries expressed interest in using it to derive their own quotas. The need for capacity building amongst forest stakeholders to increase their involvement in mahogany management and for improved communication between countries, possibly through establishment of a web-based mechanism, was also noted.

Introduction

Swietenia macrophylla is a tropical tree, one of three species in the American genus *Swietenia* (along with *S. humilis* and *S. mahogoni).* The natural distribution of *S. macrophylla* is Belize, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Peru and Venezuela.

After decades of heavy exploitation for timber, *S. mahogoni* and *S. humilis* are at or near commercial extinction through much of their ranges. *S. macrophylla* is now the most important source of the much sought-after mahogany timber, but it too is showing signs of population decline and fragmentation in much of its range.

The primary producers and exporters of *S. macrophylla* (also known as big-leaf mahogany) are Brazil, Peru, Bolivia and Nicaragua, with the major importers being the USA, Canada, the Dominican Republic and the European Union (particularly the UK, Spain, Germany, the Netherlands and France).

Mahogany and CITES

Concern over the status of big-leaf mahogany (hereafter referred to as mahogany) led Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to consider listing it on Appendix II of the treaty. Proposals for an Appendix II listing were considered at the Conference of the Parties (CoP) meetings in 1992 (Kyoto), 1994 (Fort Lauderdale) and 1997 (Harare).

Although none of these proposals was accepted, several countries did list their populations on Appendix III: Costa Rica in 1995, Bolivia and Brazil in 1998, Mexico in

Box 1: **Recommendations of the 14th Plants Committee (Windhoek, 2004) in relation to mahogany**

Management plans: The development and official approval of mahogany management plans at the national and sub-regional levels is considered to be a priority.

Inventories: It is important to promote forest inventories and to further and promote programs to determine and monitor the distribution of mahogany, its population numbers and its conservation status.

Training: It is necessary to develop training programs on the monitoring and management of CITES processes and documents.

Working groups: Mahogany working groups should be established in the range states.

International cooperation: It is recommended that the country Parties, the CITES Secretariat, international organizations and non-governmental organizations should explore ways of sharing information through regional workshops, training programs, exchange of experiences and identification of financing sources, among others.

1999, and Colombia and Peru in 2001. These Appendix III listings required that internationally traded mahogany in the specified product categories (logs, sawnwood, veneer sheets, plywood) needed to be accompanied by export permits from those range states or by certificates of origin from other countries.

At CoP10 (Harare, 1997), Bolivia, Brazil and the USA (the largest importer of the timber) agreed to form an informal working group to examine the status, management and trade in mahogany. At CoP11 (Nairobi, 2000) a formal CITES Mahogany Working Group (MWG) was established (Decision No.11.4), aiming to include the participation of all range states and key consumer countries. This group met for the first time in Santa Cruz de la Sierra, Bolivia in October 2001.

At CoP12 (Santiago, 2002), Guatemala and Nicaragua submitted a proposal to list mahogany in Appendix II. The proposal referred to neo-tropical populations and was only applicable to logs, sawnwood, veneer and plywood. After a secret ballot, the proposal was adopted, with 68 votes in favour, 30 against and 14 abstentions. The listing came into force on 15 November 2003, one year after its adoption.

CoP12 also agreed to maintain the Mahogany Working Group but under a new mandate (Decision 12.21):

The Working Group shall discuss the capacities needed for the implementation of the Appendix II listing of Swietenia macrophylla*, related to sustainable harvest and scientifically made non-detriment findings, and shall review the recommendations contained in Annex 3 to these Decisions.*

This Working Group shall report to the Conference of the Parties at its 13th meeting.

Box 2: **Decisions relating to mahogany taken at CITES CoP13 (Bangkok, 2004)**

Decision No.	
	Directed to the Plants Committee
13.55	The Bigleaf Mahogany (*Swietenia macrophylla*) Working Group shall continue its work under the Plants Committee. The Working Group shall primarily comprise the range States of the species, the principal importing countries and at least one member of the Plants Committee.
13.56	The Plants Committee shall present a report at the 14th meeting of the Conference of the Parties on the progress made by the Working Group.
	Directed to the Plants Committee
13.57	The countries belonging to the Bigleaf Mahogany Working Group should attempt to ensure the presence of their representatives at the meetings of the Group.
13.58	The range States of *Swietenia macrophylla* should: a) prepare and officially adopt, as a priority, mahogany management plans at national and subregional level; b) promote the conduct of forest inventories, as well as progress and promote programmes to determine and monitor the distribution, population size and conservation status of mahogany; c) develop capacity-building programmes in monitoring and management relating to CITES procedures and documents. To this end, if considered appropriate, it may request assistance from the Plants Committee and the Secretariat; d) submit reports on progress in the implementation of this Decision to the Secretariat no later than 90 days before the 16th meeting of the Plants Committee, so that the Secretariat may include them in a report that it will present at that meeting; and e) establish, if considered necessary, working groups to implement the present Decision.
	Directed to Parties, the Secretariat and intergovernmental and non-governmental organizations
13.59	Parties, the CITES Secretariat and intergovernmental and non-governmental organizations shall seek ways to share information though the organization of regional workshops, capacity-building programmes, the exchange of experiences and the identification of financial resources.

Accordingly, the second Mahogany Working Group meeting was held in Belem, Brazil in October 2003. Recommendations from this meeting were submitted to the CITES Plants Committee (PC14, Windhoek, February 2004), in order to establish priorities and provide practical guidance for their implementation. The priority measures and recommendations agreed by the Committee are given in Box 1.

At CoP13 (Bangkok, 2004) further decisions were taken relating to mahogany, including the continuation of the Mahogany Working Group under the Plants Committee (see Box 2).

Sustainable management of mahogany – implications of the Appendix II listing

Sustainable management of mahogany as required by CITES is the responsibility of the individual producer country, and specific means to achieve this are outside the scope of the Convention. Each Party to the Convention is, however, required to establish a Management Authority and a Scientific Authority as part of the implementation process.

The requirements of Appendix II are sent out in Article IV, paragraph (2) of CITES which states that:

> *An export permit shall only be granted when the following conditions have been met;*
> *(a) a Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species;*
> *(b) a Management Authority of the State of export is satisfied that the specimen was not obtained in contravention of the laws of that State for the protection of fauna and flora.*

The Scientific Authority of the exporting country is thus responsible for making a so-called non-detriment finding (NDF) and for monitoring the levels of export to ensure the conservation of the species or its ecological functioning is not damaged.

Making a non-detriment finding

The manner in which a non-detriment finding is made is a management decision for the exporting country. The text of the Convention indicates that a non-detriment finding should be made for each export. This is, however, not always necessary where, for example, countries have voluntarily established annual export quotas. Such a quota means that the country concerned has determined that the export of a certain amount of specimens per year will not be detrimental to the survival of the species.

General guidance for the development of NDFs has been developed (Rosser & Haywood 2002), but until *Swietenia macrophylla* was listed on CITES little attention was paid to the specific application of NDFs for timber species. This issue was addressed at the second Mahogany Working Group (MWG) meeting, where a paper prepared by the IUCN Global Tree Specialist Group suggested that:

> *Recognizing that the information currently available is incomplete and scattered and that policies for sustainable forest management are not yet fully in place, procedures for NDF development for mahogany should be developed and refined in an incremental way as approaches are tested, sustainable forest management more generally is developed and information is built up.*

Three components were suggested as a basis for developing NDFs for mahogany:

- A national or regional-level stock assessment as a basis for determining overall quantities for export, for example through an annual export quota;
- A requirement for management plans for forest management units from which mahogany is harvested for export: management plans should demonstrate provisions for sustainable management of the forest unit and mahogany stocks as a prerequisite for determining that export will be non-detrimental;
- Monitoring of mahogany harvesting in the forest management units and timber exports against the overall export quota.

The second Mahogany Working Group meeting agreed that the forest management unit is the most appropriate for making an NDF for mahogany, and recommended that only wood originating under management plans, with specific components for mahogany management, should be accepted for export under Appendix II.

The role of importing countries

Importing countries have an important role to play in ensuring CITES requirements for the issuance of permits for international trade are met, in seizing or confiscating shipments that arrive at their ports without the correct documentation, and in reporting on levels of trade. Some importing countries have imposed stricter domestic controls than those required under the Convention (e.g. the European Union).

Workshops to promote the implementation of Appendix II

The International Tropical Timber Organization (ITTO) works closely with CITES to implement the provisions required by the convention for timber species. A workshop on capacity building for implementation of the CITES Appendix II listing of mahogany was convened on 18-21 May 2004 in Pucallpa, Peru (a key mahogany processing and transit point), with the assistance of the Peruvian National Institute for Renewable Resources (INRENA).

The overarching purpose of the workshop was to encourage and inform practical action with respect to the formulation of non-detriment findings for mahogany exports, focused on the key mahogany-producing countries of Bolivia, Brazil and Peru. The workshop was based on the understanding

that the determination of non-detriment findings is the role of individual countries, and that the criteria for that determination will be set by each country. The workshop provided a forum for countries to share their early experiences in implementing the Appendix II listing and allowed a review of capacity in key range states to effectively implement CITES obligations with respect to mahogany. A report presenting the main content and results from the meeting was published by ITTO (ITTO 2004).

The Nicaragua workshop

Recalling the recommendations of both the 14th meeting of the CITES Plants Committee (see Box 1) and the 13th meeting of the Conference of the Parties to CITES, and building on the success of the Pucallpa meeting, the Government of Nicaragua (the fourth largest producer of mahogany), together with Fauna & Flora International, decided to develop a project to promote the sustainable management of mahogany in Central America.

The project, entitled 'Current situation and harmonization of procedures for the sustainable use of mahogany *Swietenia macrophylla* in Central America', was supported by the Flagship Species Fund and involved two major components: (i) a detailed diagnostic study of the status of mahogany in Nicaragua; and (ii) organization of a regional workshop to evaluate the current status of mahogany in each country of the region and to establish a base for the regional harmonization of procedures and combined actions for the sustainable use of the species.

The workshop was held on 23-24 November 2004 in Managua, Nicaragua and was attended by 35 delegates from 11 countries. Additional financial support for the meeting was provided by USAID, and by Vodafone (for publication of this report).

The general objective of the Nicaragua meeting was to develop a basis for regional management of *S. macrophylla* in accordance with CITES. Specific objectives were:

Objective 1. To present an analysis of the current situation for mahogany in Nicaragua based on a diagnostic study undertaken within the country.

Objective 2. To understand the current situation of *Swietenia macrophylla* in each country in the region, and the methods and strategies for, and experience of, implementation of the Appendix II listing for the species.

Objective 3. To coordinate efforts for the harmonization of regional procedures and actions for the sustainable management of the species.

Objective 4. To agree a regional strategy for the effective implementation of the Appendix II listing of mahogany.

The workshop programme included presentations by each of the participating countries, working groups for the elaboration of themes and a plenary session for the presentation and discussion of results reached by the working groups. Through the presentations, each participating country gave an analysis of the current situation for mahogany within its borders, and summaries of existing studies and practices that have been developed for the conservation and protection of the species.

The themes selected for discussion within the working groups were informed by the recommendations of the second Mahogany Working Group meeting (Belem, 2003) and by the recommendations of the CITES 14th Plants Committee meeting (Windhoek, 2004). According to these, the groups were organized under the following headings:

- Forest management and inventories;
- Capacity building;
- Communication and coordination;
- Regional harmonization.

This report has been compiled and edited by Fauna & Flora International from the information presented at the workshop, the main results of the working groups and the overall conclusions and recommendations from the meeting. It includes an edited version of the detailed diagnostic study of mahogany in Nicaragua (component (i) of the Flagship Species Fund project). It is hoped the report will make a useful contribution to increasing information about mahogany in Central America, and inform future work in the region for sustainable management of this valuable species.

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Status and sustainable use of mahogany in Nicaragua

Synthesis of a diagnostic study by Gabriel Travisany

Introduction

In Nicaragua, mahogany occurs naturally in the departments of Jinotega, the North Atlantic Autonomous Region (RAAN), the South Atlantic Autonomous Region (RAAS) and Rio San Juan. This study is therefore centred on these departments.

Within those departments, mahogany is found in the moist tropical forest life zone (MARENA/INAFOR 2002), which corresponds to Ecological Region IV, Atlantic Sector. It occurs alongside other species of the Meliaceae family such as *Carapa guianensis* and *Cedrela odorata*, and other trees such as *Castilla elastica*, *Hyeronima alchorneoides*, *Anacardium excelsum*, *Copaifera aromatica* and *Dialium guineense*.

The most recent study on the conservation of Nicaraguan ecosystems (Meyrat 2001) states that mahogany is part of several important natural ecosystems of the Caribbean region, such as permanently flooded evergreen rainforest, moderately drained evergreen rainforest, flooded evergreen rainforest, gallery evergreen forest, and well-drained lowland evergreen forest.

Hardwood forests in Nicaragua

The advance of the agricultural frontier has severely damaged the rainforests of the Atlantic basin. According to the forest valuation study (MAGFOR-PROFOR-INAFOR 2001), there are currently 5.1 million ha of hardwood forest in Nicaragua compared with 6.3 million ha in the 1950s (Table 1).

Table 2 shows the extent of hardwood forests in the departments included in the study. As these forests make up 87% of the hardwood forests of the whole country, the departments hold great strategic importance for the future of the national

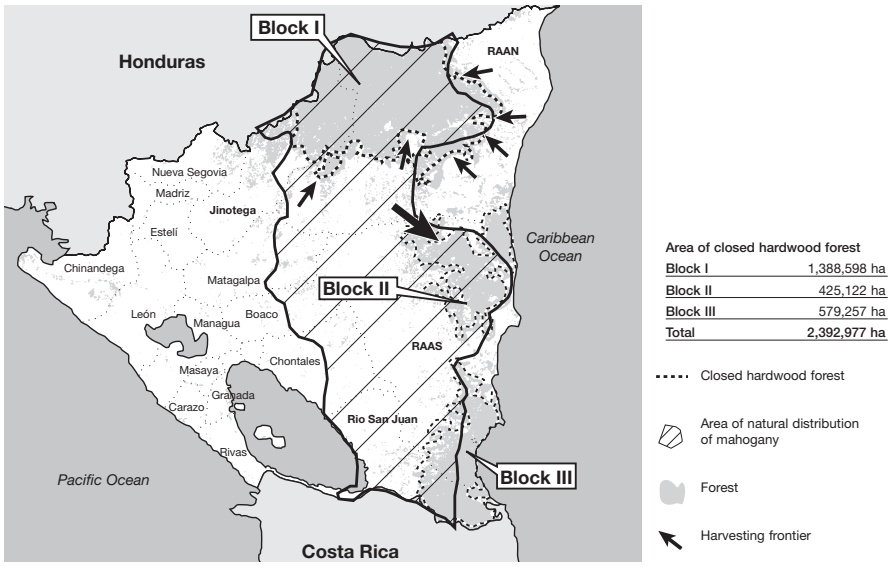

Figure 1: **Natural distribution of mahogany in Nicaragua, delimitation of blocks of closed hardwood forest and the mahogany harvesting frontier**

Table 1: **National forest cover in Nicaragua in different time periods**

Organization	Year	Cover (ha)	Hardwood (ha)	Conifer (ha)
FAO	1948	7,100,000	6,300,000	800,000
AID	1960	6,320,000	5,400,000	920,000
CATASTRO	1973	4,760,000	4,288,000	472,000
ASDI	1983	6,862,915	6,402,436	460,479
PAF-NIC	1992	4,200,000	3,700,000	500,000
MAGFOR-INAFOR	2000	5,619,533	5,104,654	514,879

Source: MAGFOR-PROFOR-INAFOR 2001.

Table 2: **Hardwood forest cover in selected departments of Nicaragua**

Department	Closed (ha)	Open (ha)
Jinotega	422,166	116,840
RAAN	1,443,023	481,114
RAAS	921,781	679,445
RSJuan	270,989	123,870
Sub-total	**3,057,959**	**1,401,269**
National total	**3,177,376**	**1,927,275**

Source: Forest valuation study, Nicaragua 2001 (MAGFOR-PROFOR-INAFOR 2001).

forest sector. The RAAN contains the largest area of closed hardwood forest, representing 44% of Nicaragua's total.

The forest map developed in 2000 (MAGFOR-PROFOR-INAFOR 2001) defined three large blocks of closed hardwood forest in the Atlantic region with 70% or more canopy cover (see Figure 1).

- **Block I,** with the Coco River as its northern boundary, between Jinotega and the RAAN, covers Bocay, Kayayawas to Bonanza, Rosita, Kukalaya and Waspán.
- **Block II,** in the northeastern corner of the RAAS, includes La Cruz del Río Grande up to Kuanwatla and down to the Laguna Perlas and the Wawashang Hill.
- **Block III** is located east of the RAAS and Rio San Juan, up to the Costa Rican border, from southern Bluefields up to Monkey Point, Punta Gorda, San Juan del Norte and El Castillo.

This analysis does not consider areas classified as open hardwood forest, since evidence indicates that species of high commercial value such as mahogany and cedar have already disappeared from them, mainly due to selective use (MIFIC 2001). It is unlikely that these species will regenerate sufficiently to make them commercially useful, and much of the forest is in the process of transformation into agricultural or grazing land.

Characteristics of closed hardwood forest

The dimensional characteristics, composition, number of individuals, vertical structure, horizontal distribution, quality and other features of forests in the Atlantic Region vary according to environmental factors such as temperature, precipitation and light, and the composition, structure and drainage of the soil. Consistent factors of the forest areas include an average temperature of 25-26°C, an annual precipitation above 2,000 mm, reaching 5,000 mm in the extreme southeast of Rio San Juan, and an altitude of 0-200 m above sea level, reaching 500 m in Jinotega.

Meyrat (2001) classified the principal natural ecosystems, especially evergreen forests, according to the soil material, drainage characteristics and the pattern of precipitation.

Forests of Block I

These include the most commercially productive forests of Nicaragua, which yield volumes of more than 122 m³/ha (MAGFOR-PROFOR-INAFOR 2001). Table 3 shows the most notable species in terms of volume are *Carapa guianensis*, *Dialium guineense*, *Hyeronima alchorneoides*, *Vochysia ferruginea* and *Calophyllum brasiliense.* Total volumes for a range of 20-25 commercial species vary from 23.9 m³/ha to 65 m³/ha.

The overall density of commercial mahogany trees in this block is close to 0.47 trees/ha, with low values of around 0.10 trees/ha in southern Prinzapolka, near the Kukalaya zone. In the north of the municipality, values vary between 0.46 and 0.72 trees/ha. The average volume of mahogany is reported as 1.3 m³/ha.

The forest in the zone of Siuna, Rosita, in the south of the block, has been heavily depleted due to its proximity to main roads, and there are fewer mahogany trees present. The forests in the northern area of Rosita and Waspán exhibit a larger volume of harvestable mahogany, with more than 1.2 m³/ha available in trees above 50 cm diameter at breast height (DBH) (Aguilar 2005). This area includes the buffer zone of the Bosawas Reserve, which is the region that has most mahogany trees. The forests of Puerto Cabezas and Prinzapolka have low volumes of mahogany, but have

Table 3: **Commercial volumes available in Nicaragua in the forests of Block I, according to various inventories**

Species	Scientific name	Volume according to forest inventory (m³/ha)				
		Wakambay	Awas Tingni	La Esperanza	Kukalaya	Lag. Kukalaya
Cedro macho	*Carapa guianensis*	8.41	5.15	5.21	2.13	4.84
Comenegro	*Dialium guineense*	4.53	5.54	4.48	18.03	-
Zopilote	*Vochysia ferruginea*	4.19	5.33	2.92	-	-
Nancitón	*Hyeronima alchorneoides*	3.78	3.14	1.62	4.53	-
St. María	*Calophyllum brasiliense*	2.16	2.30	2.25	-	-
Leche maría	*Symphonia globulifera*	2.01	1.40	0.96	-	-
Banak	*Virola koschnyi*	1.77	-	4.85	-	-
Guayabo	*Terminalia amazonia*	1.20	2.00	1.60	-	-
Caoba	*Swietenia macrophylla*	1.09	1.30	1.26	0.23	1.40
Others		7.01	12.01	16.66	40.08	17.66
Total (m³/ha)		**36.15**	**38.17**	**41.81**	**65.00**	**23.90**

Source: Author's compilation.

abundant *Carapa guianensis*, *Myrica cerifera*, *Tetragastris panamensis* and other species suitable for producing board.

In the 1970s concessions were given to large timber companies in several areas of the RAAN. For example, Celulosa de Nicaragua S.A. (CELNIC 1975a & b) obtained a 52,000 ha concession between the Kukalaya and the Wawa rivers, which is a permanent forest reserve. According to inventories carried out by the Food and Agriculture Organization of the United Nations (FAO) in 1972, the area contained net volumes of 192 m³/ha, with commercially harvestable volumes of 26.7 m³/ha (Henning 1972). Around 35% of this was timber of first and second quality. The most common species were *Dialium guineense*, with 2.4 trees/ha and 5 m³/ha, *Carapa guianensis*, *Calophyllum brasiliense*, *Hyeronima alchorneoides*, *Vochysia ferruginea* and *Virola koschnyi*. Density of mahogany was calculated as 0.30 trees/ha and 0.6 m³/ha.

Forests of Block II

The forests of Block II have a more balanced composition of commercial or sought-after species such as *Carapa guianensis*, *Calophyllum brasiliense*, *Vochysia ferruginea* and *Vochysia hondurensis*, which are all present in roughly equal volumes. The amount of mahogany is 0.6 m³/ha, and stocks are under considerable pressure from loggers (Table 4).

The forested areas south of La Cruz del Río Grande and east of Tortuguero are the most logged at present. The volumes per hectare vary from 7.6 m³/ha to 32.8 m³/ha and commercial densities are around 4 trees/ha. These areas were heavily exploited in the early 20th century, using the large rivers for transport. Inventories consulted show that very little of the volume of timber is present in trees with diameter greater than 70 cm DBH. Some municipalities – Bluefields, Kubra and Laguna Perlas – have areas inside the Wawashang and Cerro Silva Reserves in which there is no legal forest exploitation.

The forests in the sector known as Kuanwatla, south of Prinzapolka, and the south zone of La Cruz de Río Grande, have not been inventoried. However, their structure is thought to be similar to the above (MAGFOR-PROFOR-INAFOR 2001).

Forests of Block III

Most of the forests of Block III are inside the Southeast Forest Reserve protected area. Information about these forests is quite scarce; the only data available are from the 1984 inventory of the Southeast, which classified the forests as coastline, intermediate and inland (Table 5). The first two are dominated by *Schizolobium parahybum* and *Terminalia catappa*, which are hardwoods suitable for building. There is also a large presence of *Vochysia ferruginea*, which is soft and porous and therefore seldom harvested. The inventory reports low volumes of mahogany per hectare; these forests have been so heavily disturbed that the species is commercially exhausted. There is no information about the volume structure and base area of the different size classes of mahogany trees, so it is difficult to predict the chances of rehabilitation and management in the future.

Several inventories have been undertaken for management plans in the buffer area of the Southeast Forest Reserve, in the municipality of El Castillo. These show that *Carapa guianensis* is the most abundant species along with *Dipteryx oleifera* and *Dialium guineense*. More academic research has been carried out for management purposes in the El Romerón site, an area

Table 4: **Commercial volumes available in Nicaragua in the forests of Block II, according to various inventories**

Species	Scientific name	Volume according to forest inventory (m³/ha)			
		Profosa	South Patch R.	El Gallo	Zelaya Central
Níspero	*Manilkara zapota*	3.11	-	-	0.33
Cedro macho	*Carapa guianensis*	2.90	0.70	4.16	2.39
Palo agua	*Vochysia hondurensis*	1.96	-	2.10	2.02
Zopilote	*Vochysia ferruginea*	1.93	-	-	0.16
St. María	*Calophyllum brasiliense*	1.92	2.70	5.16	0.37
Guayabo	*Terminalia amazonia*	1.35	-	-	0.18
Comenegro	*Dialium guineense*	1.10	-	-	1.12
Caoba	*Swietenia macrophylla*	0.92	0.60	3.58	0.30
Leche maría	*Symphonia globulifera*	-	0.70		0.18
Others		2.61	2.90	4.90	25.78
Total (m³/ha)		**17.80**	**7.60**	**19.90**	**32.83**

Source: Author's compilation.

Table 5: **Commercial volumes available in Nicaragua in the forests of Block III, according to various inventories**

Species	Scientific name	Volume according to forest inventory (m³/ha)					
		Las Maravillas	La Bijagua	El Romerón	Southeast coastal	Southeast intermediate	Southeast inland
Cedro macho	*Carapa guianensis*	11.3	10.3	44.5	0.68	6.9	5.30
Sebo	*Virola sebifera*	6.3	6.6	24.4	1.10	2.5	1.40
Rosita	*Saccoglottis trichogyna*	2.7	3.5	2.8	-	-	-
Pansubá	*Lecythis ampla*	0.3	2.7	-	-	-	-
Palo agua	*Vochysia hondurensis*	-	1.9	-	-	-	-
Almendro	*Terminalia catappa*	-	12.6	-	1.00	18.8	4.90
Comenegro	*Dialium guineense*	-	10.3	-	-	1.5	1.70
Manga larga	*Vochysia ferruginea*	-	8.6	-	-	11.0	-
Gavilán	*Schizolobium parahybum*	-	-	-	19.40	14.3	-
Nancitón	*Hyeronima alchorneoides*	-	-	-	2.00	1.5	-
Caoba	*Swietenia macrophylla*	-	-	-	-	-	0.28
Others		3.1	38.9	13.4	40.42	56.9	31.42
Total (m³/ha)		**23.7**	**95.4**	**85.1**	**64.60**	**113.4**	**45.00**

Source: Author's compilation.

without extractive intervention, and the reported volumes of *Carapa guianensis* and *Myrica cerifera* are high. These species are sought-after because they are suitable for the production of plywood.

Mahogany in Nicaragua

Diametric distribution of mahogany

According to the data evaluated for various General Forest Management Plans for hardwood forests in the RAAS and the RAAN (see Annex 2), there are some distinct features concerning the density and volume of mahogany in different size classes. First, it is common to find either no individual trees in the 60 cm and above DBH classes, or that the densities per hectare are very low, as shown in Figures 2-5. A possible explanation for this is the overexploitation of the species in the early 20th century, when enormous volumes of large-dimension timber were exported and trees with DBH greater than 70 cm were exhausted.

Further evidence comes from data obtained from management plans for the RAAS (Figure 2), from which it can be seen that there are almost no individuals in the DBH classes of 60 cm and above. The data assessed for the RAAN (Figure 3) show that 87% of the individuals correspond to the 40-50-60 cm DBH classes, although some of the remaining trees are of larger diameter.

If we assume a diameter increase of 0.5 cm per year for hardwood species including mahogany (MIFIC 2001, Lamprecht 1990), trees of 50 cm diameter would be between 90 and 100 years old. This observation is consistent with the intense exploitation of mahogany by large foreign companies at the beginning of the last century, leaving only the youngest individuals, which have now grown to a commercial size. Logging in the RAAN occurred some 100 to 120 years ago, which is confirmed by the presence of trees of 50 and 60 cm DBH. In the RAAS the major period of logging occurred more recently, 80 to 100 years ago, and the most commonly occurring DBH is 40 cm. A few individuals of 90 cm or more DBH have been recorded, which may represent seed trees left untouched during historical exploitation.

In 1972, Henning noted a similar pattern when he conducted an inventory of more than 100,000 ha between the Wawa and Kukalaya rivers in the RAAN (Henning 1972). He detected no mahogany individuals of 90-140 cm DBH, which suggests that they had all been harvested for commercial purposes. However, there were individuals of more than 180 cm DBH, possibly because this class was allowed to remain for natural regeneration, but only at a low density: just 5 trees per 1,000 ha were present.

Also of interest is the impact of the management system implemented in Nicaragua on the diameter distribution. This system is based on a minimum cutting diameter, which has been set at 50 cm DBH for mahogany. The very limited presence of individual trees of more than 50 and 60 cm DBH is perhaps the result of the systematic logging of trees as soon as they grow to such proportions. The impact of this system, however, is not as great as the effects of the overexploitation of the Atlantic forests in the past century.

The density of mahogany trees in the RAAS varies from 1 tree per 3.7 ha to 1 per 100 ha,

Figure 2: **Distribution of mahogany trees by diameter class in the RAAS, Nicaragua (number of trees per hectare)**

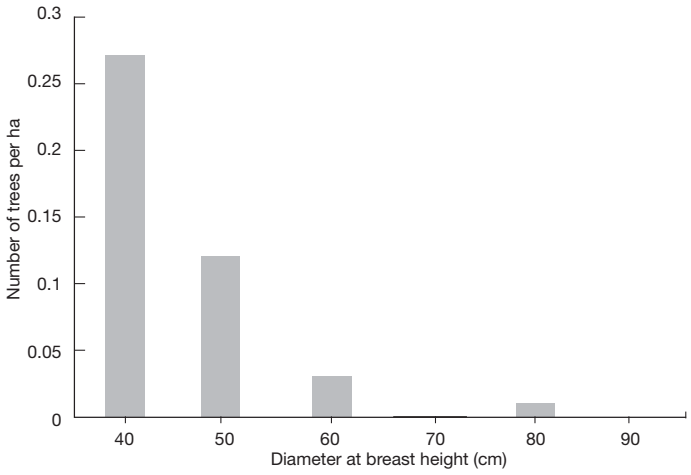

Figure 3: **Distribution of mahogany trees by diameter class in the RAAN, Nicaragua (number of trees per hectare)**

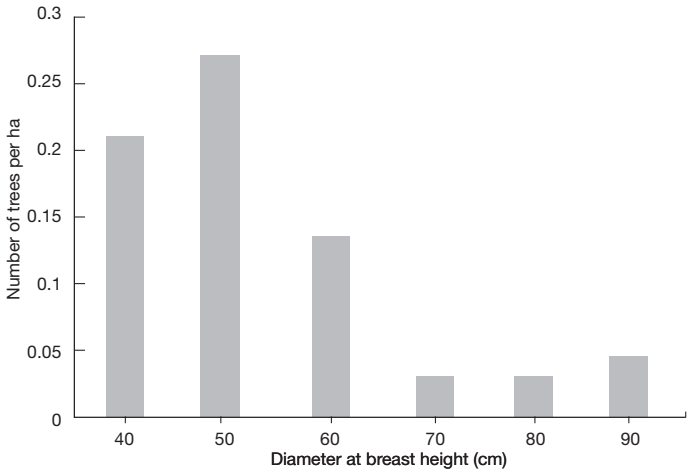

Figure 4: **Volume of mahogany trees in the RAAS, Nicaragua, by diameter class (m³/ha)**

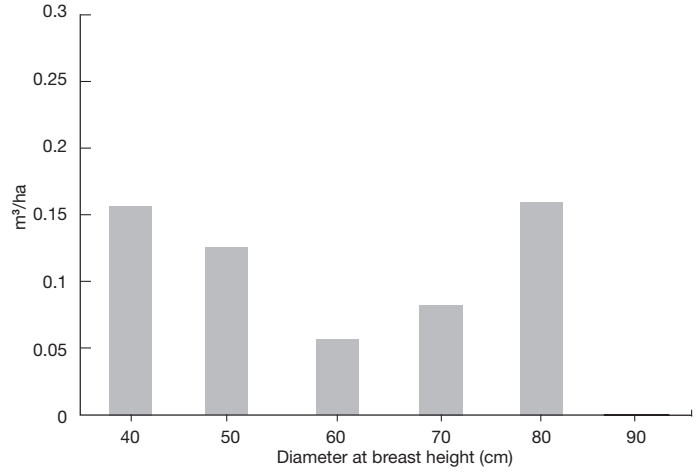

Figure 5: **Volume of mahogany trees in the RAAN, Nicaragua, by diameter class (m³/ha)**

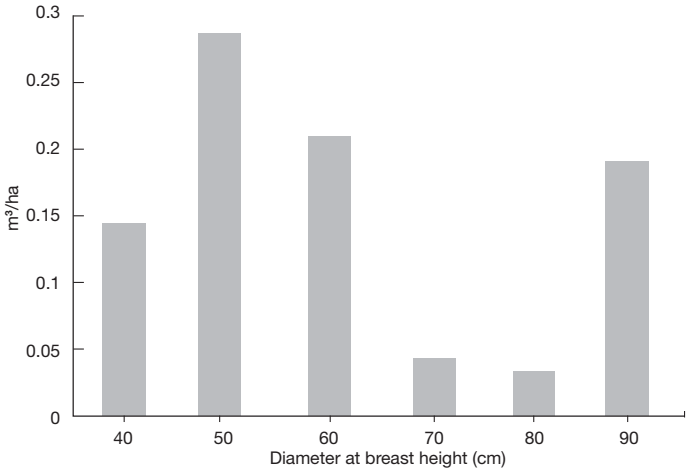

Table 6: **Types of closed hardwood forest in the areas of Nicaragua studied**

Block	Total closed hardwood forest (ha)	Productive forest (ha)	Conservation forest (ha)
Block I	1,388,598	647,555	741,043
Block II	425,122	285,888	139,234
Block III	579,257	16,552	562,705
Total	**2,392,977**	**949,995**	**1,442,982**

Source: Author's compilation, based on the Forest Map 2001 (MAGFOR-PROFOR-INAFOR 2001).

Table 7: **Amount of closed hardwood forest per municipality of Nicaragua**

Dept/Municipality	Total closed hardwood forest (ha)	Productive forest (ha)	Conservation forest (ha)
BLOCK I	**1,388,598**	**647,555**	**741,043**
RAAN (total)	**974,699**	**606,715**	**367,984**
Pto Cabezas	83,354	79,752	3,602
Waspan	547,978	308,536	239,442
Rosita	134,560	133,355	1,205
Siuna	46,717	1,055	45,662
Bonanza	162,090	84,017	78,073
JINOTEGA (total)	**413,899**	**40,840**	**373,059**
Cua-Bocay	286,377	18,817	267,560
Jinotega	4,505	4,195	310
La Concordia	81	81	0
S Rafael Norte	1,810	1,810	0
Yali	4,933	4,894	39
Pantasma	9,299	9,299	0
Wiwilí	106,894	1,744	105,150
BLOCK II	**425,122**	**285,888**	**139,234**
RAAN (total)	**92,979**	**91,307**	**1,672**
Prinzapolka	92,979	91,307	1,672
RAAS (total)	**332,143**	**194,581**	**137,562**
Cruz Río Grande	72,339	72,339	0
Tortuguero	66,225	27,796	38,429
Laguna Perlas	107,103	10,406	96,697
Desemb. RGde.	86,476	84,040	2,436
BLOCK III	**579,257**	**16,552**	**562,705**
RAAS (total)	**335,340**	**8,921**	**326,419**
Bluefields	320,705	1,044	319,661
El Rama	654	579	75
Nva. Guinea	4,325	2,974	1,351
Kukra Hill	9,656	4,324	5,332
RIO SJUAN (total)	**243,917**	**7,631**	**236,286**
San Juan Norte	143,833	-	143,833
El Castillo	75,304	7,631	67,673
S Carlos	24,780	-	24,780
Total	**2,392,977**	**949,995**	**1,442,982**

Source: Author's compilation based on measurements from the Forest Map 2001 (MAGFOR-PROFOR-INAFOR 2001).

with an overall figure of 1 tree per 2.3 ha. In the RAAN, the values range from 1 per 5.5 ha to 1 per 50 ha, with an overall value of 1 tree per 4.7 ha. Taking total commercial volumes of mahogany trees, the average in the RAAS is 0.57 m^3/ha and in the RAAN it is 1 m^3/ha.

Presence of mahogany in productive and conservation forests

Sustainable mahogany production in Nicaragua is now only feasible in closed hardwood forest; dispersed areas of forest outside the defined blocks are not considered suitable. Conservation forests, which include areas protected by law, gallery forests, areas within 200 m of rivers or on slopes of 50% or more, are also considered unsuitable for potential production.

Table 7 shows the distribution of productive and conservation forest according to department and municipality. Of the remaining productive forests, 73% are in the RAAN, while Rio San Juan department has just 0.8%. In Rio San Juan, almost all the Block III forest is in the Southeast Reserve. The remainder, which occurs in the buffer area of the El Castillo municipality, is too small to have value for sustainable harvesting and should also be considered a conservation forest.

According to surveys, almost 950,000 ha of the closed forest includes potentially usable mahogany. Productive forests with mahogany present are in Block I, excluding the Bosawas Reserve, and Block II, excluding the protected area of Wawashang Hills. The municipalities with the most important populations are Waspán, Rosita, Prinzapolka, Bonanza and the Desembocadura del Río Grande, which hold 77% of the closed productive forests in the area under study. Conservation forests include those in the Bosawas Biosphere Reserve, Wawashang Hills and the Southeast Reserve, with almost 1.5 million ha within areas protected under law.

Table 8 gives estimates of the volume of commercial mahogany in the study area. The available volumes, in m³/ha, have been estimated from average figures stated in inventories carried out for forest management plans. It should be noted that the figures from the forest valuation study of 2000 have not been considered because the sample was small and the mahogany figures not reliable.

The potential volume of mahogany in closed hardwood forest in the blocks defined is more than 1.6 million m³ of roundwood, 51% of which is in productive forest. This estimate represents the total volume of the species in diameter classes above 40 cm DBH, although the established minimum cutting diameter for mahogany in Nicaragua is 50 cm DBH. According to the average diameter distribution of the species (Figures 2 and 3, p. 14), 65% of the volume in productive forests is trees over 50 cm DBH, giving a total of approximately 542,000 m³.

As Table 8 shows, mahogany is virtually absent from Block III, where density is extremely low. The forests south of the Escondido River should therefore be excluded from any harvesting.

Table 8: **Estimated standing volume of mahogany in closed forests in areas of Nicaragua**

Department	Estimate of mahogany with diameter at breast height over 40 cm			
	Estimated volume per hectare (m³/ha)	Productive forest (m³)	Conservation forest (m³)	TOTAL ESTIMATED VOLUME (m³)
BLOCK I	**-**	**618,967**	**479,902**	**1,098,869**
RAAN	1.0	606,715	367,984	974,699
JINOTEGA	0.3	12,252	111,918	124,170
BLOCK II	**-**	**208,056**	**84,209**	**292,265**
RAAN	1.0	91,307	1,672	92,979
RAAS	0.6	116,749	82,537	199,286
BLOCK III	**-**	**6,879**	**243,109**	**249,987**
RAAS	0.6	5,353	195,851	201,204
RIO S JUAN	0.2	1,526	47,257	48,783
Total (m³)		**833,901**	**807,220**	**1,641,121**

Source: Author's compilation.

Harvesting hardwood forest

Information sources

Statistical data about mahogany harvest and trade are very limited in Nicaragua. IRENA and the National Forest Service have created a forest statistics office which produces annual statistical bulletins, some of which were consulted at CEDOC, the documentation centre of the Ministry of the Environment and Natural Resources (MARENA). Recent studies of the forest sector (e.g. Guevara 2004) provide some usable data, and INAFOR's National Forestry Registry (SIRCOF) has some useful statistics.

There is also a database produced by SINIA, MARENA's Environmental Information System, which is representative, and its website (www.marena.gob.ni) publishes analysed data.

Export data can be found at the Ministry of Finances and Trade (MIFIC), the General Directorate of Customs (DGA), the Export Promotion Centre (CETREX) and the CITES-MARENA Office in Nicaragua; the Central Bank of Nicaragua produces annual statistics and possesses historical documents (Banco Central de Nicaragua 1975). FAO's database was also consulted.

Species harvested

Logging of hardwood forests in Nicaragua is restricted to a small range of no more than 20 commercial species (Table 9, opposite) (Henning 1972, MADENSA 1992, Kumkyung Co. Ltd 1994). It is based around six emblematic species: *Swietenia macrophylla*, *Cedrela odorata*, *Carapa guianensis*, *Enterolobium cyclocarpum*, *Pithecellobium saman* and *Cordia alliodora*. The internal market requires large volumes of hardwood timber for construction and carpentry. Only a small volume of precious woods, such as mahogany and *Cedrela odorata*, is exported, traditionally to just two or three countries.

Authorized volumes

The data presented in Table 10 (p. 18) indicate the total authorized volume of hardwood cut annually in Nicaragua and the volumes of mahogany extracted, expressed in cubic metres without bark. In the period from 1975 to the 1990s an average of approximately 180,000 m³ of roundwood were harvested annually. This figure decreased to approximately 80,000 m³ per year between 1990 and 2000.

Mahogany harvesting

Table 11 (p. 19) shows the amount of mahogany authorized for harvest in different parts of the country in selected years. Up to the mid-1980s, seven departments reported mahogany, according to the data on authorized logging volumes from the National Forest Service (IRENA 1977). However, towards the late 1990s, mahogany harvesting was largely concentrated in the department of Zelaya, i.e. the present RAAN and RAAS (see Table 11).

The last few years have seen a notable increase in the volume authorized for harvesting, and levels are now similar to those

Table 9: **Species in commercial use in Nicaragua**

	Scientific name	Common name
1	*Pithecellobium saman*	Genízaro
2	*Swietenia macrophylla*	Caoba
3	*Carapa guianensis*	Cedro macho
4	*Cedrela odorata*	Cedro real
5	*Ceiba pentandra*	Ceiba
6	*Dialium guineense*	Comenegro
7	*Hymenaea courbaril*	Guapinol
8	*Terminalia amazonia*	Guayabo negro
9	*Cordia alliodora*	Laurel
10	*Tetragastris panamensis*	Kerosin
11	*Symphonia globulifera*	Leche maría
12	*Chlorophora tinctoria*	Mora
13	*Hyeronima alchorneoides*	Nancitón
14	*Brosimum costarricanum*	Ojoche blanco
15	*Vochyzia hondurensis*	Palo agua
16	*Enterolobium cyclocarpum*	Guanacaste
17	*Astronium graveolens*	Quitacalzón
18	*Callophyllum brasiliense*	Santa María
19	*Virola sebifera*	Sebo
20	*Vochyzia ferruginea*	Zopilote, Manga larga

Source: Henning 1972, MADENSA 1992, Kumkyung Co. Ltd 1994.

in the 1960s. Table 12 (p. 19) shows that, in the period 2000-03, total mahogany harvesting in the RAAS was almost double that in the RAAN. According to data collected by SIRCOF/INAFOR, the municipality of La Cruz de Rio Grande in the RAAS produced 44% of the authorized mahogany volume in 2000-03. La Cruz de Rio Grande, together with Prinzapolka in the RAAN, accounted for some 60% of the mahogany harvested, and these municipalities were the most heavily exploited areas in these years (Table 12, Figure 1). Mahogany harvesting was not authorized in the departments of Matagalpa, Jinotega and Rio San Juan after 2000 where the species was almost exhausted. There is currently no significant harvesting south of the Escondido river for the same reason. Today, the mahogany frontier is centred in Block I and most of the surrounding area, from Rosita and Siuna pressing northwards, and from Puerto Cabezas and Waspán towards the west. There is also a large timber frontier in Block II advancing southwards from La Cruz de Rio Grande, and from Tortuguero in an easterly direction (Figure 1).

Approximately 37,000 ha of forest from which mahogany is harvested are under General Forest Management Plans (GFMPs), accounted for by two management plans in the RAAS and the rest in the RAAN. Not all plans are active, however. Mahogany is also harvested from areas of between 10 and 50 ha under Minimum Management Plans (MMPs). The volume harvested from these areas is approximately equal to the volume harvested from areas under GFMPs; this was most notable in 2003 (see Table 12). The difference between current harvesting and harvesting in the 1960s, when volumes were similar to today, is that most of the permits issued now are for MMPs implemented by small traders, which has exacerbated the fragmentation of the forest. The major destinations of mahogany exports are shown in Table 13 (p. 20).

Uncontrolled harvesting

A problem found throughout the natural range of mahogany, from Mexico to Amazonia, is illegal logging and trade. This represents a huge threat to the species, and could potentially lead to its commercial exhaustion (Richards *et al.* 2003). In many cases, domestic controls have been introduced too late to prevent the unsustainable extraction of mahogany, or are insufficient to protect remaining stocks from illegal trade and the entry of illegally sourced logs into international trade. This was one of the reasons that the governments of Nicaragua and Guatemala proposed the inclusion of the species in Appendix II of CITES at the 12th meeting of the Conference of the Parties to CITES (CoP12) in Chile in 2002. Sawn mahogany timber for export from Nicaragua must now be backed by an export permit provided by the CITES-NI Office in MARENA, with INAFOR's authorization, according to procedures established under a bylaw.

Reported export figures from the year 2000 were reviewed for this study. The data were made available by three institutions that deal with exports: the CITES-NI Office in MARENA, MIFIC's database provided by DGA, and CETREX, the Centre for Export Procedures, which also provided information about non-traditional exports.

The production of 1 m^3 of sawn timber requires between 1.7 and 1.9 m^3 of debarked roundwood (INTECFOR 2003, FAO 1982), depending on the technological capabilities in the country and the dimensions of boards and planks required by the market (1 m^3 debarked roundwood = 0.52 to 0.58 m^3 sawn timber). Sawn timber for export is classified according to international standards. Traditionally, the quality of sawn mahogany must be "FAS" (firsts and seconds), "Select" or "No. 1", as classified by the National Hardwood Lumber Association (NHLA), Chicago, USA. The sawn timber export industry estimates that 1 m^3

of sawn timber will contain 50-60% wood of the required classification. Imperfect pieces are discarded and can only be sold in the local market (1 m^3 sawn timber = 0.5 to 0.6 m^3 sawn timber for export). Thus the conversion factor of roundwood into sawn timber for export varies from 0.26 to 0.35, according to the processing and classification expertise.

Table 14 (p. 20) shows the data on sawn mahogany timber for export, according to several sources, and the amount of roundwood necessary to produce such volumes, according to the most optimistic conversion factor of 0.35. The second column shows the authorized harvest volumes included in GFMPs and MMPs, information provided by SIRCOF/INAFOR and the forestry districts.

There is a large discrepancy between the authorized harvest volumes and the volume of roundwood required to produce the volume of sawn timber exported, according to several official sources. These discrepancies are a cause for serious concern, since the only plausible explanation is uncontrolled harvesting.

Research indicates that MMPs are the most frequently used way of harvesting illegally (Ampié 2002, Paniagua 2002). These types of plan offer the greatest possibilities for illegal felling and evasion of the technical and administrative responsibilities required in GFMPs. MMPs give rise to various types of illegal and fraudulent harvest: a permit is secured for a small plot of land, but the timber is actually extracted from a larger area, or inventories overestimate the volume of wood in the authorized area. It is conservatively estimated that the percentage of timber harvested illegally based on these plans is 50% of the authorized volume (Ampié 2002, Paniagua 2002).

According to data for the years 2002-04,

Table 10: **Authorized harvesting of hardwood species and mahogany in Nicaragua**

Year	Total hardwood volume authorized (m^3)	Total mahogany volume authorized (m^3)
1977	122,122	-
1978	150,625	-
1979	75,901	-
1980	412,233	-
1981	391,176	6,243
1982	91,298	-
1983	156,732	-
1984	166,028	4,220
1985	142,560	3,910
1986	115,952	-
1991	87,207	9,038
1994	89,525	-
1995	48,604	-
1996	61,179	-
1997	80,749	-
1998	96,934	2,869
1999	-	-
2000	62,005	4,292
2001	141,538	3,572
2002	128,517	14,106
2003	n/a	24,339

Sources: IRENA annual statistics (1977-85), INAFOR 1999, SIRCOF/INAFOR 2000 to 2003.

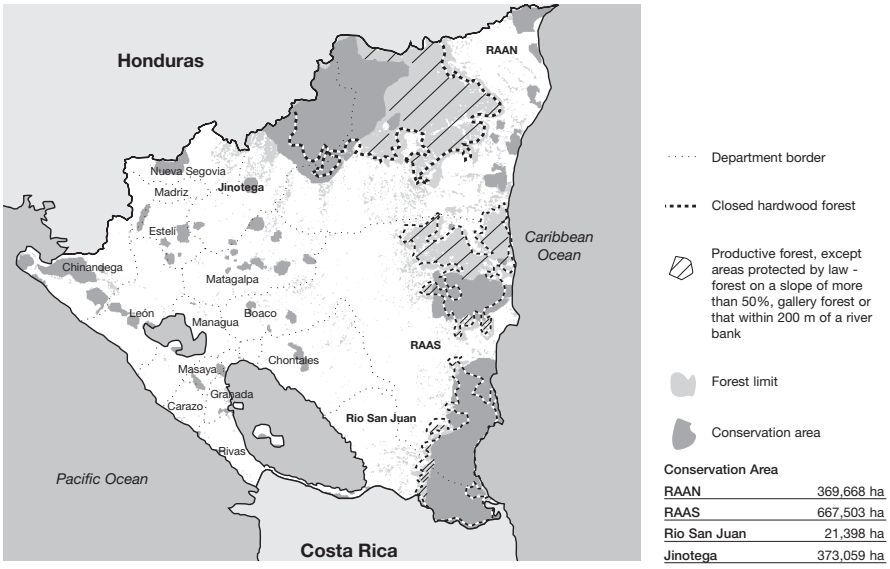

Figure 6: **Location of proposed areas of production forest with mahogany and conservation areas**

Table 11: **Authorized volume of mahogany per department of Nicaragua (m³ without bark)**

Year	Jinotega	Matagalp	Rio SJ	Zelaya*	RAAN	RAAS	National total
1981	391	123	91	5,041	-	-	6,243
1984	29	182	934	2,588	-	-	4,220
1985	0	-	292	3,198	-	-	3,910
1997	-	-	437	-	-	-	-
1998	60	15	171	2,525			2,869
1999	-	-	-	-	-	-	-
2000	-	-	-	-	2,425	1,887	4,292
2001	-	-	5	-	2,637	935	3,572
2002	-	-	-	-	4,610	9,426	14,106
2003	-	-	5	-	6,513	17,826	24,339

(*) The former Dept of Zelaya covered the current departments of RAAN and RAAS.
Source: IRENA annual statistics (1977-84), National Forest Service (1998-99), SIRCOF/INAFOR 1998-2003.

Table 12: **Volume of mahogany harvested in Nicaragua under General Forest Management Plans (GFMPs) and Minimum Management Plans (MMPs) for the years 2000-03**

Dept/Municipality	2000	2001	2002		2003		Total (m³ debarked roundwood)
			GFMP	MMP	GFMP	MMP	
RAAN (total)	**2,425**	**2,637**	**4,259**	**351**	**3,371**	**3,142**	**16,185**
Prinzapolka	2,215	2,111	1,242	n.a.	745	n.a.	6,313
Puerto Cabezas	210	172	813	-	631	1,206	3,032
Rosita	-	-	1,993	n.a.	4	n.a.	1,997
Siuna	-	354	55	n.a.	119	n.a.	528
Waspán	-	-	156	351	1,872	1,936	4,315
RAAS (total)	**1,867**	**935**	**4,049**	**5,447**	**7,547**	**10,279**	**30,124**
Cruz Río Grande	1,867	228	810	3,167	6,978	7,538	20,588
Desembocad. RG	-	-	-	-	396	695	1,091
Kubra Hill	-	-	1,928	99	-	287	2,314
El Tortuguero	-	235	1,311	1,914	-	1,212	4,672
Laguna Perlas	-	472	-	267	173	547	1,459
RIO SAN JUAN (total)	-	**5**	-	-	**5**	-	**10**
San Miguelito	-	-	-	-	5	-	5
El Castillo	-	5	-	-	-	-	5
Grand total (m³)	**4,292**	**3,572**	**8,308**	**5,798**	**10,918**	**13,421**	**46,311**

Source: SIRCOF/INAFOR 2004, District Forestry Register I and IX.
n.a.= data not available.

57 MMPs were authorized for the Waspán and Puerto Cabezas municipalities in the RAAN, for a total volume of 6,965 m³. For the RAAS, 107 MMPs were approved, with a total volume of 24,203 m³. Of this, 85% was in two municipalities: La Cruz de Rio Grande and Tortuguero. Given that the maximum area authorized for this type of plan is 50 ha, these figures indicate that the average volume of mahogany is 2.4 m³/ha in the RAAN and 4.5 m³/ha in the RAAS. This is significantly higher than the estimates derived from inventories and GFMPs in larger areas (0.57 m³/ha in the RAAS and 1.0 m³/ha in the RAAN), indicating again high levels of illegal logging under MMPs.

The economic loss from illegal harvesting is substantial (Richards *et al*. 2003), not only in direct financial terms but also in terms of effects on the economy more broadly. For example, in 2001 the value of illegally logged wood amounted to $10 million to $17 million, on which the state and municipalities did not collect any taxes. There are also opportunity costs due to the misuse of public funds and money from donors interested in sustainable forest management, and other economic costs such as soil degradation, deforestation, depression and distortion of financial investments, expatriation of illegal earnings and loss of the financial multiplier effect.

Illegal extraction is likely to decrease as a result of actions that are being implemented under the auspices of the excellent new legal tool, Forestry Law No. 462 and its Bylaws, approved in 2003. The revised management plans, form of the forest institutions, new administrative arrangements in INAFOR, the entry into force of new technical regulations and agreements with the national police force and the Nicaraguan army will very likely alleviate the problem.

CITES status of the species

As stated earlier, mahogany was included in Appendix II of CITES at the 12th meeting of the Conference of the Parties (CoP12) in Santiago, Chile, in 2002. The listing came into force in November 2003. Inclusion in Appendix II requires that two very important conditions for export are met: that the wood and its products have been legally obtained, and that the extraction has not damaged the survival of the species or promoted the deterioration of the natural population. This should increase consumer confidence in the legal origin of the product, complementing existing government and industry initiatives such as certification. Within Nicaragua, Ministerial Resolution No. 36-2003 provides the legal framework for the inclusion of mahogany in CITES Appendix II by establishing the administrative procedure for obtaining permits for the export of *Swietenia macrophylla*.

The inclusion has given support for stricter and more consistent application of CITES trade controls, especially regarding imports and re-exports, and verification that the timber has been legally obtained. Appendix II also requires that a Scientific Authority designated by the national government provides advice and information to determine that the exports will not damage the survival of the species in any way, and that the wood has been extracted in a sustainable manner.

Table 13. **Exports of sawn timber from Nicaragua by country of destination (m^3 sawn timber)**

Country	Year					
	1998	**1999**	**2000**	**2001**	**2002**	**2003**
USA	264	17	1,536	1,308	3,688	4,991
Dominican Republic	346	1,666	1,706	1,472	2,149	2,628
Spain	744	499	152	802	576	631
Others	138	84	562	954	814	354
Total	**1,492**	**2,265**	**3,956**	**4,536**	**7,227**	**8,604**

Source: MIFIC/DGA 2004.

Suggested measures to promote the sustainable use of mahogany

One of the objectives of this study is to develop proposals to improve the sustainable management of mahogany, based on the analysis of the situation and identified trends. Many existing proposals and plans are based on information from some time ago, for example the Nicaragua Forest Development Plan (1985), the Forest Action Plan (1992) and the Nicaraguan Environmental Action Plan (2002). The proposals developed here relate to sectoral policies and legal aspects, administration of the present law and bylaws, and other technical aspects.

Development of instruments to verify General Forest Management Plans

The Ministry of Environment and Natural Resources in Nicaragua published criteria and indicators for forest sustainability in 2002 (Resolution No. 28-2002), with the aim of guiding forest policy, but in practice these have not been effectively implemented. These principles should be used in an evaluation of the functioning of different types of forest management plan. No such evaluation has been carried out since 1996, when there was an analysis of the forest management situation in the Atlantic North of Nicaragua (Camino 1996). A revision of the management system and monitoring tools used in Nicaragua is therefore needed.

Modification of the silvicultural system

According to the technical guidelines for the sustainable management of tropical hardwood forests in Nicaragua (MIFIC 2001), the management system should be polycyclic, based on minimum cutting diameters (MCD) and logging cycles.

In a system based on MCDs for commercial species, only large trees can be harvested, with the aim of conserving the

Table 14: **Comparison of volume of sawn mahogany authorized for harvest in Nicaragua and volume exported**

	Volume of mahogany authorized (m^3 debarked roundwood)	Export of mahogany according to various sources (m^3 sawn timber)			Volume of roundwood required using a conversion factor of 0.35 (m^3 debarked roundwood)		
Year		CITES	MIFIC/DGA	CETREX	CITES	MIFIC/DGA	CETREX
2000	4,292	3,863	3,956	3,946	11,100	11,367	11,339
2001	3,572	9,846	4,536	11,211	28,293	13,034	32,215
2002	14,106	7,199	7,226	7,488	20,686	20,764	21,517
2003	24,339	7,260	8,603	8,418	20,862	24,721	24,189

Source: CITES/MARENA 2004, CETREX 2004, MIFIC/DGA 2004, SIRCOF/INAFOR.

medium and small diameter classes to ensure regeneration and sustainable production. But this will only happen if there are enough large trees to allow a profitable harvest, and if the diameter distribution of the species is regular. As has been shown in the previous section, these conditions are difficult to meet in the case of mahogany in Nicaragua. In addition, systematically removing the trees with the greatest growth will lead to genetic erosion of the species, resulting in a long-term deterioration of the forest.

Improvement systems (Lamprecht 1990), on the other hand, domesticate standing forest species with the aim of improving their future yield. One of these systems, called the Silvicultural System for Tropical Rainforest Management developed by the Surinam Agricultural Research Centre – CELOS, consists of a polycyclic management that includes silvicultural and harvesting factors (Bodegom & Graaf 1994). Amongst the principal components are the removal of lianas and the felling of undesirable trees to provide sufficient nutrients to trees selected for the final cut and to decrease the damage caused by logging. Harvesting aspects include an inventory for planning purposes, a count of commercial trees in each defined block and planning of blocks, roads and skid trails (Graaf 1986). These systems require long-term commitments, for which the issue of land ownership is extremely important.

Inventory of closed hardwood forests with mahogany

The CITES Mahogany Working Group has recommended carrying out regional inventories of the species (CITES 2003, CITES 2004). A forest inventory directed at mahogany-containing forest in Nicaragua should be based on the following principles, as agreed at the First Mesoamerican Workshop on Mahogany (MARENA/CITES & INAFOR 2004).

- The selection of areas for inventory should initially be made according to the pressure on the mahogany resource and the characteristics of the species. The inventory should be conducted first in municipalities where the resource has not yet been harvested and that are considered critical, followed by the verification of information collected from areas under GFMPs.
- Mahogany habitat sampling should be carried out, including the specific characteristics of the soil and the topographic conditions. The detailed requirements of mahogany can then be developed.
- The inventory should lead to the establishment of a network of permanent plots for the collection of a range of information on the species. This information should be gathered in a systematic way and fed into the proposed management system, so that adjustments can be made to guarantee the sustainability of the species. The network of permanent plots should be replicated in different conditions, such as protected areas (which can be used as a baseline) and post-harvest areas. The information collected could also form part of a Mesoamerican effort to compare conditions throughout the natural range of the species.
- Preliminary use quotas should be established according to data obtained from the inventory. The data can be improved once information from the permanent plots becomes available.

Delimitation of productive and conservation areas for mahogany

According to the forest map updated in 2001, mahogany production areas must be established at the municipal level, to facilitate identification of the location of areas proposed for harvesting and management plans, and the approval or rejection of proposals. This delimitation could be exclusively for mahogany harvesting, or could be extended to other commercial species. Conservation areas could also be proposed as protected areas in order to obtain greater protection for the species.

Establishment of an annual harvesting quota

A regional, district or municipal quota will allow the relevant authorities to regulate and control the harvesting of the species and plan for its sustainable use. The definition of annual harvest levels or quotas cannot by itself guarantee the sustainability of a species, however, and annual levels or quotas should be part of a suite of measures.

The process of establishing a quota should be based on the precautionary principle, since there are several variables that affect the calculations. The precautionary principle is a response to uncertainty (Newton & Oldfield 2005), faced with risks to the environment or health. Application of precaution in the management of natural resources and biodiversity is clearly essential, but often it is not very clear how the principle should be applied in practice.

A recommendation from the second meeting of the Mahogany Working Group suggested that mahogany management plans should indicate "*…the conservation of a sufficient number of trees larger than the minimum cutting diameter, to ensure the reproductive regeneration of the forest after harvest (seed-producing trees). This level must correspond to at least 20% of the original commercial density, must not reduce the population density below 1 tree per 50 hectares (0.002/ha) and the maximum distance between trees must be 1 kilometre*."

In the case of mahogany, the precautionary principle could be implemented by the establishment of a number of reserve trees of a given volume, or of a percentage of the available volume that must be left. Once natural regeneration is established, this reserved volume could be commercially harvested. Another way of applying

the precautionary principle is through the use of conservative values for the volume of standing harvestable timber per hectare.

According to data available from selected management plans in Nicaragua and taking into consideration the need for tree retention, it is estimated that there are approximately 387,000 m^3 of standing mahogany in harvestable trees above 50 cm DBH. If the trees require around 30 years to grow from 40 cm to 50 cm DBH, in reality from 35 cm to 50 cm DBH, at a growth rate of 0.5 cm per year (MIFIC 2001), then, conservatively, 12,000 m^3 can be harvested per year (see calculations in Annex 1.) The rest of the volume in the 35-50 cm DBH class represents the recruitment volume, provided that it is left standing. This calculation of the annual cut takes into account the whole 950,000 ha of productive forest in the country (see Table 7, p. 15).

Harvesting under General Forest Management Plans only

The numerous small MMPs for areas under 50 ha have a considerable effect on mahogany (see Table 12, p. 19). RAAN's Forestry Development Strategy (RAAN Regional Autonomous Council 2004) proposes the establishment of a regulation that at least 70% of the wood used by industries in the RAAN must originate from forests under GFMPs and not from forests with minimum or regeneration plans. This study recommends going further, and authorizing mahogany harvesting only in areas under GFMPs. These plans are administered by professionals, have more rigorous monitoring of the harvesting and recovery of the forest, and are more likely to result in sustainable forest management.

Promotion of forest certification

Nicaragua has just started a process of certification in hardwood forests. At the time of writing, 16,700 ha of forest have been certified, of which 12,700 ha are hardwood forest. In the coming years, demand from the international market for verification of sustainable forest management is expected to provide an important incentive for certification. Consumers can help conserve mahogany by purchasing products that bear the registered logo of the Forest Stewardship Council (FSC), or other international certifiers, that guarantee that the wood was obtained from forests managed under the principles and criteria of the FSC.

The constant demand for mahogany and its high profile make it a good candidate for forest certification. The demand for the timber makes forest management and low-impact logging economically feasible for many operations. However, for certification to operate there needs to be secure long-term tenure of the resource, as the benefits of the process accrue over many years.

Community forestry and joint investment

The application of autonomous laws in the regions of the Atlantic reinforces the legal status of community ownership of forest resources within communities' territories. The optimum area for the development of sustainable forest management is considered to be 10,000-20,000 ha, with planning based on the volume of harvestable timber as opposed to the size of the area (Bodegom & Graaf 1994).

It is recognized that investment in forests needs to be significant. Such investment is also long term, and cannot be recouped quickly. For example, forest planning should be undertaken at least every five years, and harvesting inventories must be drawn up early enough to allow pre-harvest silvicultural interventions and the planning of roads and camps. Secure tenancy of the resource is therefore crucial. Joint ventures between forest owners and investors may be the only way forward.

Strengthening databases and statistical information

Predicting the outcome of forest planning requires a statistical database, which should be up to date, reliable and user friendly. The National Forest Registry, currently being consolidated, will be responsible for information relevant to the sector and will establish appropriate links with other institutions in order to become a unique depository of information.

Strengthening forestry authorities and audits

The legal structure of the forestry authority is fundamental to the planning and implementation of a GFMP and annual operational plan. The introduction of forest audits will oblige periodic evaluations of the implementation of management plans and the effectiveness of legal instruments.

Strengthening the forest sector and secondary processing

The National Development Plan has identified forestry as a sector to be strengthened and a number of measures have been drawn up. Value should be added to raw mahogany through investment in the secondary processing industry, so that the export of sawn timber does not continue. Sawn timber exports promote waste as only the highest quality timber is exported, leaving a significant volume in the forest or for the local market.

Promoting the use of a wide variety of species

Harvesting in hardwood forests centres around no more than 20 species, and 90% of the timber comes from approximately six of these species. Mahogany represents around 3-7% of the volume of hardwood harvested annually, but 11-13% of the total value of forest product exports, including processed products. The use of a wider range of species should be promoted.

Incentives for sustainable management

The new Forestry Law (2003) states the need for incentives for the development of forestry activity and the transformation of the sector into an economic success. Incentives have been planned for forest recovery activities, for making good use of forest resources and for good forest management practices. The use of management plans, certification and the maintenance of biodiversity should be practices that carry incentives, that can help to reduce the cost of the production of forest products.

Conclusions

Mahogany is a species of tropical humid forest that is declining in Nicaragua, both in its natural area of distribution and in the volumes available for commercial use. Eighty years ago, mahogany was spread across the Atlantic region, from the Coco river to the San Juan river. In 1983, closed hardwood forest with mahogany covered around 45% of the natural range of the species; by 2001, the area of hardwood forest had been reduced by 40% and only remained in 27% of the species' original range. The species is almost extinct in the departments of Matagalpa, Jinotega and Rio San Juan. The volume of standing mahogany has also seriously decreased, as evidenced by the diameter of trees in the remaining forests. The total area of closed hardwood forest containing mahogany has been estimated at 2.4 million ha, with a total standing volume of approximately 1.6 million m^3 in trees with a DBH greater than 40 cm.

Closed hardwood forests containing mahogany can be classified into two types according to the proposed management regime. Productive forests cover almost 950,000 ha, most of them in the RAAN (73%), while the RAAS accounts for 21%. Conservation forests, which include areas protected by law, cover around 1.4 million ha and are found in the RAAS (32%), Jinotega (26%), RAAN (25%) and Rio San Juan (16%). Mahogany is almost non-existent in the protected areas of the department of Rio San Juan, according to non-specific inventories carried out in the area. Closed hardwood forest in Nicaragua has been divided into three blocks: Block I in the north part of the RAAN, Block II in the region of Bluefields and Block III in the southeast. Block I is the largest and includes 60% of this type of forest and 67% of mahogany stocks. Mahogany harvest areas are concentrated around the productive forests of the RAAN, where most of the General Forest Management Plans are being implemented, and in the RAAS, where a significant timber frontier is advancing from La Cruz de Rio Grande, in areas with a large number of Minimum Management Plans in operation.

Highly valued timber species such as mahogany and *Cedrela odorata* have become extinct in open hardwood forest due to selective logging. This type of forest is severely disturbed and is undergoing conversion to extensive cattle ranching and subsistence agriculture.

Dasometric data for mahogany come from management plans that have operated during the last eight years in various departments within the species range. However, variations in the methodology of forest inventories, the large area of the plans assessed, and the quality of information collected means there are inadequate data to understand how the species develops or how it should be managed. Once a species-specific inventory has been carried out and permanent plots are established in production forests, information should be collected in a methodical manner and a dynamic and up-to-date database created.

According to data available now, the dasometric characteristics of mahogany vary according to geographic area. In the RAAN, the distribution of trees per hectare is fairly regular, with values between 0.10 and 0.15 trees/ha for DBH classes of 40 to 60 cm, while for DBH classes of 70 to 90 cm the figures are much lower, with values down to 0.02 trees/ha. Volume distribution is also concentrated in the lower diameter classes, ranging from 0.15 to 0.27 m^3/ha, while in the higher diameter classes there are very few trees with an appreciable volume. In the RAAS, the number of trees is concentrated in the 40 to 50 cm DBH classes, with some trees of 60 cm DBH, but a low occurrence of trees with DBH larger than 60 cm. Volume is distributed over a range of diameter classes.

The management system used in the country at present is based on a minimum cutting diameter of 50 cm. The system has had some direct impacts on the species. According to data analysed, there are very few individuals of higher diameters, which means that all the trees above the MCD have been harvested. It is well known that, when trees grow to certain diameters and age, their seed production increases, which justifies the need to leave a few large trees after harvesting for seed production and regeneration. Raising the MCD to 55 cm would have the desirable effect of prolonging the logging cycle, giving smaller trees more time to develop and mature, and securing greater reproduction. The introduction of proactive silvicultural practices into current management plans would also benefit the regeneration of the species.

The availability of only modest harvestable volumes of mahogany per hectare indicates that sustainable use will be successful only if several hardwood species are managed at the same time. It is unrealistic to fund forest activity, including post-harvest silvicultural activities, from just one species, since infrastructure costs are high and the need for profit would lead

to overexploitation of that species. The undervaluation of other species and of the forest as a whole means that forest owners believe that once mahogany has been harvested the forest is of no further use and it is easier to switch the land to other uses.

The precautionary principle should be routinely adopted in the formation of forest management plans, especially when determining the annual use quota. The precautionary principle may be implemented by using conservative figures for harvest volumes per hectare, along with silvicultural practices recommended in international agreements such as retaining a percentage of trees as a base for regeneration. In this manner, it is possible to estimate an annual harvest quota for mahogany in the order of 12,000 m³, available from productive forests. These figures should be consolidated at the municipal level based on technical information from GFMPs. A further precautionary factor is that remaining trees in the open hardwood forests have not been included in this estimation.

Recommendations

- Carry out a forest inventory in municipalities with closed hardwood forests containing mahogany as soon as possible.
- Once the inventory has been completed, use the results to establish annual harvesting quotas at the regional and municipal levels.
- Review mahogany extraction permits from areas under Minimum Management Plans and establish the use of General Forest Management Plans for mahogany extraction in natural forest.
- Improve the follow-up of General Forest Management Plans, including measurable indicators, according to the Criteria and Indicators for Sustainable Forest Management prescribed by law.
- Expedite the certification of remaining productive forests, using a scheme with verifiable technical commitments that will protect the forest in the long term.
- Promote added value in mahogany products for export.
- Evaluate whether increasing the minimum cutting diameter for mahogany to 55 cm and prolonging the logging cycle to around 40 years would benefit the species.
- Involve regional universities in forest research, especially regarding development, monitoring and evaluation of permanent plots.
- Evaluate the different types of management plans in operation and analyse how they contribute to sustainable forest development, updating the only evaluation carried out in 1996.
- Evaluate and update Forest Development Policy, based on paradigms established in the new Forest Law of 2003.
- Involve the municipal authorities in areas where mahogany occurs in the distribution of, and support for, these recommendations.

Table 15: **Volume of mahogany by diameter class in selected inventories in Nicaragua (m³ debarked roundwood/ha)**

	Diameter at breast height (cm)						
	40	50	60	70	80	≥90	TOTAL
RAAS							
Profosa	0.043	0.073	0.050	0.160	0.240	0.000	0.566
Patch River	0.260	0.170	0.060	-	0.070	-	0.570
Average vol. (m³ debarked roundwood/ha)	0.152	0.122	0.055	0.080	0.155	0.000	0.568
RAAN							
Kukalaya	-	0.008	0.009	0.004	0.014	0.009	0.044
Laguna Kukalaya 1	0.220	0.250	0.660	-	-	0.280	1.410
Laguna Kukalaya 2	0.079	0.596	-	-	-	-	0.675
Awas Tigni	0.260	0.300	0.280	0.210	0.150	0.090	1.290
La Esperanza E1	0.162	0.274	0.095	0.129	0.195	0.573	1.428
Average vol. (m³ debarked roundwood/ha)	0.144	0.286	0.209	0.043	0.033	0.190	0.905

Source: SIRCOF/INAFOR, consultant's data.

ANNEX 1

Proposed methodology to determine annual logging volumes for mahogany

The volume of the annual allowable cut should be established at the municipal level. The actual logging volume method is easier to understand and to work with than the intensity or possible logging volumes methodology, so this is the method used. Volume is recognized as a variable directly related to the availability of biomass in forests of any kind, while with other parameters the relationship is indirect.

The productive forests identified in Blocks I, II and III have the capacity to produce a certain amount of mahogany, which can be extracted each year or over another time period in a manner that is non-detrimental to the population of the species.

The most important parameters to consider in the establishment of the annual harvest level are the area of closed forest

Table 16: **Criteria for retention of trees from the annual cut in Nicaragua**

	Diameter at breast height (cm)						
	40	**50**	**60**	**70**	**80**	**≥90**	**TOTAL**
1) Volume present (m³/ha)							
RAAN	0.144	0.286	0.209	0.043	0.033	0.190	0.905
RAAS	0.152	0.122	0.055	0.080	0.155	0.000	0.568
2) No. trees present							
RAAN (trees/ha)	0.140	0.180	0.090	0.020	0.020	0.030	0.470
RAAS (trees/ha)	0.270	0.120	0.030	0.000	0.010	0.000	0.430
3) Volume/tree (m³/tree)							
RAAN	1.029	1.589	2.322	2.150	1.650	6.333	1.925
RAAS	0.563	1.017	1.833	-	15.500	-	1.321
4) RETENTION 20% of trees							
RAAN (tree/ha)	0.140	0.108	0.018	0.004	0.004	0.006	0.280
RAAS (tree/ha)	0.270	0.072	0.006	0.000	0.002	0.000	0.350
5) Volume retained (m³/ha)							
RAAN	0.144	0.172	0.042	0.009	0.007	0.038	0.411
RAAS	0.152	0.073	0.011	0.000	0.031	0.000	0.267
6) Volume harvestable (m³/ha)							
RAAN	0.000	0.114	0.167	0.034	0.026	0.152	0.494
RAAS	0.000	0.049	0.044	0.080	0.124	0.000	0.297

available, and the density, pre-commercial and commercial volumes available according to data from local inventories.

The commercial volume is the volume in trees above the minimum logging diameter established by the regulations. Pre-commercial volume is that between 35 and 50 cm DBH found during existing inventories, and represents the resource for replacement and growth.

The calculation will be made separately for the RAAN and the RAAS because mahogany grows at different rates in each region.

Determination of the available volume per diameter class in each region

Table 15 shows the volume per hectare (m³ debarked roundwood/ha) in each diameter class, taken from selected forest inventories in Nicaragua (see Annex 2). The total volume of mahogany available in a closed hardwood forest is the amount calculated for individuals in the 40 cm and above DBH classes. However, the total harvestable volume corresponds to the sum of the existing volumes above 50 cm DBH. Since the 50 cm class includes individuals with DBH of 45-55 cm, only half the volume in this class can be counted as harvestable. Adding the average harvestable volumes per hectare in Table 15, there are approximately 0.351 m³/ha in the RAAS that can be harvested, while the RAAN has approximately 0.618 m³/ha.

Recruitment periods of diameter classes

The average annual diameter increase has been estimated at 0.5 cm. It takes approximately 30 years for a tree to grow from the 40 cm DBH class (from 35 cm) to the 50 cm DBH class, which means that the logging cycle should not be shorter than 30 years.

Considerations based on the precautionary principle

In the case of mahogany, the precautionary principle can be implemented by establishing a number of trees to be set aside, which will give a reserve volume left to guarantee the regeneration of the species. Once regeneration has been established, this volume can be harvested. According to the recommendations of the Mahogany Working Group, 20% of trees should be counted as reserve when calculating the available volume.

Annual usable volume

The use of conservative volume data from inventories also contributes to the implementation of the precautionary principle. Evaluation of selected management plans provided the data in Table 16 for existing volume (1) and the number of trees (2). From this the volume per tree (3) is obtained. Then 20% of the trees are set aside as reserve (4), noting that the MCD is 50 cm and that trees of 40 cm or less DBH cannot be harvested. Then, the volume in the classes that will not be harvested and the volume in the trees to be retained are both calculated. Finally, this total set-aside volume is subtracted from the volume from the inventory, which gives the harvestable volume (m³) for each size class (6).

In short, the RAAN has a total harvestable volume of 0.494 m³/ha, while the RAAS has 0.297 m³/ha. Some conservative values have been assigned to the departments of Jinotega and Rio San Juan because there is insufficient information to make the same calculations.

Taking the factors above, Table 17 shows the annual harvestable volume of mahogany in each municipality. This has been calculated using a set-aside volume equivalent to 20% of the trees. The RAAN provides 90% of the annual harvestable volume of mahogany and the RAAS 10%. The municipalities with the largest annual harvest volumes are Waspán, Rosita, Bonanza, Puerto Cabezas, Prinzapolka and the Desembocadura Río Grande. Production would be greatest in the municipality of Waspán (40%), followed by Rosita (17%), Prinzapolka (12%) and Puerto Cabezas (10%). In the RAAS, the Desembocadura Río Grande would produce 4%, while in La Cruz del Río Grande the annual volume that could be harvested is estimated at 3% of the authorized total.

Table 17: **Annual harvestable volume of mahogany per municipality of Nicaragua**

	Area of closed hardwood forest	Volume of mahogany over 40 cm diameter at breast height		Volume harvestable over 50 cm diameter at breast height		Annual mahogany harvest
Municipality	(ha)	(m^3/ha)	Total (m^3)	(m^3/ha)	Total (m^3)	(m^3)
BLOCK I	**647,555**		**618,967**		**305,762**	**10,192**
RAAN	**606,715**	**1.0**	**606,715**	**0.494**	**299,717**	**9,991**
Pto Cabezas	79,752	1.0	79,752	0.494	39,397	1,313
Waspan	308,536	1.0	308,536	0.494	152,417	5,081
Rosita	133,355	1.0	133,355	0.494	65,877	2,196
Siuna	1,055	1.0	1,055	0.494	521	17
Bonanza	84,017	1.0	84,017	0.494	41,504	1,383
JINOTEGA	**40,840**	**0.3**	**12,252**	**0.148**	**6,044**	**201**
Cua-Bocay	18,817	0.3	5,645	0.148	2,785	93
Jinotega	4,195	0.3	1,259	0.148	621	21
La Concordia	81	0.3	24	0.148	12	0
SRafael Norte	1,810	0.3	543	0.148	268	9
Yali	4,894	0.3	1,468	0.148	724	24
Pantasma	9,299	0.3	2,790	0.148	1,376	46
Wiwili	1,744	0.3	523	0.148	258	9
BLOCK II	**285,888**		**208,056**		**79,780**	**2,659**
RAAN	**91,307**	**1.0**	**91,307**	**0.494**	**45,106**	**1,504**
Prinzapolka	91,307	1.0	91,307	0.494	45,106	1,504
RAAS	**194,581**	**0.6**	**116,749**	**0.297**	**34,674**	**1,156**
Cruz Rio Gde	72,339	0.6	43,403	0.297	12,891	430
Tortuguero	27,796	0.6	16,678	0.297	4,953	165
Laguna Perl	10,406	0.6	6,244	0.297	1,854	62
Desemb. RGde	84,040	0.6	50,424	0.297	14,976	499
BLOCK III	**16,552**		**6,879**		**1,742**	**58**
RAAS	**8,921**	**0.6**	**5,353**	**0.297**	**1,590**	**53**
Bluefields	1,044	0.6	626	0.297	186	6
El Rama	579	0.6	347	0.297	103	3
Nva Guinea	2,974	0.6	1,784	0.297	530	18
Kukra Hill	4,324	0.6	2,594	0.297	771	26
RIO S JUAN	**7,631**	**0.2**	**1,526**	**0.100**	**153**	**5**
El Castillo	7,631	0.2	1,526	0.100	153	5
Grand total	**949,995**		**833,901**		**387,284**	**12,909**

Source: Author's compilation.

ANNEX 2 General Forest Management Plans and forest inventories consulted during the study

Date	Region	Municipality	Name	Owner	Area (ha)	Comercial volume (m^3/ha)	Availability for consultation
1972	RAAN	Rosita	Inventario For. Bosque Latifoliados	N. Henning	100,556	26.70	Yes
1976	RAAN	Rosita	CELNIC Plan Manejo	CELNIC	51,108	30.09	Yes
1983	RAAS	Bluefields/SJNorte	Recursos Forestales Sureste Nicarag	IRENA	869,200	45-113.4	Yes
1984	RAAS	L.Perlas/Tortuguero	Recursos Forestales Zelaya Central	IRENA	973,000	32.60	Yes
1992	RAAN	Rosita	Inventario Awas Tingni	MADENSA	42,887	38.17	Yes – evaluated
1992	RSJuan	El Castillo	Sitio Romerón (1)	UCA/CATIE	4	85.10	Yes
1994	RAAN	Rosita	Inventario Wakambay	Kumkyung Co.	62,000	36.15	Yes
1994	RSJuan	El Castillo	PGM Las Maravillas	ITCR	1,500	23.70	Yes
1994	RSJuan	El Castillo	PGM La Mónica	Sta Cruz Forestal	1,361	29.00	Yes
1995	RAAS	Cruz Río Gde	PGMF Río Kung Kung	PROFOSA	34,695	17.80	Yes – evaluated
1996	RAAS	Cruz Río Gde	PGM El Gallo	Maderas Tecnicas SA	1,934	19.90	Yes
1999	RSJuan	El Castillo	PGM Boca Escalera	Plynic	1,622	23.72	Yes
1999	RAAN	Rosita	PGM Okonwas Norte	Comunidad	640	66.35	Yes
2000	RAAS	Lag.Perlas	PGM South Patch River	NIVESA	1,824	17.80	Yes – evaluated
2000	RAAN	Rosita	PGM Kukalaya	PRADA S.A.	4,900	65.00	Yes – evaluated
2000	RAAN	Prinzapolka	PGM Laguna Kukalaya	Comunidad Lag. Kukal.	2,400	23.90	Yes – evaluated
2000	RAAN	Pto Cabezas	PGMF Columbos 2000	B. Rosales	1,294	-	No
2000	RAAN	Pto. Cabezas	PGMF El Naranjal	M. Salgado	1,354	51.90	Yes
2000	RAAN	Rosita	San Isidro	Marcos A. Oporta	140	-	No
2001	RSJuan	El Castillo	PGM La Bijagua	Plynic	1,536	81.50	Yes
2001	RAAN	Prinzapolka	PGMF El Cascal	PRADA S.A.	4,034	-	No
2001	RAAN	Prinzapolka	PGM Tungla	Petrona Boudier	4,385	-	No
2001	RAAN	Siuna	San Martin	Hnos Ubeda	3,494	-	No
2001	RAAN	Siuna	POA Unidades #1,2,3,4	EE Hnos. Ubeda	-	29.90	Yes
2001	RAAN	Rosita	Hnos. Romero	Fermin Romero	500	-	No
2002	RAAN	Prinzapolka	PGMF Layasiksa	PRADA S.A.	4,950	-	No
2002	RAAN	Pto. Cabezas	El Tío	Heriberto Salgado	2,000	-	No
2005	RAAN	Waspán	PGMF La Esperanza	Maderas Girón S.A.	7,426	41.81	Yes – evaluated
2002	RAAN	Rosita	PGM Okonwas Kuliwas	Comunidad	765	-	No
2002	RAAN	Siuna	Finca Angel Benavides	-	100	-	No
2002	RAAN	Waspán	La Piñera	-	220	-	No

Sources: Personal records, Banco Central de Nicaragua 1975, SIRCOF/INAFOR 2004.

Note: Commercial volume is the total volume of timber in cubic metres without bark of all species that are considered currently marketable, i.e. the range of species used for industrial sawn timber, boards and plywood.

(1) Area of investigation of tropical forest management, UCA/CATIE.

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Regional workshop on mahogany management in Central America

Country presentations

Guatemala

Edited from presentation by Edin Orlando López Tejada, CONAP/PETEN

Forests in Guatemala cover approximately 37,500 km², or 34% of the land area. Eighty percent is hardwood forest (see Table 18), with two mahogany species in the country, *Swietenia humilis* and *S. macrophylla.* The natural range of *S. humilis* is the Pacific coastal plain in an area of 15,000 km², in hot, very humid sub-tropical forests. It is commercially extinct. The natural range of *S. macrophylla* covers 46,000 km² in the Atlantic lowlands, including El Peten, Alta Verapaz, Quiche and Izabal. It, too, occurs in hot, humid sub-tropical forests.

Table 18: **Forest cover in Guatemala**

Category	Area (km²)	% of total
Hardwood forest	30,170	80.5
Coniferous forest	2,280	6.1
Mixed forest	1,270	3.4
Other forest	3,770	10.1
Total forest	**37,490**	**100.0**
Total land area	108,889	

Source: SIRCOF/INAFOR, consultant's data.

Historical use of mahogany

Commercial interest in the exploitation of mahogany in Guatemala began between 1860 and 1870. Between 1900 and 1956, 2.1 million m³ of mahogany were extracted from El Peten alone (37,500 m³ annually). During this time, Decree No. 543 was passed, entitled 'Law for the Exploitation of National Forests'. World War II had an impact on mahogany in Guatemala, with 200,000 m³ logged within two years to meet the wartime demand from the USA. The period 1958-82 was a time of colonization in El Peten, and 50% of the forest was lost. It was during these years that industries were established to process cedar and mahogany extracted from the forests.

Between 1983 and 1988 timber extraction in Guatemala was closed down. This period saw the start of illegal logging operations in the country. In 1989 the Protected Areas Law (Decree 4-89) and the Maya Biosphere Reserve Law (Decree 5-90) were established.

Protected areas, management and conservation of mahogany

The total amount of land within protected areas in Guatemala, and the amount in El Peten department, is shown in Table 19. El Peten is a refuge for mahogany within Guatemala, containing more than 90% of mahogany reserves. It is also host to around 83% of the Guatemalan System of Protected Areas, which totals 28,659 km² (26.3% of the area of the country). Protected forests are managed by the National Council of Protected Areas (CONAP), while unprotected forest is the responsibility of the National Forest Institute.

The Maya Biosphere Reserve is one of the most important protected areas in the country. The core zone of the Maya Biosphere Reserve in El Peten is 767,000 ha (36% of the reserve), and mahogany occurs in 460,000 ha of this. The multiple use zone of the reserve covers 848,000 ha (40%) and is also composed of forest containing mahogany. Since 1994, forest management in the multiple use zone has been enforced and forest concessions have been granted to communities and companies. To date, CONAP has granted a total of 16 forest concessions, of which 14 are community concessions and two are industrial. Table 20 shows the amount of protected and productive forest within the two types of forest concession.

Table 19: **Total area protected in Guatemala and area protected within El Peten department**

Land	Area (km²)	Within El Peten (km²)	El Peten %
Total land area	108,889.0	35,854.0	32.9
Area within the Guatemalan System of Protected Areas	28,659.2	23,667.0	82.6
% land protected	26.3	66.0	

Table 20: **Total area of productive and protected forest within community and industrial concessions in the Maya Biosphere Reserve, Guatemala**

Type of concession	Total area (ha)	Forested area (ha)	Productive forest (ha)	Protected forest (ha)
Community concessions	400,830.6	380,682.0	225,731.5	154,950.5
Industrial concessions	132,303.0	132,104.0	125,248.5	6,855.5
Total	**533,133.6**	**512,786.0**	**350,980.0**	**161,806.0**

Table 21: **Diameter distribution of mahogany in the multiple use zone of the Maya Biosphere Reserve, El Peten, Guatemala (number of trees/ha in each diameter class)**

Sector	Diameter at breast height in cm									
	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	>90	Total trees/ha
East	1.02	0.80	0.50	0.25	0.13	0.09	0.10	0.04	0.10	3.02
Northwest	0.87	0.60	0.56	0.50	0.38	0.28	0.18	0.13	0.21	3.72
Central	0.93	0.17	0.60	0.17	0.17	0.13	0.17	0.03	0.07	2.43
Weighted average	0.93	0.59	0.55	0.36	0.27	0.20	0.16	0.09	0.15	3.29

Table 22: **Volume and intensity of mahogany harvesting in the multiple use zone of the Maya Biosphere Reserve, El Peten, Guatemala, 2000-03**

	2000	2001	2002	2003
Volume harvested (m^3)	8,851.8	11,632.4	11,731.2	12,972.9
Area harvested (ha)	8,762.5	10,707.8	10,659.8	12,990.4
Intensity of harvest (m^3 per ha)	1.01	1.09	1.10	1.00

Within these concessions, mahogany is believed to be present at a density of approximately 3 trees per hectare, and the diameter class distribution approximates the typical inverse J shape (see Table 21). Mahogany is found in forest with a low rate of cover (18-22 m^3/ha), and analytical studies conclude that the prospects are good for the development of the species. Silvicultural interventions in these forests, such as thinning, are not deemed necessary.

The amount of mahogany harvested from El Peten in the period 2000-03 is shown in Table 22. Historically, the most important commercial species in the region's forests was mahogany. Efforts have been made to incorporate more species in the market to reduce the dependence on mahogany, and around 50 hardwood species are now harvested. Mahogany remains the principal product from these forests, however, constituting approximately 30% by volume of the hardwood extracted.

Forest management requirements

Forest management is regulated by CONAP. A management plan is required, which establishes the general forest management strategy for a stated time period. Management plans are developed according to a simplified model proposed by the Tropical Agricultural Research and Higher Education Centre (CATIE), and cover a five-year period.

The five-year management plan for large forests establishes the arrangement of productive forest, and maps showing the areas to be used each year (annual harvesting areas – AHA) during the five years are prepared. For each annual harvesting area, an annual operating plan (AOP) is elaborated, and a census of all species of commercial interest is conducted. Within each AHA, the trees to be cut, seed trees and those left for future harvest are identified. The intensity of cut is adjusted according to the specific sector of the forest. A polycyclic management system is used, with irregular management of stands. As well as the harvesting of timber trees, conservation of the understorey is essential. The level of exploitation that is permitted depends on the regenerative capacity of the forest. The regeneration of light-demanding species must be promoted.

To be a viable, sustainable system, the size classes of the species of interest should exhibit the typical inverse J distribution. Variables that are used to regulate harvesting are the minimum cutting diameter (MCD), the cutting cycle and the intensity of cut. The MCD for mahogany is between 55 and 60 cm diameter at breast height (DBH). Harvesting cycles vary from 25 to 40 years. The MCD of 55 cm is applied to management units with longer cutting cycles (40 years), while units with shorter cutting cycles (25 and 30 years) are managed with an MCD of 60 cm to compensate for the shorter rotation time.

The maximum allowable logging intensity is 80%. Trees with no commercial potential (due to defects in shape, for example) are not considered in this calculation. The logging intensity is adjusted for different scenarios to determine the volume authorized for harvest. To predict the capacity for recuperation of the species, a rate of growth in diameter of 0.4 cm per year is used, along with a mortality rate of 1.5% per year. If the species recovers more rapidly than predicted, the logging intensity must be reduced for the next cut to ensure a maximum of 80% of the standing timber is harvested. In cases where the proportion of recoverable timber is relatively low (e.g. 45%), the logging intensity can be adjusted so that the final yield equals the recoverable portion plus one third of the non-recoverable wood, provided the maximum logging intensity of 80% is not exceeded.

Silvicultural activities include the opening of the upper canopy, the retention of seed trees (ideally 10% of trees), cutting of lianas on the trees for future harvest, seed trees and trees for extraction, the dispersion of residues, enrichment planting in disturbed areas (areas of fall, skid trails, etc.), and the dispersal of seeds.

Honduras

Edited from presentation by Luis Cortes, AFE-COHDEFOR

Honduras is located in the middle of the Central American isthmus, and its human population is estimated at nearly 6.6 million. Forests cover 87% of the country (112,000 km²). Of these, it is estimated that 4.0 million ha are coniferous forest, 5.5 million ha are hardwood forest and 0.2 million ha are mangroves and other types of forest.

Hardwood forests have been particularly poorly managed in Honduras, and by the 1970s they were already disappearing at a rate of 80,000 ha per year. Cattle grazing and settlement by migrants are the major causes of this decrease; the process has been exacerbated by the policies of the Honduran government and international agencies, which have promoted agriculture – and therefore deforestation – rather than forestry.

Hardwood forests contain a wide variety of species, including fine woods such as mahogany and cedar. The high species diversity means that commercial species are only present at low densities, offering little incentive for cattle ranchers and agricultural farmers to manage the forests productively. When harvested, the forests are logged selectively and many species are underexploited, either because management costs make their use uneconomic, or because their exploitation is not in compliance with the annual allowable cut (AAC).

Forest management

With the exception of protected areas such as the Río Plátano Biosphere and Humankind Reserve, Patuca National Park and the Tawahka Biological Reserve, hardwood forests in Honduras are largely composed of small areas managed by Forest Social System groups. Management plans for these areas are relatively recent, dating from the 1990s. These management plans take into account the biophysical characteristics of the area (soil, water, climate, flora and fauna) and the rotation period of the key species. To improve implementation, evaluation and follow-up, management plans are divided into five-year periods; at the end of each phase, changes necessary to ensure achievement of the objectives of the plan are identified and must be implemented.

Management plans

The following outlines the basic characteristics of a forest management plan.

- *Objectives of the plan.* One objective is generally to enable inhabitants of the area to benefit from the forests through the sustainable use of forest resources. This should result in increased valuation of the forest by its inhabitants, and thus improved protection. Other objectives include the promotion of forest management, the use of non-traditional species with market potential, capacity building and increased awareness amongst the members of the community.

- *Internal and external limitations on forest management.* Some areas may have characteristics that limit the options for forest management. For example, the topography may impede logging and transportation, or high precipitation at certain times of the year may make activities difficult, in which case work is usually carried out from November to May only.

  Similarly, there may be external factors that hinder forest management. Legislation restricts the volume of wood used by campesino groups, but the amount allowed may not be in compliance with the management plan. The illegal timber trade creates unfair competition for those who abide by management plans. Obtaining financial credit facilities can be very difficult for agro-forestry groups, which is why they often sell their primary products to middlemen at very low prices. Technical personnel are so scarce that there may not be adequate follow-up to the management plans, especially after harvesting.

- *Biophysical characteristics.* In addition to the location, boundaries (geo-referenced) and area, information concerning climate, precipitation, altitude, soil characteristics, habitat types, contours, temperature, hydrology and vegetation description is required.

- *Socio-economic characteristics.* A prerequisite is that local communities must be adequately organized to participate in forest management agreements with the government Forest Administration service (AFE-COHDEFOR). A number of other features of the community are considered, the most important being financial aspects (the annual average income), social aspects (the organization and legal status of groups, direct and indirect beneficiaries, the average number of offspring, literacy levels), health and nutrition (the most common ailments, infection sources, basic services and the availability of food), and infrastructure (the availability of health centres, education, community centres, churches, types of housing).

- *Stratification and land use.* The forest strata and the area and percentage of each must be defined (see the example in Table 23). A coding system is used for different strata or vegetation type. Each stratum should also be described.

- *General forest inventory.* Information on the sample and design of the inventory, the method used, the intensity, the area sampled and calculation of the volume must all be provided. The inventory results should provide data on the different species found (traditional,

Table 23: **Example of strata and land use information required in a management plan in Honduras**

Strata	Code	Total area (ha)	%
Mature forest	L2	327	26.0
Young forest	L1	300	23.9
Protection forest	LPT	349	27.8
High fallow land	A2GII	159	12.7
Low fallow land	A2GI	25	2.0
Grassland	A2P	96	7.6
Total		**1,256**	**100.0**

current and potential commercial species), describing each according to the number of trees, basal area and volume per hectare in each stratum and diameter class.

- *Silvicultural criteria.* The silvicultural criteria establish the minimum cutting diameter, felling intensity, felling cycles, annual allowable cut and the volume of the annual allowable cut for all traditional, commercial and potentially commercial species. There are also criteria for the selection of trees for retention and those for harvesting (e.g. topography, access and road network, seed trees, etc.), and the specific fate of individual trees.

Five-year and annual operational plans

As well as the general information above, forest management plans must contain five-year harvesting, silviculture and protection plans, and an annual operating plan, detailing the operations to be undertaken each year.

Five-year harvesting plan

- Objective. To achieve the annual allowable cut, to improve the quality of the timber through the implementation of improved techniques and to provide income to local residents.
- Planning of harvesting. This includes the annual operating plan, which considers harvesting, silviculture and protection. Harvesting must be developed on low-impact techniques (directed felling, marking of seed trees, protection of water sources, design and building of access roads for timber removal).
- Description of sawing and transportation technology. Manual chainsaws are used for felling, logging and branching. Framed saws are used for pit sawing. These methods are used for their minimal environmental impacts and because they are more adaptable to site characteristics. Primary products are sent down the mountainside on the backs of mules and later transported on rivers, boats and trucks.

Five-year silvicultural plan

- Objective. To provide space and light to the remaining forest; to improve the shape of trees for future harvesting; to create favourable conditions for the regeneration and establishment of desirable species.
- Planning of silvicultural methods, considering each affected strata, year, intervention area and method used.

Five-year protection plan

- Objective. To achieve protection of the area under management, to increase awareness among the population about management and conservation of natural resources, to support the programme of agricultural and livestock activities and its complementary relationship with forestry.
- Protection activities. To identify problems and define activities, persons responsible and year of implementation (e.g. marking and maintenance of trails, labelling of areas, surveillance visits, protection against fires and pests, training opportunities).

Annual operating plan

- Objective. To define forestry activities that will be carried out during one year.
- Activities: harvesting, protection, pruning, thinning, regeneration.

The equation used to calculate the volume of the annual allowable cut (VAAC) is shown in Box 3. Table 24 (p. 34) shows the harvesting volumes for a sample five-year plan.

Extraction process and impacts

Extraction consists of cutting the tree in a directional way, then sectioning it where it has fallen into such pieces as it is possible to obtain using a frame saw. This is a slow process that requires the participation of several people. The resulting large logs are then transported by mule or sometimes by water to a point where they can be loaded onto boats or lorries. When extraction is carried out according to the management plan, the impact is minimal and beneficial, because the canopy is opened up, creating space, air and light for seedlings.

National regulations for the conservation of mahogany

The national regulations for general timber harvesting (as outlined above) must be followed for mahogany. Factors that hinder the sustainable management of the species include:

- Illegal indiscriminate logging that does not comply with any regulations;
- The advance of the agricultural frontier, agriculture being the most important activity for Honduran campesinos;
- Increased cattle ranching among major landowners (in many cases these two factors are incentivized by national and international banks);

- The lack of a regulatory scheme to promote forestry, with costs and benefits that could improve the income of forest managers.

Regarding transportation and processing, regulations have been introduced to promote the adding of value to forest products. This is set out in Decree 328-98, Article 7, which "*prohibits the export of products from hardwood forests except finished goods, furniture or worked furniture components*". Another control measure about to be implemented is a chain of custody for primary mahogany products that are harvested, transported and traded in national markets for further processing into finished products. An additional instrument that is gradually becoming accepted is the certification of products or raw material that originate from managed forests. This process is just commencing in Honduras.

Trade issues

The major issue for the mahogany trade is the unequal value of wood obtained legally via permits and management plans and wood originating from illegal sources. There are companies that process primary timber and export it without a CITES certificate, thus promoting illegal logging and trafficking.

The USA, through the Central American and Caribbean Environmental Centre and the Costa Rican Environmental Ministry, is promoting the identification of mahogany and control of its traffic throughout Central American countries, in order to ensure that exploitation is according to the national sustainable use plans that each country has introduced. In late 2004 and early 2005, a series of national-level workshops was held for agricultural quarantine officers, customs officials and forest staff charged with the control of this type of product. This initiative should also help coordinate actions between the borders of the respective countries.

Box 3: **Calculation of the volume of the annual allowable cut (VAAC) in Honduras**

$$VAAC = \frac{IC \times Vol/ha \times AS}{CC}$$

$$\text{and } IC = \frac{\text{Basal area available for regeneration}}{\text{Basal area of trees with diameter} > MCD} \times 100$$

where Vol/ha - the volume in m3 per ha in the strata
AS – area of the strata
CC – cutting cycle
IC – intensity of cut
MCD – minimum cutting diameter

Table 24: **Example of harvesting volumes in the Honduras five-year plan**

Year	Stratum	Area (ha)	Total volume (m^3)	Volume of the annual allowable cut (m^3)		Volume for extraction (m^3)	Volume remaining (m^3)
				Traditional species	Commercial species		
1	L2	20	21,748.12	241.66	634.83	876.49	20,871.63
2	L2	20	21,748.12	241.66	634.83	876.49	20,871.63
3	L2	20	21,748.12	241.66	634.83	876.49	20,871.63
4	L2	20	21,748.12	241.66	634.83	876.49	20,871.63
5	L2	20	21,748.12	241.66	634.83	876.49	20,871.63
Total		**100**	**108,740.06**	**1,208.00**	**3,174.20**	**4,382.50**	**104,358.15**

CITES procedure for mahogany

Honduras has established a procedure for the export of mahogany products, which is set out in Chapter V of the Regulations for the CITES Convention (see Box 5).

Decisions regarding the granting of CITES certificates for flora and fauna are made by AFE-COHDEFOR. This is done via the Directorate of Ecosystem Protection, which determines if all the documents are in order, then refers them to the Directorate of Productive Development to issue a decision. The following are the internal procedures for approval:

1 Presentation of invoices for the raw materials, which support the shipment of the product to be exported.
2 Presentation of documents proving the origin of the traded timber and documents proving that the area of origin is under a management plan.
3 The commercial invoice supporting the sale of the product to be exported must state the species, dimensions of the pieces (breadth, width and length), quantities of each, number of packages, number of pieces, number of board feet, or other identifying features of the product.
4 Before issuing a permit, the closest forest region staff must check and certify that the shipment reflects what is stated in the invoice and that it is supported by the CITES certificate.

A simple idea for a mahogany chain of custody

Management plans must identify and number the trees to be felled during the five-year period. A simple chain-of-custody

Box 4: **Example of a technical summary of a management plan in Honduras**

Protected Forest Area: 349 ha
Productive Forest Area: 627 ha

Table 25. **Volume and basal area by layer and species group.**

Layer	Area (ha)	%	Basal area (m^2/ha) DBH >MCD cm			Volume (m^3/ha) DBH >MCD cm		
			Traditional species	Commercial species	Potential species	Traditional species	Commercial species	Potential species
L2	327	52	2.258	7.01	2.310	25.225	66.51	24.241
L1	300	48	0	2.83	0.419	0	37.50	4.172
Total	**627**	**100**	**2.258**	**9.84**	**2.729**	**25.225**	**104.01**	**28.413**

Authorised Annual Felling	
Traditional species	241.66 m^3/year
Commercial species	634.83 m^3/year
Available volume of potential species	9,178.41 m^3
Annual Allowable Cut (Commercial)	876.49 m^3/year
Felling Cycle	30 years

Table 26: **Silvicultural activities in the Honduras five-year plan**

Activities	Area (ha)	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Complementary sampling and/or regeneration	20			X		
Complementary sampling and/or regeneration	20				X	
Complementary sampling and/or regeneration	20					X

DBH – Diameter at breast height
MCD – minimum cutting diameter

procedure could be implemented by numbering the pieces extracted from each tree according to their tree of origin. This would render a unique number for each piece, which would be marked on the piece itself and stated in the sales invoice. For example, the Rio Plátano Biosphere Forest region works under management plan no.12, and has identified tree no. 41 for felling; the marked piece is no. 18 from this tree. The number of the piece would therefore be 124118, whose dimensions are 4 x 6 x 8, and the volume is 16 board feet. Agreement of a procedure such as this would allow control of the movement of the products from a certain tree during their processing, storage, transport and inventory in shops or timber yards.

Box 5: **Procedure to obtain CITES permits and certificates in Honduras (from Chapter V of the Regulations for the CITES Convention)**

Art. 25. The application will be presented by a legal representative to the general secretariat of the SAG (Agriculture and Livestock Secretariat), which will decide in one day whether to accept or reject it.

Art. 26. In cases where the application is not complete, a three-day period will be granted for completion.

Art. 27. If the application is not completed in the three-day period mentioned above, it will expire, without prejudicing a new application from the same applicant.

Art. 28. The General Secretariat of SAG will forward the documents to AFE-COHDEFOR (Forest Administration of the Honduran State Corporation for Forest Development) or DIGEPESCA, whichever is pertinent, so that it can issue a decision in seven working days.

Art. 29. Once the decision has been issued, the General Secretariat of SAG will be notified so that it, in turn, can issue its decision in two working days.

Art. 30. Once the decision has been issued, the documents will be forwarded to the National CITES Office, so that a CITES certificate or permit can be issued in two working days.

Mexico

Edited from presentation by Cuauhtemoc Tejeda Godinez, SEMARNAT

Distribution of *Swietenia macrophylla*

The natural distribution of mahogany *Swietenia macrophylla* in Mexico comprises the states of Campeche, Chiapas, Oaxaca, Puebla, Quintana Roo, Tabasco, Veracruz and Yucatán. It is estimated that 80% of mahogany forests have been depleted, but the present status of the species is stable. The main threats to mahogany are changes in land use, closely followed by illegal extraction.

National institutions and regulations for the control of forest resources

Mexico includes three important forest ecosystems (woodland, rainforest and arid zones), and the country boasts one of the richest and most varied floras in the world. The depletion of forests has increased in the last few decades, and the Mexican Government has recently created more specific regulations and institutions charged with the protection of these resources. A legal framework applicable to forest issues has been developed, the main elements of which are outlined in Box 6. The newest instrument is the General Law for Sustainable Forest Development (LGDFS), which entered into force in 2003, and which aims to regulate and promote the conservation, management, use and restoration of the country's forest ecosystems.

The following are the main institutions responsible for the management of forest resources in Mexico.

SEMARNAT

The Environment and Natural Resources Secretariat (SEMARNAT) authorizes the use of forest resources and the establishment of commercial forest plantations, according to criteria and management methods that depend on the resource characteristics and the zones or ecosystems where they occur. SEMARNAT develops and implements ecological restoration programmes that aim to

Box 6: **Principal elements of Mexico's legal framework for regulation of forest activities**

- Article 27 of the Political Constitution of the Mexican United States establishes that the State has the right to regulate conservation and use of the country's natural resources. The article was reformed through the Decree of 1992, published in the Official Journal of the Federation (DOF), which establishes that:

  "The Nation will always have the right to impose upon private property all regulations regarding public interest, as well as to regulate, for social well-being, the use of natural resources susceptible to appropriation, in order to equally distribute public assets, ensure conservation, achieve balanced development of the country and improve the conditions of life of rural and urban populations. Consequently, the State will dictate all necessary actions to organize human settlements, establish adequate supplies, services, land, water, and forest reserves, carry out public works, plan and regulate the establishment, conservation, improvement and growth of centres of population, in order to preserve and restore ecological balance, to distribute uncultivated lands, to enforce bylaws that allow for the establishment and collective exploitation of lands and communities, to develop small rural properties, to promote agriculture, livestock herding, forestry and all other financial activities in rural areas, and to prevent the depletion of natural elements and any destruction within properties that would be counter to the public interest."

- Paragraph XXIX-G of Article 73 of the Constitution grants Congress the right to issue bylaws that establish the rights of the Federal, State and Municipal governments, within their respective competencies, with reference to the protection of the environment and the preservation and restoration of the ecological equilibrium.

- The General Law for Ecological Equilibrium and Environmental Protection (LGEEPA), published in the DOF of January 28, 1988, and reformed through the Decree dated December 13, 1996, establishes the criteria that must guide the use, protection and preservation of natural resources, as well as the prevention and control of environmental pollution. The national environmental policy and its bylaws also establish the same recommendations.

- The main objective of the General Law for Sustainable Forest Development (LGDFS), published in the Official Journal of the Federation on February 25, 2003, which entered into force on May 26, 2003, is to regulate and promote the conservation, protection, restoration, production, ordinance, planting, management and use of the country's forest ecosystems.

- A law regarding CITES was approved by a Decree published in the Official Journal of the Federation on June 24, 1991.

Box 7: **Required components of a forest management plan in Mexico**

- ☐ General objectives of the management plan, taking into account the range of use proposed, and the sustainable management and maintenance of the primary resource.
- ☐ The term of the plan, which must take into account whether it can be fully carried out with the agreed objectives and the supporting information provided.
- ☐ Geographic location of the plot(s), using coordinates approximated to tenths of a second.
- ☐ General description of the plot(s), which should include: analysis of past uses and response of the resource to treatments applied, chronological description of the process of change of land use, and the composition of the forest soil during the previous year.
- ☐ Area of the plot(s) designated for each of the following: conservation and restricted use, production, restoration and other uses, considering the specifications of Article 23 of the current guidelines.
- ☐ General description of the physical and biological characteristics of the area, which should include: climate, soil, topography, hydrology, types of vegetation and dominant wild flora and fauna species.
- ☐ A study of tree dimensions, including a description of the inventory methodology that will provide dimensional information about the plot(s) at the species level, to comply with technical specifications established in the relevant official Mexican guidelines.
- ☐ Description of the silvicultural system consistent with the basis for management of the resource, according to the technical specifications established in the relevant official Mexican regulations.
- ☐ If applicable, actions to preserve and protect the habitat of threatened and rare flora and fauna species and subspecies, or those that have been identified for special protection under law.
- ☐ Measures required to prevent, control and extinguish fires, pests and forest diseases, according to official Mexican prescriptions.
- ☐ Measures to prevent and mitigate environmental impacts during all management phases, which should be carried out even if extraction is suspended or has finished. This should include a calendar of events and staff responsible for each of the measures.
- ☐ Measures that will ensure the recuperation of the plot after harvesting, following Mexican technical specifications.
- ☐ Calendar of reforestation in case the plot has not recovered from the previous harvesting cycle. If reforestation is deemed appropriate immediately after felling, species native to the region must be used to restore the forest to its original state.
- ☐ If applicable, reforestation measures for the recovery of individual species that need to be restored.
- ☐ The planning of necessary infrastructure to transport raw materials, including distances (in km), type and conditions of the existing road network, maps showing their location, facilities that will be built, and maintenance techniques and activities that will be implemented to reduce environmental impacts to a minimum, as per applicable official Mexican guidelines.
- ☐ Method for identification of trees to be felled, as established in paragraphs VI and VII of Article 75 of the current guidelines.
- ☐ Name, identification and National Forestry Registry code of the person that drafted the plan and the person in charge of implementation and assessment.

reverse the process of degradation and desertification, or restore serious ecological imbalances in forested lands.

SEMARNAT also develops and supervises all phytosanitary measures for forest species and coordinates, supervises and implements prevention, emergency and control actions in case of fires, pests and forest diseases. SEMARNAT takes care of logistics regarding transportation, storage and transformation of forest raw materials, strengthening the state's capacity to tackle all activities with a negative impact on forest resources.

The National Forestry Technical Consultative Council

The National Forestry Technical Consultative Council is composed of representatives from all organizations, research and education centres, producer and corporate associations, non-governmental organizations (NGOs) and other institutions involved in forest issues. It was created to act as the official consultation and assessment group for issues relating to the LGDFS. The group may also give opinions on other matters where its input is sought. The Council is also in charge of assessment, supervision, surveillance, evaluation and follow-up in the application of forest policy and related instruments prescribed by the LGDFS. The Council must always be consulted about any issues concerning forest planning, bylaws and regulations.

CONAFOR

The National Forestry Commission (CONAFOR) is a decentralized autonomous public institution of the Federal Public Administration. CONAFOR is coordinated by SEMARNAT, and its main objectives are to develop, benefit and promote forest production activities through funding for the development of management programmes and their execution, as well as establishing and maintaining commercial forest plantations. The promotion of forest plantations in deforested zones helps to provide raw materials to industry and reduce the pressure on the natural forest. It also offers an opportunity for the restoration of degraded areas that are currently unproductive as agricultural or grazing land.

CONAFOR also supports the protection, conservation and restoration of forest resources defined by the LGDFS as priority areas for development, participates in the drafting of plans and programmes, and in the enforcement of sustainable forest development policies and related instruments.

Procedures to authorize timber use in forests

An application must be submitted to SEMARNAT in order to obtain authorization to harvest timber resources, including mahogany. The application must include documents attesting to the applicant's legal authority to carry out the proposed activities and an environmental impact authorization. The required components of a management plan are listed in Box 7. In the case of commercial forest plantations, the land title that gives authorization to the applicant and a simplified management programme must be submitted. For areas up to 800 ha that are largely forest or agricultural land, a public notice system speeds up the procedure.

Once the forest management programme is presented, SEMARNAT will initiate an assessment to determine if it complies with all legal requirements. SEMARNAT will also evaluate the feasibility of the activities proposed in the plan with regard to the resources to be exploited and the entire forest ecosystem. Those responsible for the development, management, execution and evaluation of this planning system are forest professionals enrolled on the National Forestry Registry. They also review the annual performance reports submitted by the person or institution executing the management plan.

SEMARNAT may authorize the plan as presented or may require modifications, such as additional forest management prescriptions or environmental impact mitigation. If modifications are required, SEMARNAT will identify the restrictions or requirements that must be observed when implementing the plan, with the aim of preventing, mitigating or compensating for the negative effects upon the ecosystem.

According to the LGDFS and the criteria and indicators set out in relevant regulations, SEMARNAT may only deny a request if:

- It notices non-compliance with the LGDFS, its regulations or any other applicable legal prescriptions;
- The forest management programme is not consistent with the regional forestry study (if it exists) of the forest unit where the plot is located;
- The biodiversity of the area and its regeneration and productive capability are in any way compromised;
- The area has been set aside by the LGDFS for protection;
- Any information provided by the applicant is found to be untrue;
- Conflicts of ownership, rights or boundaries arise. In such cases, the application will be denied only for the area of conflict.

Technical components of forest management

The technical basis for the management of productive forests is the concept of minimum cutting diameter. A minimum cutting diameter is established for all tradeworthy species or groups of species. The goal is to guarantee regeneration by protecting individuals of medium and small

Box 8: **Legal basis for sanctions for transgression of forest regulations in Mexico**

The Penal Code for the Federal District related to Matters of Common Interest and for the Republic related to Matters of Federal Interest: Decree dated December 13, 1996 includes a chapter that refers to environmental transgressions, which categorizes negative conduct towards protection, preservation and the use of natural resources as established in the environmental legislation and bylaws.

In this context, environmental transgressions relating to forest matters are included under Title XXV of environmental transgressions, in Articles 418 and 419 of the Federal Penal Code.

Article 418: A six months' to nine years' prison term or the payment of the equivalent of 100 to 3,000 days of minimum wage will be imposed on those who carry out the following actions in non-urban areas:

- □ clearance or destruction of natural vegetation;
- □ felling, extraction or logging of trees; or
- □ changes in the use of forest lands.

The penalty would be increased by three years and the financial fine would increase to at least 1,000 days of minimum wage if the actions take place in a protected area.

Article 419: Whoever illegally transports, trades, collects, stores or transforms wood into roundwood, chips, charcoal or any other timber product, or takes more than 4 m^3 of soil from forest lands, or the equivalent in sawnwood, will be subject to imprisonment for one to nine years and a fine equivalent to 300 to 3,000 minimum-wage days. The same penalty will be imposed for amounts less than 4 m^3 where multiple offences are concerned.

diameter and to consolidate sustained production, which can be achieved if:

- There is an adequate number of large trees to make harvesting profitable;
- The minimum cutting diameter is sufficiently high;
- The species used has a regular diameter distribution.

Management is based on a polycyclic system, and a guide species is generally established (the one with highest trade value). Silvicultural methods such as selected felling and enrichment plantings are also used.

The minimum cutting diameter for mahogany has been established at 55 cm, which the trees generally achieve in 75 years. The felling cycle is 25 years, which is the time taken for young trees (low-diameter class) to progress to the medium-diameter class, and those with medium diameter to develop into large-diameter trees for harvesting.

Management and coordination of forest concessions at the national level

CONAFOR, in coordination with other federal agencies, sets boundaries for forest management units, taking into consideration natural hydrological features, with the aim of achieving sustainable forest planning, methodical planning of forest activities and efficient management of forest resources. It also promotes the coordination of concessionaires whose plots are located within the same forest management unit, allowing the following:

- Integration of silvicultural information at the plot level;
- Updating of maps of the unit in question;
- Regional or zonal forest studies that support forest management at the plot level;
- Communal activities for the conservation and restoration of associated resources;
- Supplementary efforts for the prevention, detection and control of fires, pests and diseases, as well as illegal felling and, if relevant, assessment and restoration of damage caused by the above;
- Planting to support reforestation activities, especially concerning production, protection, conservation and/or restoration at the plot level;
- Development of an annual activity report for the managed area;
- Periodical reports about progress in the implementation of regional or zonal programmes;
- Balanced distribution of management costs or additional expenses among participants.

Procedures for transporting and processing timber

Once permission to harvest has been obtained, the resulting primary products may be transported under a certificate printed on security paper issued by SEMARNAT. The companies that store and process primary timber products must also be authorized by SEMARNAT and must be catalogued in the National Forestry Registry. They, too, must have certificates printed on SEMARNAT security paper for the transportation of processed products, and they must provide periodic reports on the use of the transportation documentation to SEMARNAT.

Enforcement of forest law and institutions responsible

The General Office of the Republic is the judicial institution for the United Mexican States. It imposes sanctions for illegalities concerning forest matters. The Federal Environmental Protection Office (PROFEPA) has an administrative role, inspecting harvesting, management, transportation, storage and processing operations and enforcing the law and other applicable regulations. It is responsible for imposing penalties on transgressors.

The criteria the authorities should observe when imposing sanctions are set out in the legal documents listed in Box 8 (p. 39).

During inspection visits, if PROFEPA discovers that there is an imminent risk of serious damage to the forest ecosystem, immediate sanctions can be imposed, such as:

- Precautionary impoundment of forest products and raw materials, goods, vehicles, instruments, equipment or anything else directly related to the action or omission giving rise to the penalty;
- Temporary, partial or total shutdown of facilities, machinery or equipment for the use, storage or transformation of forest resources or raw materials, or the places or facilities where actions that might harm the environment take place;
- Temporary, partial or total cessation of the authorization for the exploitation, or for the activity in question.

The Federal Executive Office has the authority to ban forest activities, based on technical studies carried out by SEMARNAT and an opinion of the National Forestry Technical Consultative Council. The owners of the affected land, be it private, communal or other, have the right to be consulted, and the rights of the person or institution that has applied to exploit the timber or afforest the area must also be respected.

Table 27: **Mexico's forest use authorizations up to 2004**

State	Number of authorized concessions	Area under management (ha)	Permitted volume of mahogany (m^3)
Campeche	49	102,418	4,303
Chiapas	11	230	468
Quintana Roo	35	384,132	8,054
Total	**95**	**486,780**	**12,825**

Table 28: **Production and value of mahogany in Mexico in 2003**

State	Production (m^3)	Production value (US$)
Campeche	790	205,595
Chiapas	343	22,307
Quintana Roo	9,314	2,799,763
Total	**10,447**	**3,027,665**

Table 29: **Mahogany plantations in Mexico, up to 2004**

State	No. of plots	Area planted (ha)
Campeche	17	893
Chiapas	7	210
Quintana Roo	3	1,576
Tabasco	33	289
Total	**60**	**2,968**

Mahogany harvesting and trade

The area of forest under management plans that included mahogany extraction during 2004 was 486,780 ha, with an authorized volume of mahogany of 12,825 m^3 (see Table 27). Trees in agricultural areas constituted an additional 5%. Actual production of mahogany in 2003 totalled 10,477 m^3 (Table 28).

There are almost 3,000 ha of mahogany plantations in the states of Campeche, Chiapas, Quintana Roo and Tabasco (Table 29). These new trees will help to reduce the pressure upon natural populations. No harvesting has been carried out so far, because the trees are between one and five years old: it is estimated that the first mahogany trees for commercial purposes will be harvested from the year 2015 on.

Import, export and re-export

The majority of mahogany exports are to the USA, Cuba and Spain; in the case of re-exports, the most important destination is the USA, with the timber originating from Brazil, Nicaragua and Peru. The most important countries of origin of imports are Peru, Brazil, Nicaragua, Guatemala and Belize. The volume of mahogany exports, re-exports and imports are given in Tables 30-32 based on information from the CITES Administrative Authority in Mexico.

Problems encountered with CITES or management procedures

So far, there have been no problems related to the issue of CITES certificates or permits, since the relevant guidelines are strictly followed. The guidelines are included in the following documents:

Table 30: **Exports of mahogany *(Swietenia macrophylla)* from Mexico, 1998-2004**

Year	Company	Number of permits	Total m³
1998	Industrializadora de Maderas y Duelas, S.A. de C.V	1	150.000
1998	Margarito Hernández Romero	1	100.509
1998	PYP Maderas de la Península, S.A. de C.V.	1	6.500
1998	Caribbean Island, S.A. de C.V.	1	14.000
Total 1998		**4**	**271.009**
1999	Grupo Iberoamericano de Comercio, S.A. de C.V.	5	168.391
1999	Surtidora Triplay, S.A. de C.V.	1	43.502
Total 1999		**6**	**211.893**
2000	Surtidora Triplay, S.A. de C.V.	1	7.580
Total 2000		**1**	**7.580**
2001	Carpicentro, S.A. de C.V.	1	2.190
2001	Ejido Noh Bec, Q. Roo	3	169.309
2001	Maderas del Sureste Tai Pan, S.A. de C.V.	2	114.150
Total 2001		**6**	**285.649**
2002	Ejido Noh Nec, Q. Roo	16	441.106
2002	Gaspar Daniel Peraza Peraza	1	1.710
2002	Jorge Alberto Reyes Pérez	2	27.650
2002	Maderas del Sureste Tai Pan, S.A. de C.V.	3	95.031
2002	Maderas Torres, S.A. de C.V.	1	40.030
2002	Surtidora Triplay, S.A. de C.V.	1	21.700
2002	Maderil La Viga, S.A. de C.V.	1	59.000
Total 2002		**25**	**686.227**
2003	Jorge Alberto Reyes Pérez	5	67.945
2003	Maderil La Viga, S.A. de C.V.	2	107.723
2003	Productos de Bosques Tropicales Certificados Noh-Bec, S.P.R. de R.L.	3	77.846
2003	Ejido X-Hazil Y Anexos	1	26.427
Total 2003		**11**	**279.941**
2004	Ejido Naranjal Poniente	3	73.847
2004	Ejido X-Hazil Y Anexos	3	70.753
2004	Maderas de la Zona Maya de Quintana Roo, S.A. de C.V.	4	94.550
2004	Madereria San Lorenzo, S.A. de C.V.	1	23.985
2004	Maderil La Viga, S.A. de C.V.	2	170.227
2004	Productos de Bosques Tropicales Certificados Noh-Bec, S.P.R. de R.L.	4	88.836
2004	Productos Forestales del Sureste Y Centro America, S.A. de C.V.	6	25.960
Total 2004		**23**	**548.158**
Grand Total			2,290.457

Table 31: **Re-exports of mahogany (*Swietenia macrophylla*) from Mexico, 1998-2004**

Year	Company	Number of permits	TOTAL m³
2002	Agrokami, S.A. de C.V.	1	28.950
2002	Jeld-Wen de México, S.A. de C.V.	4	1,067.850
Total 2002		**5**	**1,096.800**
2003	Jeld-Wen de México, S.A. de C.V.	1	60.000
Total 2003		**1**	**60.000**
Grand Total		6	1,156.800

Table 32: **Imports of mahogany *(Swietenia macrophylla)* into Mexico, 1998-2004**

Year	Company	Number of permits	Total m^3
1998	Comercializadora Internacional Concord, S.A. de C.V.	1	64.430
1998	Maderas Tropicales y Finas, S.A. de C.V.	1	32.000
1998	Selva Corporation de Mexico, S.A. de C.V.	1	26.000
Total 1998		**3**	**122.430**
2001	Sudamerican Lamber, S.A. de C.V.	6	67.340
2001	Triplay, Aglomerados y Muebles Azteca, S.A. de C.V.	3	23.155
2001	Triplay Frontera 2000, S.A. de C.V.	1	6.430
2001	Tablerama, S.A. de C.V.	1	5.784
2001	Consorcio Forestal Amazónica, S.A. de C.V.	1	8.720
2001	Enchapados Nacionales S.A. de C.V.	1	6.070
2001	Jeld-Wen de México, S.A. de C.V.	1	2,000.000
Total 2001		**14**	**2,117.499**
2002	International Maderera y Triplayera, S.A. de C.V.	2	7.970
2002	Sudamerican Lomber, S.A. de C.V.	4	7.310
2002	Jeld-Wen de México S.A. de C.V.	4	2,468.440
2002	Consorcio Forestal Amazónica, S.A. de C.V.	6	231.630
2002	Carlos Eduardo Ledesma Reynoso	1	24.000
2002	Juan Torres Garcia	1	6.100
Total 2002		**18**	**2,745.450**
2003	Bozovich de Mexico, S.A. de C.V.	2	170.350
2003	Consorcio Forestal Amazonico, S.A. de C.V.	9	395.430
2003	Fabrica Y Maquiladora de Triplay Mayaplay, S.A. de C.V.	1	0.903
2003	Instrumentos Musicales Fender, S.A. de C.V.	1	7.720
2003	Internacional Maderera Y Triplayera, S.A. de C.V.	1	6.730
2003	Jeld-Wen de Mexico, S.A. de C.V.	3	964.770
2003	Juan Torres Garcia	1	12.590
2003	Julia Arminda Cevera Bolio	1	17.700
2003	Madereria del Bajio, S.A. de C.V.	1	18.870
2003	Madereria Modelo de Mexico, S.A. de C.V.	1	37.730
2003	Mónica Vietnica Alegre González	1	0.042
2003	Pisos en Madera, S. de R.L.M.I.	1	11.790
2003	Productos Forestales del Sureste y Centro America, S.A. de C.V.	9	271.973
2003	Sud American Lumber, S.A. de C.V.	8	78.369
Total 2003		**40**	**1,994.967**
2004	Bozovich de Mexico, S.A. de C.V.	1	19.880
2004	Grupo Maderero Najal, S.A. de C.V.	2	19.039
2004	Maderas Tropicales El Pajarito, S.A. de C.V.	1	30.460
2004	Cg Grupo Forestal, S.A. de C.V.	1	71.674
2004	Distribuidora Continental de Madera, S.A. de C.V.	1	83.700
2004	Jeld-Wen de México, S.A. de C.V.	5	2,545.000
2004	Julia Arminda Cevera Bolio	2	12.260
2004	Productos Forestales del Sureste Y Centro America, S.A. de C.V.	16	631.065
Total 2004		**29**	**3,413.078**
Grand Total		104	10,393.424

Note: The General Directorate of Wildlife did not issue any CITES importation permits during 1999 and 2000 due to lack of requests.

- *The Manual of Procedures for Import and Export of Wild and Aquatic Flora and Fauna Species, Products and By-Products*;
- *The Import of Forest Products subject to regulations by the Environmental, Natural Resources and Fisheries Secretariat* and modifications published in the Official Journal of the Federation on 26 March, 1999;
- *The Agreement that Establishes the Classification and Codification of Merchandise whose import and export is subject to regulations by SEMARNAT*, published in the Official Newspaper of the Federation on 29 March, 2002.

As far as problems encountered with management plans are concerned, there may be a delay in the environmental impact evaluation, which can sometimes take from six months to one year. Another issue that arises is that mahogany is often the only species extracted from plots while other usable species are left standing (approximately 11 species).

Illegal trade

Table 33 shows the seizures of wood suspected to be of illegal origin in 1998-2003. Seizures have taken place in non-mahogany-producing states in Mexico when the legal origin of products in transportation, storage or processing is unconfirmed.

Seizure of wood occurs as a precautionary measure, and, once the administrative procedure is complete, the timber can be released and sent to a number of final destinations, such as:

- Direct sale, when the value of the product seized does not exceed 5,000 times the minimum wage;
- Sale at public auction, when the value of the product seized does not exceed 5,000 times the minimum wage;
- Donation to public organizations and scientific or academic institutions, or to welfare;
- Destruction, when the products or subproducts harbour any diseases that may hinder use.

During 2002 and 2003 there were three operations during which the main access roads were closed for one to two months in the south-southeastern region, in the states of Campeche, Chiapas, Oaxaca, Quintana Roo, Tabasco, Veracruz and Yucatán, for the purpose of verifying the legal origin of primary forest products.

During February 2003, the Working Group for Enforcement of the North American Law (NAWEG) coordinated a workshop on the illegal trade of flora. Further training courses are required, however, to include all of PROFEPA's 600 inspectors who carry out surveillance of natural resources and environmental impact.

Table 33: **Seizures of mahogany (*Swietenia macrophylla*) in Mexico, sawnwood (S) and roundwood (R) (m³) 1998-2003**

State	1998		1999		2000		2001		2002		2003		Total	Total
	S	R	S	R	S	R	S	R	S	R	S	R	S	R
Aguascalientes	-	-	-	-	5	-	-	-	-	-	-	-	5	-
Campeche	-	-	-	-	32	27	66	32	45	6	75	8	217	73
Chiapas	-	-	147	-	-	-	5	-	31	-	-	-	183	0
Colima	-	-	-	-	-	-	-	-	1	-	-	-	1	0
Distrito Federal	-	-	-	-	6	-	8	-	-	-	-	-	14	0
Guerrero	-	-	-	-	-	-	35	-	99	-	-	-	133	0
México	-	-	-	-	-	-	-	-	1	-	-	-	1	0
Michoacán	-	-	6	-	-	-	-	-	-	-	-	-	6	0
Morelos	-	-	-	-	-	-	-	-	8	-	-	-	8	0
Nayarit	-	-	-	-	-	-	-	-	0	-	-	-	0	0
Puebla	-	-	-	-	-	-	-	-	2	-	-	-	2	0
Querétaro	-	-	-	-	-	-	-	-	2	-	-	-	2	-
Quintana Roo	133	-	42	64	30	2	84	20	21	11	161	3	470	100
San Luis Potosi	-	-	-	-	-	-	-	-	5	-	-	-	5	0
Tabasco	-	-	-	-	-	-	-	-	5	-	-	-	5	0
Yucatán	-	-	34	-	11	-	144	-	7	-	20	49	216	49
Zacatecas	-	-	-	-	-	-	-	-	-	-	5	-	5	0
Total	133	0	228	64	84	29	341	52	227	16	260	60	1,273	222
Total = 2,768 m³ roundwood *														

**Total sawnwood is multiplied by two to give roundwood equivalent (assuming a conversion factor of 50% for roundwood to sawnwood).*

Note: The number of mahogany seizures in 2004 w7as 23; the data on volume seized are under review.

Panama

Edited from presentation by Narciso Cubas Pérez, ANAM

Panama has a total area of 74,927 km². Forest cover is 33,645 km², and the annual area deforested is estimated at 47,158 ha.

Relevant aspects of forest law

The Forest Law in Panama sets out the framework for general forest management in the country. Article 11 of the Forest Law establishes that inventories, reforestation plans and forest management plans should be carried out for both natural and artificial forests by forestry specialists, and should be presented for approval to the Institute for Renewable Natural Resources (INRENARE).

Article 16 requires that all persons involved in forest exploitation, industrialization, commercialization, reforestation, the collection or sale of forest seeds, or relevant scientific research must register on the Forestry Register. They must provide INRENARE with relevant, up-to-date information and offer technical assistance for the improvement of forest activities.

Authorization must be sought from INRENARE for sustainable harvesting in areas of privately owned natural forest (Article 26). This is granted on presentation of a forest inventory, management plan and the identification of individual trees to be cut. This identification process will be carried out by INRENARE's technical personnel accompanied by the land owner or an elected representative. Forest harvesting may be suspended according to the grounds laid out in Article 36 of the law.

To ensure that the concessionaire's obligations are carried out, a deposit of five balboas per hectare (approx. US$5) must be paid for the duration of the concession (Article 34). If the concession is for less than 400 ha the deposit is set at a minimum of 2,000 balboas (approx. US$2,010). The deposit can be made in cash, by cheque, state bonds, banker's reference or by insurance policy. The deposit will be returned no later than six months after the termination of the contract, as long as the requirements of the contract have been met.

The grounds for early termination of the harvesting contract are set out in Article 36 as follows:

- The departure or death of the person responsible for the contract;
- Bankruptcy or the build-up of debt by the concessionaire;
- Failure of the concessionaire to meet any of the requirements of the contract;
- Failure to deliver the actions laid out in the management plan or delivery of false information in response to that required by Article 32 of the current law;
- Failure to control fire, pests or disease in the concession area;
- Failure to present the annual budget for forest management, or the catalogue of equipment used, or other additional requirements of the contract.

No forest product may be transported within national territory without the corresponding permits issued by INRENARE (Article 49). INRENARE manages control posts with support from the Public Forces and has the authority to confiscate any products found to be transported without the requisite permits. These are then subject to investigation by the authorities of INRENARE.

Article 50 establishes the role of INRENARE's inspectors, forest rangers and park rangers to carry out protection and control for the conservation, management, use and transport of renewable natural resources, and maintain the required coordination with the Public Forces.

Article 53 requires that all industries and businesses involved in the production and use of forest products are obliged to submit information and statistics on an annual basis to the relevant authorities. This information is treated as confidential, but may be requested for inspection by officials from INRENARE. According to Article 54, INRENARE officials may also, at any time, call for an inspection of industries or businesses involved in the processing of forest products. During such inspections, the companies under scrutiny must present all information pertaining to the processing of these materials.

Other elements of the Forest Law and its regulations

Volume tables are utilized for natural forests, with a standard formula for calculating timber volumes. Management plans must be developed by suitable professionals, and environmental impact assessments must be approved. Information on annual operations have to be presented to the authorities. The area to be harvested must be demarcated with signs and the trees that are to be cut marked. Directional felling has to be used, and a certain number of commercial trees left as seed trees. The minimum cutting diameter and the cutting cycle must be followed; once an area has been harvested, it cannot be cut again until the cutting cycle has been completed.

Executive Decree No. 57

In 2002, a new law was passed concerning the forest industry and forest exploitation (Executive Decree No. 57 of 5 June 2002). The first article of this law strictly prohibits the export of roundwood, logs, blocks, sawnwood or simply planed timber of any species taken from natural forests or submerged in any artificial body of water. The second article promotes actions and administrative sanctions that guarantee the sustainability of natural forests, and the sufficient supply of primary materials for national industry.

Mahogany harvesting and trade

Limitations on the harvesting of mahogany include a minimum cutting diameter of 75 cm. From a 100% inventory of an area, only 30% of the volume of timber can be authorized for harvesting. In fact, the largest populations of mahogany are

found inside classified protected areas or indigenous reserves, which therefore limits their harvesting.

Table 34 shows the volume of mahogany timber exported from Panama in recent years. In order to export mahogany, the following requirements must be met:

- Compliance with Executive Decree No. 57;
- Possession of a permit for forest harvesting;
- Possession of transport documents (determining the origin of the timber);
- Possession of the documents of embarkation;
- Compliance with the documents required by CITES.

Table 34: **Volume of mahogany *Swietenia macrophylla* exported from Panama**

Year	Volume exported (m^3)
1998	70.76
2000	650.26
2001	2,010.38

Report of the workshop working groups

During the workshop, four working groups were formed to address priority themes relating to issues highlighted by the CITES Mahogany Working Group. The issues discussed and conclusions reached are summarized below.

Group 1: Forest management and inventories

This group discussed the requirement for inventory information on the population, distribution and conservation status of the species as a basis for management. It also considered the potential for harmonization of management plans at a regional level.

It was agreed that it would be valuable to standardize methodologies regionally for the development of forest inventories as a basis for determining sustainable levels of harvesting, quotas and monitoring for *Swietenia macrophylla*. Forest inventories should contribute to the establishment of a network of permanent plots which would generate a range of information on the species in different habitat conditions. Sampling should take account of characteristics such as soil type and topography that affect the growth of mahogany. Inventory and research data should be incorporated into a regional-level geographic information system, in order to facilitate decision making.

It was also agreed that a standard methodology for forest management plans should be developed at a regional level, taking into account the methodology proposed by CATIE. In the absence of comprehensive information, the precautionary principle should be applied to ensure that extraction from natural forests does not impact negatively on the species.

As a follow-up activity, funding should be sought for further research and improvement of forest management for mahogany harvesting. The CITES Secretariat, the ITTO and NGOs such as FFI, TRAFFIC and WWF will be approached to support this process. FFI offered to help with coordination.

Group 2: Capacity building

This group reviewed the priorities for capacity building defined by the CITES Mahogany Working Group at the Belem meeting. It considered existing tools for capacity building at national and international levels and the establishment of further approaches and mechanisms.

It was agreed that CITES documentation relating to mahogany should be circulated more widely within countries to increase understanding of the requirements of the Convention. There is a general need to disseminate information on the species and to make available results of research into alternative species. National legal frameworks for sustainable management of mahogany generally need to be strengthened, with capacity building leading to improved enforcement of legislation. Training in identification of mahogany remains a specific requirement.

Group 3: Communication and coordination

This working group discussed mechanisms for effective communication between CITES Scientific and Management Authorities and other stakeholders in the sustainable management of mahogany.

It was agreed that a data bank of NGOs and international organizations working on mahogany issues would be useful to facilitate the identification and administration of funds for national and regional activities. A database of research would also be valuable. Furthermore, it was agreed that a manual on the sustainable use of mahogany and the application of CITES should be developed for the region. Workshops should be arranged at border crossings to improve the coordination and communication between individuals charged with border control.

The working group considered that the Mesoamerican mahogany workshop should be formalized with annual meetings, if possible, the next one to be held in Guatemala.

Group 4: Regional harmonization

This group discussed mechanisms for regional harmonization and the formalization of procedures and strategies in relation to CITES mahogany issues.

The results of the workshop will be used as a basis for developing a regional workplan. The workshop report will be sent to the Executive Secretary of the Central American Commission on Environment and Development (CCAD) for further consideration. Follow-up of the workplan will be coordinated through the regional representative of the CITES Plants Committee (Costa Rica) and the regional representative of the CITES Standing Committee (Nicaragua). Representatives of Management Authorities of each of the countries agreed to follow up on commitments, actions and recommendations raised in the workshop. A specific activity will be to assess the model developed in Nicaragua (and presented at the meeting) for establishing a mahogany quota for replication in other countries.

Conclusions and recommendations

Conclusions

The regional coordination workshop successfully provided an opportunity to exchange skills and experience relating to the management and use of *Swietenia macrophylla* and the implementation of the CITES Appendix II listing. It is clear from discussions at the workshop that further action is necessary to improve sustainable management and trade in the species both nationally and regionally. There is a strong commitment to build on the discussions through regional networking and development of a workplan.

Follow-up will be coordinated through the regional representative of the CITES Plants Committee (Costa Rica) and the regional representative of the CITES Standing Committee (Nicaragua).

Recommendations

1 Continue the work initiated at the workshop through the development of a regional workplan and annual meetings, with coordination by the appropriate regional CITES representatives.
2 Build greater understanding of the development of sustainable forest management and mahogany exploitation in each of the countries and consolidate regional approaches in research and management. Develop baseline studies, as part of the workplan, to support this process. Consider the model provided by Nicaragua of rapid assessment of mahogany stocks as a basis for quota setting.
3 Strengthen the framework for regional and national communication on mahogany issues.
4 Establish a web-based mechanism for the effective exchange of information generated within each country.
5 Use the workplan as a basis to develop projects that take into account regional needs and present these to the CITES Secretariat and other potential funders.
6 Involve all stakeholders, including local government bodies and forest landowners, in the implementation of the legal framework for mahogany forest management and increase their capacity in this area.

Appendix

List of participants
First Mesoamerican Workshop on the Status of Mahogany and Harmonization of Harvesting Procedures
Nicaragua, 23-24 November 2004

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The CITES Appendix II listing of mahogany *Swietenia macrophylla* presents challenges for sustainable forest management and control of the international timber trade. To assist with meeting these challenges in Central America, the Government of Nicaragua (the fourth largest producer of mahogany), together with Fauna & Flora International, developed a project on the current status and sustainable use of mahogany in the region, comprising a diagnostic study of the species in Nicaragua and a workshop to promote coordination within the region. This report presents a synthesis of the Nicaraguan study and the information and outcomes from the regional workshop.

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