



NDF Workshop Case Studies

WG 1 - Trees

Case Study 4

Swietenia macrophylla

Country: Peru, Brazil and Bolivia

Original Language - English

BIG-LEAF MAHOGANY (*SWIETENIA MACROPHYLLA*) IN PERU, BOLIVIA AND BRAZIL

AUTHORS:

Elena Mejía¹

Ximena Buitrón²

Marielos Peña-Claros³

James Grogan⁴

1 & 2: UICN SUR Regional Office for South America

3 Instituto Boliviano de Investigación Forestal, Bolivia

4 Yale University, USA

Acknowledgements

For providing valuable information and data we thank Ignacio Lombardi, CITES Scientific Authority of Peru, Universidad Nacional Agraria La Molina – UNALM; Juvenal Silva & Mickelly Cuba, Frankfurt Zoological Society of Peru; Cristian Velasco, CITES Management Authority of Ecuador, Ministry of Environment, National Forestry Department DNF-MAE; Doris Cordero, Forest Program Officer, UICN-SUR; Filippo del Gatto, consultant for TRAFFIC South America; Claudia Mello & José Humberto, IBAMA, Brazil; and José Natalino da Silva & Rubens Mendonça, Serviço Florestal Brasileiro, Brazil.

I. BACKGROUND INFORMATION

The debate over bigleaf mahogany's commercial and conservation status across its neotropical range has dominated CITES deliberations over timber species since the early 1990s (OIMT 2004). Mahogany was first proposed – unsuccessfully – for listing on Appendix II at CoP8 (Kyoto) by Costa Rica and the USA. Similar proposals met similar fates in 1994 (CoP9, Fort Lauderdale) and 1997 (CoP10, Harare). In 1995

Costa Rica included the species on Appendix III, followed by Bolivia, Brazil, and Mexico in 1997 and Colombia and Peru in 2000 (CoP11, Gigiri). The Bigleaf Mahogany Working Group was established following discussions at CoP11 (decision 11.4) and convened for the first time in 2001 (MWG1, Santa Cruz de la Sierra, Bolivia). A proposal by Guatemala and Nicaragua to uplist mahogany to Appendix II, covering only logs, sawn timber, veneer and plywood, was finally adopted at CoP12 (Santiago) by a vote of 68–30. The listing went into effect on 15 November 2003. At CoP12 the Mahogany Working Group's mandate was revised for subsequent meetings in 2003 (MWG2, Belém, Brazil) and 2006 (MWG3, Lima, Peru) (Blundell 2004).

As the world's most valuable widely traded tropical timber species, mahogany has faced commercial exploitation since the Spanish first discovered its unique properties in the 16th Century. While early exploitation focused on accessible Caribbean populations of the congeneric *Swietenia mahagoni* (listed since 1972 on Appendix II) and Central American populations of *S. macrophylla*, large-scale industrial logging shifted to vast South American stocks by the mid to late 20th Century as overland transportation networks penetrated previously inaccessible *terra firme* forests across southern Amazonia (Lamb 1966, Grogan *et al.* 2002). Mahogany's extraordinary value made single-species logging in previously unlogged primary forest profitable to hundreds of kilometers from the nearest sawmill. These were typically mining operations that removed trees as small as 20 cm diameter so long as they could pay their way out of the forest (Veríssimo *et al.* 1995). Particularly controversial were consistent reports of post-logging regeneration failure, attributed to mahogany's reliance on large-scale disturbance (as opposed to small-scale single-tree logging disturbance) for population renewal (Snook 1996, 2003, Gullison *et al.* 1996).

Moreover, mahogany's association with seasonally dry tropical forests puts it in conflict with competing land uses, especially agriculture and livestock grazing. Thus it faces severe habitat pressure: forests have been cleared from more than 63% of mahogany's range in Mesoamerica and 26% in South America (Blundell 2004).

From the early 1970s to the late 1990s, the major source of internationally traded mahogany was Brazil. As stocks there declined and the international controversy over the illegal origin of much of this supply grew, Brazilian exports fell until the government ban on harvest, transport, and commercialization in 2001. Bolivian supplies flooded the market during the early 1990s, until commercial stocks neared exhaustion and a new regulatory environment halted widespread illegal harvests. As Brazilian mahogany largely vanished from international trade in the early 2000s, Peruvian supplies spiked in response to increased demand and price, peaking at 52,000 m³ of sawn timber in 2002 (Grogan & Schulze 2008). Since mid-2003, internationally traded mahogany sawn wood has been largely from Peru. After export quotas were imposed by Peruvian authorities in 2005, and as commercial stocks neared exhaustion, exports declined to 20,407 m³ in 2006 (Phumpiú 2007) and below 5000 m³ in 2007 (Grogan & Schulze 2008).

To support CITES Appendix II implementation, the 16th Meeting of the Plants Committee established 10 conditions as a framework for developing non-detriment

findings (NDF) for three tree species including mahogany (Van Damme 2006). At the International Workshop of Experts on NDF for Big-leaf Mahogany (Cancún, Mexico, 2007) it was agreed to facilitate NDF by preparing, adopting and implementing management plans and developing and conducting forest inventories and monitoring programs (CITES 2007); measures to be taken by range nations were contingent on government approval.

This case study reviews mahogany life history, management, trade, and NDF procedures in the three principle South American range nations, **Peru, Bolivia,** and **Brazil**. In sections where information differs among nations, we indicate this by highlighting the applicable range nation in **bold**.

1. BIOLOGICAL DATA

1.1. Scientific & common names

Swietenia macrophylla King is classified in the family Meliaceae and order Sapindales. It is called big-leaf, Brazilian, or Honduras mahogany in English; caoba, aguano or mara (Bolivia) in Spanish; mogno (Brazil) or aguano (Acre) in Portuguese; and mahogani grands feuilles in French.

1.2. Distribution

Mahogany's natural range stretches from Mexico at 23° N of the equator down the Central American Atlantic coastal strip into South America, continuing in a broad southeasterly arc from Venezuela through the Colombian, Ecuadorian, Peruvian, Bolivian, and Brazilian Amazon regions to points as far south as 18° S (Lamb 1966, Pennington *et al.* 1981). Mahogany's South American historical natural range has been estimated as 278 million hectares, of which 57% occurred in Brazil and 21% were deforested in 2000 (Martinez *et al.* n/d; **Fig. 1**). Its distribution generally corresponds to forests classified as 'tropical dry', with annual temperature averages of greater than or equal to 24° C and 1000–2000 mm annual precipitation (Holdridge 1967). While primarily found in South America along aseasonal tributaries of the Amazon River and seasonal streams feeding them, mahogany also grows in humid and subtropical zones, at elevations ranging from sea level in Central America up to 1400 m in the Andean foothills of Ecuador, Peru, and Bolivia, in a wide variety of soil types and conditions (Lamb 1966).

Mahogany's natural range in Peru, Bolivia and Brazil is restricted to southern Amazonian forests. In Peru it covers an estimated 54.8 million hectares of which approximately 4% have been deforested. Its historic range in Bolivia covers an estimated 29.9 million hectares in the departments of Beni, Cochabamba, La Paz, Santa Cruz and Pando, of which roughly 8% has been deforested. In Brazil, mahogany's natural range covers approximately 153.6 million hectares of which an estimated 24% has been deforested. Mahogany's range is less fragmented in Peru and Bolivia than in Brazil due to lower rates of deforestation, land-use change, and overexploitation (Kometter *et al.* 2004, Martinez *et al.* n/d).



Fig. 1. Mahogany's natural range in South America. From Grogan *et al.* (2002) based on Lamb (1966) and field observations.

1.3. Life history

1.3.1. General biological & life history characteristics

Table 1. Mahogany life history characteristics based on field studies carried out in Mexico, Bolivia, and Brazil as well as on extensive descriptive literature, including Cornelius *et al.* 2004, Grogan 2001; Grogan & Galvão 2006, Gullison *et al.* 1996, Günter 2001, Lamb 1966, Norghauer *et al.* 2006, Pennington 2002, Pereira & Fredericksen 2002, Rocas n/d, Snook 2003, Verwer *et al.* 2008.

- | | |
|--------------------------------|---|
| General characteristics | <ul style="list-style-type: none"> • Emergent deciduous tree to >2 m diameter & 50 m height • Light demanding but may tolerate partial shade depending on local forest conditions • Occurs in groups along watercourses or at lower density in low-lying terra firme forest |
| Reproduction | <ul style="list-style-type: none"> • Monoecious, flowering during mid to late dry season • Minimum diameter of reproduction is 20–30 cm depending on location • Reproductive maturity attained by trees 70–80 cm diameter; |

- fecundity peaks at ~130 cm
 - Mature trees produce up to 800 fruit capsules 10–20 cm long containing ~50 seeds each
 - Seeds are wind dispersed during early to mid dry season
 - Dispersal mainly to within 32–36 m from seed tree but >150 m also possible
- Regeneration & recruitment**
- Seeds germinate at the beginning of the rainy season
 - Germination under controlled conditions = 80–90%
 - Germination under forest conditions = 10–68% but varies with year, precipitation & forest type
 - Seedling growth depends on light availability but survival is possible in the understory in more open forest
 - Requires large disturbances (stochastic) for regeneration but possible in the forest understory in more open semi-deciduous forests
 - Regeneration failure after logging has been widely documented, with exceptions
- Survival rate**
- Increases with stem size & varies with logging intensity
 - <1.3 m height: 10–40% per year depending on size & growing conditions
 - >1.3 m height: >60% per year
 - >50 cm diameter: close to 100% per year
- Growth rate**
- Few studies have been done
 - Variables affecting growth rate:
 - light conditions & degree of crown liana coverage
 - plant size: poles & adults grow faster than seedlings & saplings
 - logging intensity
 - geographic location: higher in transitional forests than in pre-Andean forests
 - Responds to silvicultural treatments with increased growth rate
- Pests**
- *Hypsipyla grandella*, the mahogany shoot borer, a larval caterpillar that feeds on growing apical meristems (leaders), destroying stem form or killing the growing sapling/pole
 - *Steniscadia poliophaea*, a larval caterpillar that defoliates seedlings & saplings; so far observed only in South America

1.3.2. Habitat types & degree of habitat specificity

Mahogany has a broad distribution in terms of precipitation, altitude, and soil types. It attains greatest stature in rich, deep, well-drained riparian or seasonally moist soils, while also tolerating dry conditions in open forests. In **Peru, Bolivia** and **Brazil** it occurs in three ecoregions: Amazon, pre-Andean Amazon, and the Chiquitano-Amazon transition (Bolivia, **Fig. 2**). Within these ecoregions it occurs in various forest types, including seasonal, moist semi-deciduous, and evergreen forest; non-flooded and temporally flooded alluvial plain forest in Bolivia; and dry upland inselberg ('island mountain') forest especially in Brazil. Mahogany's occurrence in a wide range of eco- and habitat types across a vast natural range suggests adaptability and phenotypic plasticity.

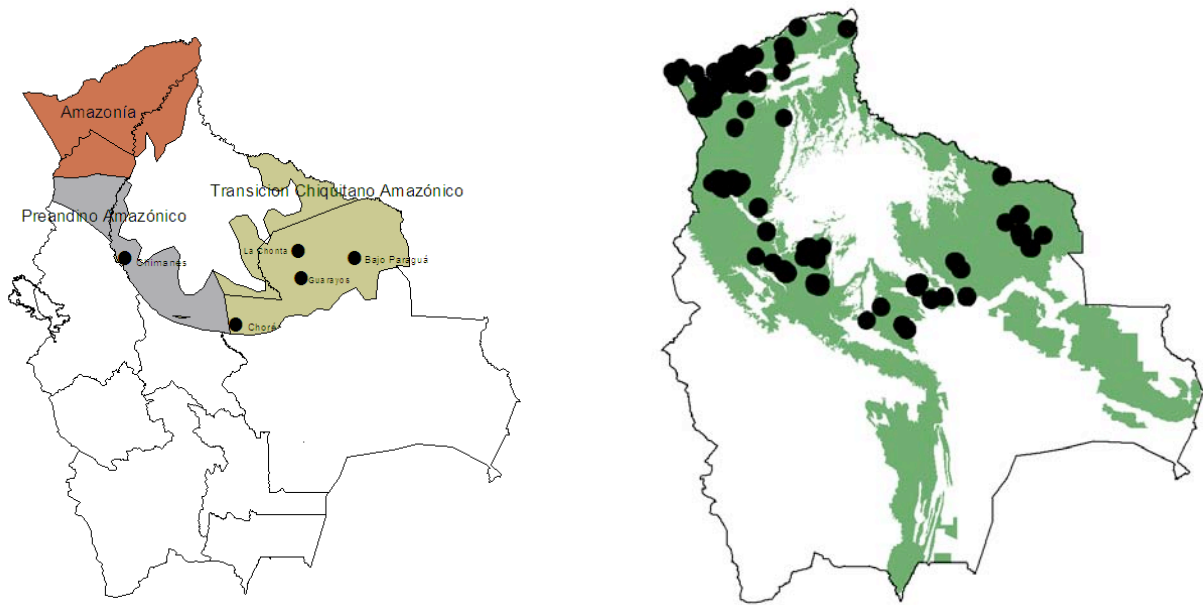


Fig. 2. Geographic distribution of mahogany in Bolivia. **Left:** Ecoregions and study sites mentioned in the text. **Right:** Circles indicate areas under forest management where mahogany has been found. Data are from the Superintendencia Forestal and figures are from Peña-Claros *et al.* (2004) & Mostacedo *et al.* (in prep).

1.3.3. Role of the species in its ecosystem

In seasonally dry tropical forests where mahogany typically occurs, it is one of a small number of emergent canopy tree species that play important structural and biological roles in the ecosystem. Mahogany's enormous stature and life cycle spanning two or more centuries combine to create persistent habitat for animals and insects adapted to life in the high forest canopy. Mahogany's tendency to form hollow boles as it ages provides an essential service to cavity-nesting birds like toucans and macaws. Its annual massive flowering generates pollen and nectar for a wide diversity of small butterflies, moths, and bees. Macaws and large parrots consume maturing fruit capsules while still on the tree crown during lean rainy season months. Several species of ground-dwelling rodents, including pacas and cutias, consume seeds on the ground in the vicinity of parent trees after dispersal in the late dry season. Other specialized insect predators depend on mahogany seedlings and saplings to complete their life cycles, including one moth (*Steniscadia poliophaea*) with no other known food source. Finally, as a fast-growing but long-lived late successional tree species, mahogany carries a wide variety of woody vine species into the forest canopy whose flowers and fruits provide life support for canopy dwelling animals and insects.

The key structural and biological roles that mahogany plays in forest ecosystems where it occurs are thus contingent on the presence of large, reproductively mature individuals. According to Lambert *et al.* (2005), even low-offtake, highly selective logging may dramatically impact mahogany's role in forest ecology and ecosystem function; data on the effects of such logging are urgently needed.

1.4. Population

1.4.1. Population size

Determining historical and current stocking levels of mahogany in South America has not been possible due to logistical and financial difficulties associated with inventorying its vast natural range across remote Amazonian regions, and due to rapid exhaustion of commercial stocks beginning in the early 1970s by a largely unregulated logging industry. Only remote populations that so far occur beyond the reach of mechanized overland logging operations survive intact. The geographical extent and size of these populations remains largely speculative (Kometter *et al.* 2004, Martinez *et al.* n/d). While many forests selectively logged for mahogany across southern Amazonia have been converted to pasture, agriculture, or degraded by fire, where forests persist mahogany also likely occurs at low densities compared to pre-logging populations, with most surviving individuals <45 cm diameter (i.e., sub-commercial at the time of logging; Grogan *et al.* 2002).

Little empirical data on mahogany populations is available from **Peru**. Preliminary data from an ITTO-sponsored national inventory project to describe mahogany's natural distribution and quantify remaining commercial stocks has been used to develop a distribution model (FloraMap) to predict mahogany's natural range based on climatic variation. The model predicts that most remaining populations occur in the southern Amazon region of Ucayali, Madre de Dios and Loreto (**Figs. 3 & 4**), beyond the reach of mechanized logging (Lombardi & Huerta 2007). Inventory data indicate landscape-scale density ranges from 0.003 to 0.164 trees per hectare, with a 40/60 proportion for trees <75 cm and >75 cm diameter, the legal minimum felling size for mahogany in Peru. That is, large mature trees dominate current population structures. However, detailed understanding of population structure necessary for projecting yields and planning sustainable management does not yet exist (INRENA 2007). As accessible populations have been commercially exhausted, illegal loggers have moved into ever more remote regions in search of unexploited populations (Rojas 2007).

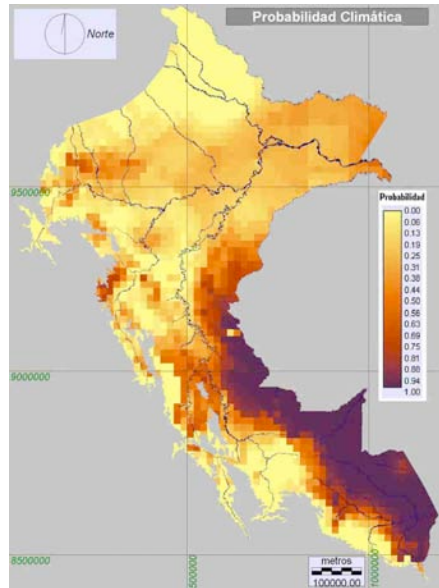


Fig. 3. Mahogany's frequency in Peru according to the climate probability model (Lombardi & Huerta 2007).

Pixel: 465 m (21,6 ha)

Densidad de árboles (árb/ha)
 Nivel de probabilidad de ocurrencias de
 árboles de caoba, según el modelo
 climático.

Factores como cuerpos de agua
 (valor 0) y zonas pantanosas
 (valor 0,2) determinan un
 densidad menor o nula

Clases	Superficie (ha)
< 0.0002	< 5000
0.0002 – 0.001	5000 - 1000
0.001 – 0.005	1000 - 200
0.005 – 0.025	200 - 40
> 0.025 (árb/ha)	> 40

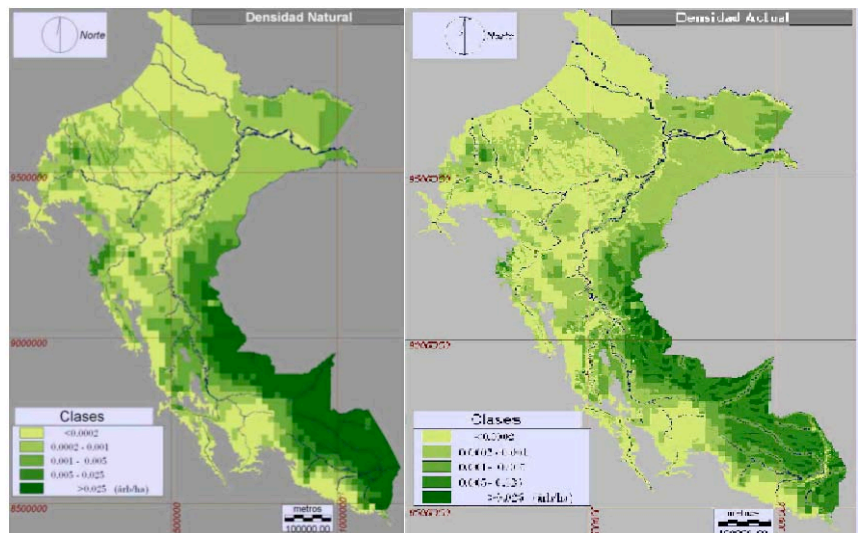


Fig. 4. Maps showing natural and adjusted density (Lombardi & Huerta 2007).

Insufficient information exists to calculate the population size of mahogany in **Bolivia**. Field studies have been local, with variable sampling methodologies. Another problem is that density of the species varies among forest type. Consequently, more detailed information at the forest type level is needed. Density data from forestry inventories and permanent sample plots (**Table 2**) demonstrate that mahogany population structures vary along its distribution range and according to exploitation history. In unlogged forests mahogany population structures show multiple peaks (i.e., density does not decrease continuously as size increases but is high in certain size classes), with trees reaching a maximum size of 200 cm diameter. This population structure suggests that cohorts of individuals recruit episodically, followed by periods of reduced recruitment (Gullison *et al.* 1996). In areas like La Chonta and Lago Rey where mahogany was exploited for about 20 years, population structures show decreasing density as size increases (**Fig. 5**), with very few trees >60 cm diameter. It is difficult to know whether these overexploited populations also showed multiple peaks in size classes before logging, indicating episodic recruitment.

Table 2. Mahogany population density in different ecoregions in Bolivia. Data are number of individuals per ha. Forest inventory data are from Dauber *et al.* (2001). Data from permanent sample plots are from the Instituto Boliviano de Investigación Forestal database (unpublished).

Ecoregion	Subregion	Density (>20 cm diam)	Permanent sample plots (>10 cm diam)
Amazon		0.07	0.03
Pre-Andean Amazon		0.35	0.64
Amazon	Choré	0.46	
Chiquitano-Amazon transitional	Guarayos	0.44	0.56
	Bajo Paraguá	0.53	

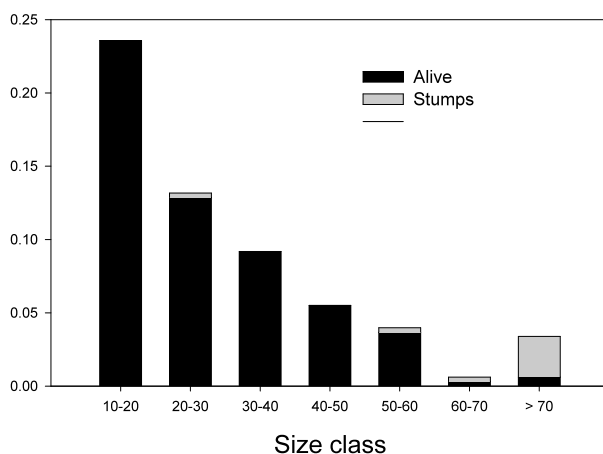


Fig. 5. Population structure of mahogany by size class in the Long Term Silvicultural Research Program plots in a tropical moist semi-deciduous forest in Bolivia. Original

population structure reconstructed using observed stumps (trees logged during 1970–1995).

In **Brazil**, large-scale inventories conducted in logged and unlogged forests across southern Amazonia indicate landscape-scale densities ranging from 0.014 – 1.18 trees >20 cm diameter per hectare where mahogany occurs (Grogan *et al.* 2008). Historical densities were highest in southeast Pará and Rondônia, but few populations survive within the so-called Arc of Deforestation that largely coincides with (and to some extent was fueled by) mahogany’s occurrence in southern and southeastern Amazonia (Grogan *et al.* 2002). Mahogany’s vast range in Brazil, and its extraordinarily rapid commercial exploitation since the early 1970s coinciding with the completion of north-south and east-west Trans-Amazon highways, means that a national inventory to assess surviving stocks would be prohibitively expensive. Martinez *et al.* (n/d), based on extensive sawmill processing center and transportation data, estimate that commercial mahogany populations may survive across only 35% of its range in Brazil. Most remaining populations are located in remote regions where transportation infrastructures remain incipient, or where terrain is steep, or where seasonal rains impede access. These populations occur mostly along the northern and western limits of mahogany’s range, at low or extremely low densities compared to high-density populations once common in Rondônia and southeast Pará. This estimation likely overstates the extent of surviving stocks due to methodological factors.

1.4.2. Current global population trends

increasing **decreasing** stable unknown

1.5. Conservation status

1.5.1. Global conservation status: IUCN Red List (2002) & others

Table 3. Classification of the conservation status of big-leaf mahogany by international organizations (Blundell 2004).

Organization	Comment
IUCN (2002 Red List)	Vulnerable (based on criteria A1cd+2cd)1
CITES (PC11 Doc.13.3)	Appendix II
UNEP–World Conservation Monitoring Centre	CITES Appendix II
International Board for Plant Genetics Resources	High priority for genetic conservation
International Tropical Timber Organization	High priority species
FAO Panel of Experts on Forest Gene Resources	High priority for <i>in situ</i> conservation

1.5.2. National conservation status for the case study countries

In **Peru**, mahogany's conservation status category set by IUCN (see above) is accepted (El Peruano 2006), as determined by Supreme Decree N° 043-2006-AG (Resolution Decree 002-2008). Mahogany is also considered by INRENA (National Institute for Natural Resources and CITES Management Authority) to be an endangered species (INRENA 2006).

In **Bolivia** and **Brazil**, mahogany's conservation status is principally established by its listing on CITES Appendix II. It can only be legally harvested following technical norms for forest management set by federal legislation.

1.5.3. Main threats within the case study countries

- No threats
- Habitat loss/degradation** (human induced)
- Invasive alien species (directly affecting the species)
- Harvesting** (logging)
- Accidental mortality (e.g., bycatch)
- Persecution (e.g., pest control)
- Pollution (affecting habitat and/or species)
- Other _____ Unknown

2. SPECIES MANAGEMENT

2.1. Management measures

2.1.1. Management history

Mahogany has been commercially exploited in **Peru** since the 1920s beginning in the Iquitos region, in **Brazil** since the 1930s beginning in the western state of Acre, and in **Bolivia** since the 1950s. In all three countries riverine populations growing in clusters along tributaries of the Amazon River were logged first, felling trees into or near flowing water and floating logs downstream to urban processing centers. As the most readily accessible populations were eliminated and transportation infrastructures improved, mechanized overland logging began in the 1970s in Brazil (southeast Pará and then Rondônia), in the 1980s in Bolivia, and in the late 1990s in Peru. By 2000, mahogany had been commercially extirpated within an estimated 49% of its range in Peru, 79% of its range in Bolivia (Kometter *et al.* 2004), and 65% of its range in Brazil (Martinez *et al.* n/d). Most sawn timber has been exported to Europe and the US.

It was only during the 1990s in Bolivia and Brazil and in the early 2000s in Peru that regulatory frameworks were created to 'manage' mahogany harvests. Before then, mahogany was essentially mined from primary forests wherever loggers could access natural populations. To no small degree, new laws prescribing management criteria for mahogany were responses to the international debate about its

commercial and conservation status culminating in mahogany's listing on Appendix II in 2002.

In **Peru**, mahogany could be harvested without management plans before 2000. Loggers were required to pay a fee to the Committee of Reforestation to assure that mahogany seedlings would be replanted. During 2000–2001 the Peruvian government implemented a system of annual contracts for 40-year land concessions to private enterprises, with the right to log 5% of forest area per year (i.e., 20-year cutting cycle) and requiring a management plan for approval by INRENA. Concessions smaller than 1000 hectares did not require approved management plans (INRENA 2006; The Economist 2007; Lombardi comm. in lit. July 2008). Since then, legal and administrative measures aimed at encouraging mahogany's sustainable management have included forest planning and management tools such as General and Annual Operating Plans, logging bans, and export quotas (INRENA 2007).

In **Bolivia**, mahogany was the main timber species harvested until the mid 1990s (Bascopé 1992). Technical norms promulgated by the new forestry law (MDSP 1998) defined best management practices for timber species including mahogany, but illegal harvesting persists. The importance of mahogany in terms of roundwood volume harvested declined after 1998 to 12th during the period 1998–2006 (average volume per year 16,591 m³ representing 2% of the total harvested volume).

In **Brazil**, an estimated four million m³ of sawn mahogany timber was exported during the period 1971–1992, much of this originating illegally from within Protected Areas and Indigenous Lands, with an additional estimated 1.7 million m³ consumed domestically (Grogan *et al.* 2002). Mahogany's exploitation began to be regulated in the early 1990s with the imposition of export quotas and with gradually increasing scrutiny of logging industry practices by federal and state authorities, including the requirement that production originate only from legally registered forest management areas. As the logging sector specializing in mahogany continued to ignore or evade regulations governing mahogany harvests during the 1990s even while its inclusion on Appendix II was debated, the Brazilian government responded with a moratoria on new management plans including mahogany in 1996, and by suspending all commercial trade in the species in 2001. Export quotas had fallen in 2000 to 50,000 m³, from 150,000 m³ in 1990. In response to the Appendix II listing in late 2002, new and stricter management guidelines for mahogany were developed and signed into law in 2003 for companies intending to harvest mahogany.

2.1.2. Purpose of the management plan in place

The concessions system in **Peru** and federal regulation of forest practices in **Bolivia** aim to encourage best practices management plans. While management plans are not specifically tailored for mahogany, their overall objective is to manage and control forest operations to guarantee sustainable production and conservation of the environment and biological diversity. In **Brazil**, management plans for forests with mahogany require extra provisions explained in detail below (section 3.2.1).

The Strategic Action Plan for the Conservation and Implementation of CITES Appendix II for Mahogany in **Peru** (Plan de Acción Estratégico para la Conservación y la Implementación del Apéndice II de la CITES para la Caoba en el Perú, 2007–2011) is a management tool aiming to identify, sustainably manage, and protect all mahogany populations within concessions, native communities, Protected Areas and land reserves, thereby generating major social and economic benefits for local populations by 2011. Its main objective is to contribute to the sustainable use of natural populations of mahogany and promote plantation production. Specific objectives include:

- strengthen the development of silviculture within general and annual management plans (POAs);
- strengthen the monitoring system for better control;
- conserve genetic biodiversity in natural Protected Areas and programs of *ex situ* conservation;
- strengthen institutional capacity for implementation of the plan;
- promote forest products with added value and establish policies and norms for promoting incentives for plantations;
- monitor the Action Plan inventory with State support to secure viable populations and commitment with CITES (INRENA 2007).

2.1.3. General elements of the management plan

Forest Management Plans (PMF) in **Peru** have two required levels of planning:

- the General Forest Management Plan (PGMF) provides a framework for long-term strategic planning, formulated over the 40-year duration of private concessions;
- the Annual Operating Plan (POA) is the short-term planning tool for field operations.

In **Bolivia**, all timber species are harvested using similar practices delineated in Forestry Law N° 1700 and its technical norms. However, by applying the current technical norms, several the recommendations from the 2nd Mahogany Working Group (MWG2, Belém, Brazil, 2003) are fulfilled. MWG2 recommended that all exported mahogany should originate from areas with forest management plans including at least those elements listed in **Table 4** (next page).

In **Brazil**, the broad contours of current legislation regulating forest management include:

- basic characterization of physical and biotic environments;
- required technical capacity for planned forest operations (adequate logging practices, silviculture, post-logging recovery) according to Annual Operating Plan (POA);
- quantify commercial stocks;
- cutting cycles of 25–35 years depending on site productivity;
- limits on logwood extraction per unit area (10–30 m³/ha) depending on site capacity and on ownership or use category;

- minimum cutting diameter that varies by species;
- 10% retention of commercial-sized trees, except 20% for mahogany (Grogan *et al.* 2005).

Table 4. MWG2 recommendations compared to the situation in Bolivia.

Recommended by MWG2	Situation in Bolivia as required by the Forestry Law & current technical norms
Commercial census	<ul style="list-style-type: none"> • Commercial census is carried out in logging compartments at 100% intensity. All timber species included in the commercial species list of the company are included in the census. Only trees larger than the minimum cutting diameter are included. • Census results are used to elaborate annual operational logging plans (POAFs).
Mapping of commercial & sub-commercial trees	<ul style="list-style-type: none"> • Maps are elaborated based on the commercial census data, including topographic features, water courses, roads, and harvestable trees. Maps are a component of POAF. • Sub-commercial trees are not mapped as they are not included in the census.
Seed tree selection & minimum post-logging density	<ul style="list-style-type: none"> • 20% of harvestable trees are retained, mapped and tagged. They are also clearly marked in the field to assure retention as a seed tree. • There is no selection criteria, the 5th tree encountered should be retained as a seed tree. • Minimum tree density after logging depends on the initial density.
Minimum cutting diameter (MCD)	<ul style="list-style-type: none"> • 70 cm for mahogany
Monitoring dynamics of future crop trees	<ul style="list-style-type: none"> • Monitoring is not specifically required for individual species. Although permanent plots must be established to assess the effect of logging on long-term forest dynamics & timber yields, not all companies have done so. • Mahogany is present in several established permanent plots but the number of individuals is relatively low.
Improvement of regeneration	<ul style="list-style-type: none"> • Not required, only indirectly done by promoting the use of other species, requiring that seed trees are left behind, and the use of cutting cycles. • Several experiments have looked at mahogany regeneration. The most promising results are coming from enrichment planting in logging gaps.

2.1.4. Restoration or alleviation measures

In **Peru**, the General Forest Management Plan must indicate silvicultural practices aimed at recuperation of forests where mahogany has been harvested. Details vary among concessions; in most cases, natural regeneration is preferred. This

aspect has not yet been monitored (Lombardi comm. in lit. July 2008). In **Bolivia**, no restoration measures are required, though retention of seed trees should encourage natural regeneration. In **Brazil**, natural regeneration encouraged through retention of seed trees must be supplemented by artificial regeneration through outplanting nursery-grown seedlings into logging gaps.

2.2. Monitoring system

2.2.1. Methods used to monitor harvests

In **Peru**, INRENA monitors commercial logging of mahogany through the concession system and evaluation of POAs. More than 20 concessions and 27 permits in native communities' territories have been verified (INRENA 2007). The CITES Management Authority (MA), which resides within INRENA, applies pre-harvest verification of trees before approving POAs. The MA also conducts a post-harvest verification of stumps, suspending harvests in the case of inconsistencies. The CITES Scientific Authority (SA) has developed a database and map for mahogany's distribution at three levels: national, within forest concessions, and within forest communities (Vargas & Lombardi 2006).

In **Bolivia**, various mechanisms exist to monitor commercial timber harvests:

- **Certificate of logging origin (CFO):** During the production chain all timber produced must be accompanied by a CFO. The CFO is issued by the Superintendencia Forestal (SF) and different CFO types are used along the production chain. In the case of mahogany, four different types of CFO are used to track mahogany timber from the forest to the point of exportation. CFOs can be used to track wood volume along the production chain but this tracking can sometimes be cumbersome as there are too many parties involved.
- **Permits for export:** The CITES Management Authority (Autoridad Administrativa, AA) must approve mahogany exports. To provide export permits, the AA requires, among others, the CFO used for exporting timber. The SF, the AA, and SIVEX (organization dealing with the export of all Bolivian products) coordinate among themselves to assure that all parties have the required information to carry out their tasks. The AA checks with the SF to assure that information provided is correct.
- **Forestry inspections** are carried out by the SF by randomly selecting areas under forest management. There are also 'puestos de control' on main roads that compare CFO with volumes and species being transported. The SF carries out audits every five years to determine if companies will keep their concessions for 40 additional years. Not all of these mechanisms are used as much as desirable due to funding shortages.
- The GIS system managed by the SF could be used to monitor harvesting activities at the forest management unit, but currently it is mostly used to monitor deforestation and wildfires.

In **Brazil**, the Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA) is the government agency responsible for evaluating, approving, and regulating forest management plans. Any management plan including mahogany is first reviewed by IBAMA for compliance with broad parameters of forest legislation specific to mahogany (IN 07/2003), and then referred to the Comitê Técnico-Científico (CTC), an advisory committee consisting of forest engineers and scientists with expertise in mahogany's management and ecology. Members of the CTC conduct field audits of management plans for mahogany that potentially fulfill legal standards. CTC recommendations are in turn evaluated by the CITES Management and Scientific Authorities, which reside within IBAMA, for final approval or rejection.

2.2.2. Confidence in the use of monitoring

In **Peru**, current government policy prioritizes verification of mahogany stocks before POA approval, aiming to control mahogany use authorizations (INRENA 2007). Information collected by the CITES MA and SA is confirmed directly in the field. Annual verification depends on economic resources available when validation is required (Lombardi comm. in lit. July 2008). INRENA has encouraged the voluntary certification process (INRENA 2007). "The use of certification to assure legality of CITES timber exports appears a cost-effective approach in the case of mahogany, given that currently 55% of Peru's mahogany exports already come from certified forest management units with chain of custody" (PAEC in Del Gatto & Ortiz in press), although "communities and small-scale concessionaires, that face greater difficulties in affording the costs of certification, would be put in disadvantage by such approach, losing access to higher-value export markets" (Brown & Bird in Del Gatto & Ortiz in press). Finally, the Forest Annex of the Peru-USA Free Trade Agreement, signed in October 2007, includes steps for monitoring timber species listed in CITES, including inspection of extraction areas prior to POA approval, dissemination of POAs and verification results to the public, development of tracking systems to verify legal origin and chain of custody, and improved management of forest concessions.

In **Bolivia**, confidence in the current monitoring system is average. A black market in CFOs has been reported. Some control mechanisms of the SF, for example forestry inspections and audits, are not implemented due to lack of funding to cover staff and logistical costs. Additional issues that would help improve the monitoring system include: 1) better information on yield ('rendimiento') of the species during wood transformation from log to sawn timber); 2) better system for tracking timber during various steps of the production chain, especially after sawing; 3) better system for assessing the domestic market.

In **Brazil**, the new rules for mahogany management in 2003 coupled with the additional auditing role of the Comitê Técnico-Científico (CTC) on behalf of IBAMA as the CITES Scientific Authority has effectively limited mahogany harvests and commercialization to a fraction of levels in the 1990s. While illegal felling and transport across international borders, especially Peru, has been reported in recent years, quantities traded are unknown but likely relatively small compared to historic activity.

2.3. Legal framework & law enforcement relating to conservation

In **Peru**, a state of emergency was declared in the regions of Madre de Dios and Tahuamanu and senior government forest officials were discharged because of rampant illegal logging in 1999 through Ministerial Resolution 951-99-AG (Blundell & Gullison 2003). This law banned mahogany for 10 years in the regions of Putumayo, Yavari, Tamaya and Purus (INRENA 2006). The Forestry and Wildlife Law (Ley 27308) and its regulations were approved in 2000 and 2001, respectively, and a new national forest strategy based on an historic analysis/baseline for the forestry sector was prepared in 2002 (ITTO 2005). Ley 27308 promotes harvesting a larger number of species, optimal utilization, higher value-added and production chain integration, all with a view to contributing to sustainable forest management. Harvesting rights are granted through concessions, permits, etc., particularly in the Departments of Madre de Dios, Ucayali, San Martín, Huánuco and Loreto (ITTO 2007). More recently, Decree N° 1090 (28 June 2008) created a Forestry and Wildlife Law establishing new definitions for forestry resources and use. These changes in laws and regulations are related to compliance with the Peru-USA Free Trade Agreement. Further details on legal frameworks in Peru, and a timeline, can be found in **Appendix 1**.

In June 2007, INRENA presented the Strategic Action Plan for the Implementation of CITES Appendix II for Big-leaf Mahogany (PAEC¹), approved by the Ministry of Agriculture via Resolution Decree in July 2008. The main objective of the plan is to contribute to sustainable management of mahogany natural populations and to encourage the establishment of plantations.

In **Bolivia**, Forestry Law N° 1700 bringing major changes to the forestry sector passed in 1996 and has been implemented since 1997. Although it does not include specific management guidelines for mahogany apart from the minimum diameter cutting limit of 70 cm, Law 1700 has had a very positive effect on mahogany conservation.

In **Brazil**, the Forest Code of 1965 anticipated rapid changes in land use set in motion by trans-Amazonian highways connecting Brasília with Belém on the north coast and Porto Velho across the western frontier (Lei N° 4771). Concepts of sustainable forest management and sustainable production were codified in 1986, defining the latter as “the yield which corresponds to forest-level [growth] increment” (Lei N° 7511, Portaria N° 486/86-P). Sustainable forest management was further defined in 1994 as “... forest administration yielding economic and social benefits, respecting mechanisms ensuring integrity of ecosystems under management” (Decreto N° 1282). As described previously, a series of legislative acts from 1996 to 2003 successively restricted and eventually banned management plans for mahogany, prohibited harvest, transport, and commercialization of mahogany, and specifically revised harvest regulations for mahogany in response to the Appendix II listing, strengthening protection of natural populations.

¹ Plan de Acción Estratégico para la Implementación del Apéndice II de la CITES para la Caoba en Perú

3. UTILIZATION & TRADE

3.1. Type of use (origin) & destinations (purposes)

Mahogany timber is well-known around the world for its strength, workability, durability and beauty. It is mostly used in furniture and decorative finishing. Because mahogany is an easily worked timber with unsurpassed resistance to insect and fungal attack, it is still the preferred construction timber for local use in Peru, Bolivia and Brazil (Pennington 2002). Mahogany's bark and seeds are also used as medicine for common ailments like diarrhea and toothache in some indigenous communities. Oil extracted from the bark is also commercialized by the cosmetic industry (CATIE n/d).

3.2. Harvest

3.2.1. Harvesting regime

In **Peru**, concessionaires previously worked with subcontractors who brought in their own equipment and personnel and were paid based on volume extracted. Extraction was selective, concentrating on high-value species such as mahogany, and basic silvicultural and operational measures that might ensure sustainable yield were generally not applied. The Forestry and Wildlife Law N° 27308 eliminated the former harvesting contracts and established long-term concessions over larger areas. Silvicultural treatments are now included in the terms of reference for management plans and are being applied in at least 40% of concessions (ITTO 2005). Law 27308 established 75 cm diameter as the minimum cutting diameter limit for mahogany, with a retention rate of 10% of commercial-sized trees as seed trees within each cutting unit (Lombardi & Huerta 2007).

In **Bolivia**, mahogany must attain a density >0.25 trees >20 cm diameter per hectare across the entire management area (not only in a given logging compartment) for harvests to be allowed. If that density is reached, the following rules apply: 1) the area under forest management must use a cutting cycle longer than 20 years; 2) the area is divided into logging compartments depending on cutting cycles, with logging compartments harvestable only once during a given cutting cycle; 3) only trees >70 cm diameter can be harvested; 4) only 80% of commercial-sized trees can be harvested, retaining 20% as seed trees which must be marked in the field and included in logging maps.

In **Brazil**, Instrução Normativa N° 07/2003 established guidelines for forest management plans specific to mahogany, including:

- 100% inventory of mahogany trees >20 cm diameter using an X,Y grid system;
- estimate sub-commercial population (10–20 cm diameter) based on stratified sampling;
- minimum density of 0.05 per hectare (5 trees per 100 hectares);
- minimum cutting diameter (MCD) of 60 cm;
- retention rate of 20% of commercial-sized trees;

- vine removal from commercial trees at least one year before harvest, to reduce damages;
- encourage natural regeneration or supplement through outplanting artificial regeneration;
- landscape mapping to identify drainage and off-limits permanent preserve areas (e.g., watercourses, steep slopes);
- planned harvest operations (e.g., roads & skidtrails, logyard locations, directional felling);
- mandatory chain of custody from stump to sawn timber in the sawmill
- mandatory field audit by technical experts to supplement the normal IBAMA evaluation process.

3.2.2. Harvest management / control (quotas etc.)

In **Peru**, the CITES Scientific Authority establishes the annual export quota for mahogany. In 2007 the export quota was 4,983 m³, but only 3,071 m³ were exported with leftovers of 1,912 m³. In January 2008, Peru notified the CITES Secretariat that it had set the 2008 export quota for mahogany at 2,348 m³. This was published on the CITES website in April 2008. A post resolution adopted by the CITES Authority of Peru (N° 097-2008-INRENA, 14 April 2008) increased the quota to 3,475 m³ (CITES 2008).

In 2005, 1,080 m³ of mahogany were produced from concessions that are now closed (for not being able to justify where they obtained this volume) and 2,892 m³ were produced from forest concessions that are currently being investigated. In 2006, corresponding volumes were 855 m³ and 2,622 m³, respectively. This means that during the years 2005 and 2006, 3,972 m³ and 3,477 m³ of mahogany were commercialized, respectively, from concessions whose owners could not verify legal origin (Rojas 2007).

In **Bolivia** and **Brazil**, no quotas or additional control measures apply to mahogany.

3.3. Legal & illegal trade levels

Peru became the largest mahogany exporter after the Brazilian harvest and export ban in 2001, and due to the high price of Bolivian mahogany. Export volumes increased to almost 53,000 m³ in 2002, valued at more than US\$ 55 million. Export volumes decreased in 2003 to less than 43,000 m³, valued at more than US\$ 47 million (OIMT 2004). Export levels had fallen by 2007 to 3,071 m³.

Mahogany's high value encourages illegal activities. INRENA has reported that 90% of illegally traded logs corresponded to mahogany in 2003. There are also indications that mahogany and other high-value species are being obtained illegally from Protected and Indigenous Areas (ITTO 2005). In 2005, 12.45% of the total volume of mahogany exported came from illegal logging, while 83% of companies exporting mahogany from Peru sold quantities originating from illegal logging. This figure is the minimum quantity calculated, using documented data; the volume of illegal exports could be much greater (Rojas 2007).

Mahogany in legal trade may originate from illegal sources. The government has developed a control system (based on data collected by INRENA) which indicates that all mahogany timber commercialized and exported is legal (see **Appendix 2**). However, it is very difficult to quantify the real exported volume, especially because mahogany exports have shown a gradual decrease in recent years according to ITTO. In 2007, the number of exported, harvestable trees was 715 from 16 forestry units with legal authorization to export (Lombardi comm. in lit. July 2008). From 2005–2006, only approved national quota volumes were exported (23,621 and 23,239 m³, respectively; INRENA 2007).

In **Bolivia**, the Superintendencia Forestal (SF) approved average harvests of 16,590 m³ of roundwood per year during 1998–2006. The average mahogany volume exported with CITES certificates during 1998–2003 was 9,786 m³. As only certain mahogany products (sawn wood, 'laminas', 'chapas') require a CITES certificate for export, it is necessary to add as well the volume of mahogany timber that leaves the country as 'producto elaborado' or value-added. Reported export volumes have been less than volumes approved for harvesting by the SF since 1998. Several factors help explain this apparent discrepancy. The volume approved represents standing volume based on commercial censuses. However, actual volumes harvested are normally much less because companies do not harvest all commercial-sized trees, because estimation errors are made when calculating harvestable volume based on field data, and because sawmill processing efficiency is believed to be about 50% in the best-case scenario. Taking into account all these factors it seems that the total mahogany volume being exported should be less than 50% of the approved volume. Yet export volumes consistently exceed this amount.

Domestic demand is difficult to quantify. Probably a portion of the harvested volume is consumed in-country as mahogany is highly valued in Bolivia.

Since the 2001 moratorium on harvest, transport, and commercialization in **Brazil**, legally traded volumes of mahogany have been severely restricted by new management regulations and heightened scrutiny of field operations by the CTC acting on behalf of the Scientific Authority within IBAMA. Since 2003, approximately 10 management plans including mahogany have been reviewed by IBAMA, and only one approved for harvest in 2006 in the state of Rondônia. At present, one management plan in the state of Amazonas is under review, but harvest during 2008 at this point is unlikely. As mentioned previously, it is impossible to quantify illegal trade.

II. NON-DETRIMENT FINDING (NDF) PROCEDURES

Several international meetings have been held since mahogany's inclusion in CITES Appendix II, with emphasis on implementation and recommendations regarding NDF, including the Mahogany Working Group and the CITES Plants Committee Meetings, among others. General guidelines formulated for NDF address either its development for each export or the establishment of national export quotas (Rosser & Haywood 2002). IUCN (2004) recommended establishing gradual

measures as range nations develop and implement policies oriented towards sustainable management, test different approaches, and as more information is gathered on the species. Three basic components of this approach include:

- evaluate mahogany stocks at national or regional levels as a basis for defining export quotas, and as a requirement for:
- management plans, including measures towards sustainable planning of the forestry unit and mahogany stocks as a prior condition to defining export levels non-detrimental to the species' survival; and
- control of mahogany harvests within planned forestry units, and of mahogany exports based on export quotas.

Technical recommendations from the 2nd Mahogany Working Group (MWG2), held in Belém, Brazil, are outlined in section 2.1.3.

In 2004 ITTO with support from INRENA organized a workshop in Pucallpa, Peru to develop capacities to implement CITES Appendix II for mahogany (OIMT 2004). Exporters, importers, and representatives from governmental and non-governmental organizations participated in this meeting. Focusing on the main South American exporting countries (Peru, Bolivia, Brazil), the workshop's objective was to stimulate the adoption of practical measures for making NDF. The premise was that countries are responsible for determining criteria to making NDF based on national forestry policies and laws, including control activities, private sector measures, institutional coordination, and regional cooperation in terms of financial resources and technical advice. Workshop participants recognized the planned forest management unit as the most appropriate level for NDF implementation. Participants further recommended that only mahogany harvested under specific mahogany zoning plans including specific management components for mahogany should be accepted for international trade (OIMT 2004).

The 3rd Mahogany Working Group (MWG3) meeting in 2006 (Lima, Peru) noted that field-based inventories, distribution statistics, and age-class information critical to making NDF remain unavailable in spite of the fact that some range nations had compiled trade information to estimate existing mahogany stocks. Other findings included that range nations had not developed effective mechanisms or a standardized approach to making NDF for mahogany. Among others, recommendations emphasized that no mahogany export should take place without NDF made by the Scientific Authority of the State; and that importing countries should refuse mahogany shipments accompanied by CITES export permits issued under a court order unless the importing country can confirm that NDF was made by the Scientific Authority of the country of origin (CITES 2006).

1. Is the methodology used based on the IUCN checklist for NDFs? _
_yes **X no**

The answer is no for all three countries. According Lombardi (comm. in lit. July 2008), the UICN check list must be adapted for tree species and implemented under rigorous and periodic field work.

2. Criteria, parameters and/or indicators used

In **Peru**, parameters used include mahogany population size within commercial concessions and native forest communities; population size-class distributions and estimated production volumes; bark thickness; and defective or hollow trees. In the coming years additional parameters will include control and monitoring of silvicultural practices to estimate population recovery (Lombardi comm. in lit. July 2008). Scientific Authority recommendations are listed in **Table 5**.

The timber yield coefficient was identified in 2008 as a potential loophole through which illegally acquired timber may be laundered. This technical issue has become controversial and politicized. As a result, INRENA created a commission to undertake a technical study to confirm or discard the current timber yield coefficient. This commission is chaired by INRENA and comprises the CITES Scientific Authority, eight representatives of the private sector, two NGOs, and other ministries (Resolution Decree No 075-2008-INRENA). The commission was given 180 days to provide its findings and should submit its report before the end of 2008 (CITES 2008).

Bolivia has not yet defined NDF procedures for mahogany because information upon which these should be based remains lacking.

In the absence of clear NDF procedures for timber species, **Brazil** has relied on recommendations from a series of Mahogany Working Group meetings within IBAMA and the Ministry of the Environment (MMA) during 2002 and 2003. Outputs from these meetings were incorporated into Instrução Normativa 07/2003 which regulates mahogany harvests as described in section 3.2.1. The Brazilian government additionally directly or indirectly supports on-going applied research on mahogany ecology, genetics, and management through projects in Acre, Amazonas, and Pará.

Table 5. Recommendations by Peru's CITES Scientific Authority compared to measures taken by INRENA with respect to the annual export quota for mahogany in 2007 (Rojas 2007).

Recommendations by the CITES SA	Measures taken by INRENA	Agreement between authorities?
Consider bark thickness, stem hollows (heartrot) & taper coefficient in volume estimates	Volume estimates only account for height & diameter	No
Allow extraction of mahogany only in areas with more than 2000 trees	Only regions with more than 2000 individuals approved	Yes
Allow extraction of mahogany only in areas where population density >0.005 trees per hectare (1 tree per 200 hectares)	Only regions with a population density >0.005 trees per hectare approved	Yes

Prohibit the export of mahogany coming from agricultural estates, public auctions, or rewards	Export volumes from agricultural estates, public auctions, or rewards prohibited	Yes
Raise the minimum cutting diameter (MCD) to 120 cm	MCD remains 75 cm	No
Annual export volumes should not originate from >1200 individuals	2007 export quota equal to a harvest of 1600 trees	No
Annual export quota should not exceed the sum of volumes declared in field-verified POAs	Volumes declared in 2007 POAs were not considered in establishing the 2007 export quota	No
Only mahogany originating from managed forests should be exported	Only forestry concessions & native communities with general management plans & approved or to be approved (upon verification) POAs considered	Yes
Verification of planning & execution of forestry operations within POAs should be obligatory	Implementation of forestry activities within POAs is not supervised	No

3. Main sources of data, including field evaluation or sampling methodologies & analysis used

In **Peru**, data from the on-going project 'UNALM-ITTO PD 251/03' is being used to develop NDF procedures for mahogany (INRENA 2007). This project focuses on assessment of current commercial stocks and strategies for sustainable management. It has provided basic information for mahogany population status and ecosystem characters for NDF. The CITES Scientific Authority in Peru has information from inventories and POAs including data on volume, form coefficients, bark thickness, species associations, and natural regeneration status for the Department of Madre de Dios. The Departments of Ucayali and Loreto are currently under study (INRENA 2007).

The annual export quota (yield coefficient) established in 2005 was based on mahogany inventories from POAs (Ortiz in Del Gatto & Ortiz in press), reference of origin information, and on anticipated growth rates. The coefficient will be adjusted according to information obtained from silvicultural treatments within forest management units. This information is being used to create a database containing all mahogany trees (seed trees and harvested trees), allowing continued monitoring even after harvests and development of a behavioral model to study population changes over time. To validate the system it will be important to monitor all individuals in the field and to establish reference populations of commercial mahogany within zones where mahogany occurs (Lombardi comm. in lit. July 2008).

Data obtained from a recent study in permanent production areas indicates that remaining mahogany stocks consist of 144,203 trees <75 cm diameter and 82,296 trees >75 cm diameter. With this information the SA established a volume per commercial tree of 12.5602 m³, and a cutting cycle of 100 years based on a growth rate of 0.75 cm/tree/year. Under these conditions, Peru must restrict annual harvests to 1442 m³ or approximately 216 trees (INRENA 2007). Based on the population size, the Scientific Authority considers mahogany's population status in some regions to be too low for commercial exploitation and recommends limits or bans on harvests coupled with restoration programs.

In **Bolivia**, recent research results may provide information useful for NDF (Verwer *et al.* 2008). These results, from the Long-term Silvicultural Research Project established in La Chonta, which includes the monitoring since 2002 of an overexploited mahogany population, are from simulation models constructed to assess different harvesting scenarios. Results indicate that mahogany could be sustainably harvested if:

- the minimum cutting diameter is at least 70 cm diameter;
- cutting cycles are >25 years;
- harvest intensity is reduced to 50% of commercial-sized trees;
- silvicultural treatments are applied to the species (liana cutting, liberation from competing trees) and its surrounding forest (logging and liberation of other timber species) so that optimal growing conditions are created and maintained throughout the cutting cycle.

If these conditions are not maintained and the forest is allowed to return to normal (pre-harvest) conditions, then no combination of management practices makes sustainable harvesting of mahogany possible.

In **Brazil**, results from basic and applied research programs on mahogany, especially in southeast Pará and Acre (e.g., André *et al.* 2008, Baima 2001, Brown *et al.* 2003, Grogan *et al.* 2003, 2005, 2008, Lemes *et al.* 2002, 2003, 2007, Norghauer *et al.* 2006, 2008a, 2008b, Oliveira 2000), have contributed to public policy on management and conservation of mahogany. Whether this open exchange between governmental, regulatory, and academic sectors will continue as on-going research results are disseminated remains to be seen. For example, simulations based on large-scale inventories and long-term growth data indicate that current 20% retention rates for commercial-sized trees are unsustainable except at rare historical sites (that is, already logged) where population structures were heavily weighted to sub-commercial size classes (Grogan *et al.* 2008).

4. Evaluation of data quantity & quality for the assessment

In **Peru**, the national quota process has been considered weak due to poor verification of timber stocks from inventories and to the overestimation of sawn timber yield per tree. These issues may have allowed the laundering and export of thousands of cubic metres of illegal mahogany (Ortiz in Del Gatto & Ortiz in press).

Projections from the project 'UNALM-ITTO PD 251/03' are being evaluated by the Scientific Authority through field inventories. Information on mahogany populations is monitored and under continual adjustment (Lombardi comm. in lit. July 2008). Maps of ecosystems where mahogany occurs, establishment of annual export quotas, and a national strategy for implementation of management plans for mahogany are key outcomes anticipated from this project (INRENA 2007).

5. Main problems, challenges or difficulties found in elaboration of NDF

In **Peru**, main problems continue to be related to the lack of information on mahogany distribution, stocks, ecology and regeneration. Authorities lack the capacity and resources to monitor and control harvests and commercialization, and transparency, communications and information systems need to be improved (OIMT 2004). The principal difficulties according Lombardi (comm. in lit. July 2008) are delays in information flows which prevent updating databases; the lack of economic resources for timely fieldwork for developing new indicators to analyze mahogany population status; and the lack of recognition of the SA's opinions by other government agencies.

There remains no dialogue between the CITES Scientific and Management Authorities. Not all of the recommendations made by the Scientific Authority (UNALM) to the Management Authority (INRENA) are taken into account even though the SA considers some of these key to the survival of mahogany within Amazonian forest ecosystems. For example, in October 2006, in a letter to INRENA the SA recommended raising the minimum cutting diameter (MCD) for mahogany

from 75 to 120 cm based on the estimation that 34% of remaining trees are smaller than 75 cm. The SA's position is that, given this population structure, logging practices under the current MCD are unsustainable; the MCD must be raised in order for sufficient sub-commercial trees to survive harvests. The SA's recommendation would designate 62% of the population as sub-commercial, thus guaranteeing the long-term sustainability of harvest practices. INRENA has not followed this recommendation (Rojas 2007).

In **Brazil**, management guidelines for mahogany are broadly consistent with current understanding of best practices for the species, and controls on new management plans are stringent. The main challenge will be to update guidelines as more information regarding sustainable management comes available.

In contrast to Peru, CITES Management and Scientific Authorities in Brazil reside within the same office in IBAMA and overlap to large extent. This arrangement runs counter to the usual division of labor whereby the MA verifies legal origin and the SA – a separate and independent entity – verifies non-detriment for Appendix II species.

6. Recommendations

See section 2.1.3. and **Tables 3 & 4** for recommendations from MWG2 and the Scientific Authority in Peru, respectively. The OIMT (2004, Section 5) report lists recommendations addressing problems mentioned above for the implementation of CITES Appendix II for mahogany.

In **Peru**, the Mahogany Action Plan (INRENA 2007) contains the full set of recommendations from CITES regarding Appendix II implementation including mahogany zoning and planning at national and subregional levels; conditions on export based on proven legal origin of timber and NDF determined by the SA; and establishment of quotas based on scientific and valid information.

According to Lombardi (comm. in lit. July 2008), the criteria and parameters necessary for formulating NDF must be reviewed; costs and monitoring time associated with NDF must be discussed; and a clear position on whether NDF will be based on forest management at the level of forestry units or on export quotas must be determined. Further, it is crucial to define whether management plans must contain provisions specific to mahogany, and whether any management plan for forests within mahogany's natural range must include these provisions regardless of its current status. Integral management plans must protect both mahogany and its habitat.

In **Bolivia**, although significant advances have been made towards developing a sustainable model for mahogany harvests and therefore towards NDF, the question of how mahogany regeneration can be promoted requires further examination. It will also be necessary to assess whether silvicultural treatments applied at La Chonta have the same results on mahogany populations in other forest types.

In **Brazil**, as previously noted, progress towards developing NDF procedures will depend on whether new research findings can be effectively incorporated into public policy in timely fashion.

References

- André, T., Lemes, M., Grogan, J. & Gribel, R. (2008) Post-logging loss of genetic diversity in a mahogany (*Swietenia macrophylla* King, Meliaceae) population in Brazilian Amazonia. *Forest Ecology and Management* 255: 340-345.
- Baima, A.M.V. (2001) O Status de *Swietenia macrophylla* King (Mogno) em duas florestas exploradas no Estado do Pará: O caso de Marabá e Rio Maria. Mestrado em Ciências Florestais, Universidade Federal do Pará/FCAP, Belém, PA, Brazil.
- Bascope, F. (1992) Mahogany (*Swietenia macrophylla* King) in Bolivia: its sites, industrial development and actual situation. In Mahogany Workshop: Review and Implications of CITES. Tropical Forest Foundation, Washington, DC, USA.
- Blundell, A.G. (2004) A review of the CITES listing of big-leaf mahogany. *Oryx* 38: 1-7.
- Blundell, A. & Gullison, R.E. (2003) Poor regulatory capacity limits the ability of science to influence the management of mahogany. *Forest Policy and Economics* 5: 395-405.
- Brown, N., Jennings, S. & Clements, T. (2003) The ecology, silviculture and biogeography of mahogany (*Swietenia macrophylla*): a critical review of the evidence. *Perspectives in Plant Ecology, Evolution and Systematics* 6: 37-49.
- CATIE (n/d) *Swietenia macrophylla*. pp. 901-906.
- CITES (2006) Sixteenth Meeting of the Plants Committee: Report of the Third Meeting of the Big-leaf Mahogany Working Group. Lima, Peru.
- CITES (2007) International Workshop of Experts on Non-Detriment Findings on Big-leaf Mahogany (Cancún, April 2007): Endorsement and Adoption of Guidelines for making NDFs for Mahogany. Cancún, QR, Mexico.
- CITES (2008) Fifty-seventh Meeting of the Standing Committee. Convention on International Trade in Endangered Species of Fauna and Flora, Geneva, Switzerland.
- Cornelius, J.P., Wightman, K.E., Grogan, J. & Ward, S.E. (2005) *Swietenia* (American Mahogany). Pp. 1720-1726 in Elsevier Forest Science Encyclopedia. Elsevier Science Publishers BV, Amsterdam, The Netherlands.
- Chávez, E. (2008) Alerta Roja Forestal: El Decreto Legislativo que pone en jaque la implementación del TLC. *Caretas*, 17 Julio 2008, Lima, Peru.
- Dauber, E., Guzman, R. & Teran, J. (2001) Potencial de los bosques de producción forestal permanente. Superintendencia Forestal, Santa Cruz, Bolivia.
- Del Gatto, F. & Ortiz, B. (in press) Free Trade and Forest Verification: Learning from the US-Peru Trade Promotion Agreement. Verifor Briefing Paper.
- El Peruano (2006) Decreto Supremo N° 043-2006-AG. Aprueban categorización de especies amenazadas de flora silvestre. Agricultura. Normas legales.
- Equipo del Proyecto Transparencia y Gobernabilidad Forestal – Perú (2008) Documento de análisis técnico normativo del DL 1090.
- Foro ecológico del Perú, Foro ciudades para la vida, Colectivo forestal de la sociedad civil (2008) Pronunciamiento.
- Grogan, J.E. (2001) Big-leaf mahogany (*Swietenia macrophylla* King) in southeast Pará, Brazil: a life history study with management guidelines for sustained production from natural forests. PhD dissertation, Yale University, New Haven, CT, USA.

- Grogan, J., Barreto, P. & Veríssimo, A. (2002) Mahogany in the Brazilian Amazon: Ecology and Perspectives on Management. IMAZON, Belém, Pará, Brazil. 60 pp.
- Grogan, J., Ashton, M.S. & Galvão, J. (2003) Big-leaf mahogany (*Swietenia macrophylla*) seedling survival and growth across a topographic gradient in southeast Pará, Brazil. *Forest Ecology and Management* 186: 311-326.
- Grogan, J., Landis, R.M., Ashton, M.S. & Galvão, J. (2005) Growth response by big-leaf mahogany (*Swietenia macrophylla*) advance seedling regeneration to overhead canopy release in southeast Pará, Brazil. *Forest Ecology and Management* 204: 399-412.
- Grogan, J., Vidal, E. & Schulze, M. (2005) Apoio científico para os padrões de manejo de madeira na floresta amazônica – a questão da sustentabilidade. *Ciência & Ambiente* 32: 103-117.
- Grogan, J. & Galvão, J. (2006) Factors limiting post-logging seedling regeneration by big-leaf mahogany (*Swietenia macrophylla*) in southeastern Amazonia, Brazil, and implications for sustainable management. *Biotropica* 38: 219-228.
- Grogan, J., Jennings, S.B., Landis, R.M., Schulze, M., Baima, A.M.V., Carmo, J.C., Norghauer, J.M., Oliveira, L.R., Pantoja, F., Pinto, D., Silva, J.N.M., Vidal, E. & Zimmerman, B.L. (2008) What loggers leave behind: impacts on big-leaf mahogany (*Swietenia macrophylla*) commercial populations and potential for post-logging recovery in the Brazilian Amazon. *Forest Ecology and Management* 255: 269-281.
- Grogan, J. & Schulze, M. (2008) Estimating the number of trees and forest area necessary to supply internationally traded volumes of big-leaf mahogany (*Swietenia macrophylla*) in Amazonia. *Environmental Conservation* 35: 26-35.
- Gullison, R.E., Panfil, S.N., Strouse, J.J. & Hubbell, S.P. (1996) Ecology and management of mahogany (*Swietenia macrophylla* King) in the Chimanes Forest, Beni, Bolivia. *Botanical Journal of the Linnean Society* 122: 9-34.
- Günter, S. (2001) Impacto de los factores ecológicos en la regeneración de la mara (*Swietenia macrophylla* King) en bosques naturales de Bolivia. Pp. 99-118 in Mostacedo, B. & Fredericksen, T.S. (Eds.), *Regeneración y Silvicultura de Bosques Tropicales en Bolivia*. Proyecto de Manejo Forestal Sostenible (BOLFOS), Santa Cruz, Bolivia.
- Holdridge, L.R. (1967) *Life Zone Ecology*. Tropical Science Center, San José, Costa Rica.
- INRENA (2006) Problemática de la Caoba. Pg. 24 en *Tala Ilegal Perú*, Lima, Peru.
- INRENA (2007) Plan de Acción Estratégico para la Implementación del Apéndice II de la CITES para la caoba en Perú (PAEC-Peru). Ministerio de Agricultura, Lima, Peru.
- ITTO (2005) Status of tropical forest management 2005. International Tropical Timber Organization, Yokohama, Japan.
- ITTO (2007) Annual review and assessment of the World Timber Situation. ITTO, Yokohama, Japan.
- IUCN (2004) 2004 IUCN Red List of Threatened Species. Retrieved 20 July 20 2008 from IUCN Red list: <http://www.iucnredlist.org/search/details.php/32293/all>
- Kometter, R.F., Martinez, M., Blundell, A.G., Gullison, R.E., Steininger, M.K. & Rice, R.E. (2004) Impacts of unsustainable mahogany logging in Bolivia and Peru. *Ecology and Society* 9: <http://www.ecologyandsociety.org/vol9/iss1/art12>.
- Lamb, F.B. (1966) *Mahogany of Tropical America: Its Ecology and Management*. University of Michigan Press, Ann Arbor, MI, USA.

- Lambert, T., Malcolm, J. & Zimmerman, B. (2005) Effects of mahogany (*Swietenia macrophylla*) logging on small mammal communities, habitat structure, and seed predation in the southeastern Amazon Basin. *Forest Ecology and Management* 206: 381-398.
- Lemes, M.R., Brondani, R.P.V. & Grattapaglia, D. (2002) Multiplexed systems of microsatellite markers for genetic analysis of mahogany, *Swietenia macrophylla* King (Meliaceae), a threatened Neotropical timber species. *Journal of Heredity* 93: 287-291.
- Lemes, M.R., Gribel, R., Procter, J. & Grattapaglia, D. (2003) Population genetic structure of mahogany (*Swietenia macrophylla* King, Meliaceae) across the Brazilian Amazon, based on variation at microsatellite loci: implications for conservation. *Molecular Ecology* 12: 2875-2883.
- Lemes, M.R., Grattapaglia, D., Grogan, J., Procter, J. & Gribel, R. (2007) Flexible mating system in a logged population of mahogany (*Swietenia macrophylla* King, Meliaceae): implications for the management of a threatened neotropical tree species. *Plant Ecology* 192: 169-180.
- Lombardi, I. & Huerta, P. (2007) Monitoring mahogany. *ITTO Tropical Forest Update* 17(3):5-9.
- Martinez, M., Blundell, A.G., Gullison, R.E. & Grogan, J. (Eds.) (n/d) Historic range and current status of big-leaf mahogany, *Swietenia macrophylla*, in South America. Unpublished report, Center for Applied Biodiversity Science – Conservation International, Washington, DC, USA.
- Ministerio de Desarrollo Sostenible y Planificación (1998) Normas técnicas para la elaboración de instrumentos de manejo forestal en propiedades privadas o concesiones con superficies mayores a 200 hectáreas. Resolución Ministerial No. 248/98, La Paz, Bolivia.
- Mostacedo, B., Justiniano, J., Toledo, M., Fredericksen, T.S. (2003) Guía Dendrológica de Especies Forestales de Bolivia. Proyecto BOLFOR, Santa Cruz, Bolivia. 245 pp.
- Norghauer, J.M., Malcolm, J.R. & Zimmerman, B. (2006) Juvenile mortality and attacks by a specialist herbivore increase with conspecific adult basal area of Amazonian *Swietenia macrophylla* (Meliaceae). *Journal of Tropical Ecology* 22: 451-460.
- Norghauer, J.M., Malcolm, J.R. & Zimmerman, B. (2008a) Canopy cover mediates interactions between a specialist caterpillar and seedlings of a neotropical tree. *Journal of Ecology* 96: 103-113.
- Norghauer, J.M., Malcolm, J.R. & Zimmerman, B. (2008b) Experimental establishment of big-leaf mahogany (*Swietenia macrophylla* King) seedlings on two soil types in native forest of Pará, Brazil. *Forest Ecology and Management* 255: 282-291.
- OIMT (2004) Racionalizando el comercio de caoba. Informe del taller sobre el Desarrollo de capacidad para la aplicación del listado de la caoba en el Apéndice II de la CITES. Serie técnica OIMT N° 22, Organización Internacional de Maderas Tropicales, Yokohama, Japan.
- Oliveira, M.V.N. (2000) Artificial regeneration in gaps and skidding trails after mechanised forest exploitation in Acre, Brazil. *Forest Ecology and Management* 127: 67-76.
- Peña-Claros, M., Mostacedo, B., Pariona, W. (2004). Informe base de la Republica de Bolivia. Reunión Regional de la Caoba Apéndice II CITES. Pucallpa, Perú, 18 al 21 de mayo del 2004. Ministerio de Desarrollo Sostenible, La Paz, Bolivia.

- Peña-Claros, M., Mostacedo, B., Pariona, W. (in prep.) Situación Actual de la Mara (*Swietenia macrophylla* King) en Bolivia. In Mostacedo, B. (ed), Mara (*Swietenia macrophylla*), Cedro (*Cedrela* spp.) y roble (*Amburana cearensis*): principales especies de árboles amenazadas en Bolivia.
- Pennington, T.D., Styles, B.T. & Taylor, D.A.H. (1981) Meliaceae. *Flora Neotropica Monograph* 28: 1-472.
- Pennington, T.D. (2002) Mahogany carving a future. *Biologist* 49: 204-208.
- Pereira, M., Fredericksen, T.S. (2002) Regeneración por semillas de especies maderables en áreas de aprovechamiento forestal en un bosque tropical húmedo en Bolivia. Proyecto BOLFOP, Santa Cruz, Bolivia.
- Phumpiú, V. (2007) Estadísticas del Control de las Exportaciones Forestales 2006. INRENA, Lima, Peru.
- Pulgar-Vidal, M. & Sandoval, M. (2008) Contenido ambiental de los Decretos Legislativos promulgados al amparo de lo dispuesto por la Ley 29157. SPDA (Sociedad Peruana de Derecho Ambiental), Lima, Peru.
- Rocas (n/d) *Swietenia macrophylla* King. In Species Descriptions, Mexico.
- Rojas, C.C. (2007) Illegal logging and international trade in mahogany (*Swietenia macrophylla*) from the Peruvian Amazon. Rainforest Foundation Norway, Lima, Peru.
- Rosser, A. & Haywood, M. (2002) Guidance for CITES Scientific Authorities: checklist to assist in making non-detriment findings for Appendix II Exports. Gland, Switzerland & Cambridge, UK.
- Snook, L.K. (1996) Catastrophic disturbance, logging and the ecology of mahogany (*Swietenia macrophylla* King): grounds for listing a major tropical timber species in CITES. *Botanical Journal of the Linnean Society* 122: 35-46.
- Snook, L.K. (2003) Regeneration, growth, and sustainability of mahogany in México's Yucatán forests. Pp. 169-192 in Lugo, A., Figueroa Colón, J.C. & Alayón, M (eds), Big-Leaf Mahogany: Genetics, Ecology, and Management. Springer-Verlag, New York, NY, USA.
- Snook, L.K., Santos Jimenez, V.A., Carreón Mundo, M., Chan Rivas, C., May Ek, F.J., Mas Kantún, P., Hernández Hernández, C., Nolasco Morales, A. & Escobar Ruíz, C. (2003) Managing natural forests for sustainable harvests of mahogany (*Swietenia macrophylla*): experiences in Mexico's community forests. *Unasylva* 54: 68-73.
- The Economist (2007) Commerce between friends and foes. *The Economist* print edition, 04 October 2007.
- Van Damme, P. (2006) Need for relevant information and a standardized procedure to evaluate the non-detrimental character of the trade in timber species listed in Appendix II of the CITES convention. Report, Peru, Lima.
- Vargas & Lombardi, I. (2006) Fortalecimiento de las Autoridades Administrativas y Científicas CITES-Perú. Informe Técnico, Universidad Nacional Agraria La Molina, Peru.
- Veríssimo, A., Barreto, P., Tarifa, R. & Uhl, C. (1995) Extraction of a high-value natural resource in Amazonia: the case of mahogany. *Forest Ecology and Management* 72: 39-60.
- Verwer, C., Peña-Claros, M., van der Staak, D., Ohlson-Kiehn, K., Sterck, F.J. (2008) Silviculture enhances the recovery of overexploited mahogany *Swietenia macrophylla*. *Journal of Applied Ecology* DOI: 10.1111/j.1365-2664.2008.01564.

Appendix 1. Peruvian legislation regulating forest management and conservation with timeline (**Table 6**).

In **Peru**, a national legislative reform is in process. New Law Decrees and Resolutions include the creation of the Ministry of Environment for the conservation and sustainable use of natural resources, biological diversity and protected areas; and Decree N° 1090 (28 June 2008) which created a Forestry and Wildlife Law establishing new definitions for forestry resources and use. Changes in laws and regulations are related to compliance with the Peru-USA Free Trade Agreement, and will affect forest conservation and sustainable use.

Ley 27308 defined a system of land use including Forests for Permanent Production (BPP) which encompass the concessions system. Concessions are subject to approval and implementation of Management Plans; harvests must observe minimum diameter cutting limits established by INRENA (OIMT 2004). Ley 27308 established the creation of a control organism for timber resources (OSINFOR, Organization for the Supervision of Forest Resources & Wild Fauna) to monitor the compliance of Management Plans in forestry concessions at the national level. This provision has not yet been implemented, however, and INRENA remains the controlling agency. Legislative Decree 1085 (28/06/2008) re-established the creation of OSINFOR, with legal authority to supervise and control the sustainable use and conservation of the forest and wild fauna resources and natural services from forests.

According to new proposed decrees, the Ministry of Agriculture (MINAG) is the unique National Forest Authority and together with Regional Governments is in charge of the management of forestry resources and wild fauna, generating an overlap with the Vice Ministry of Strategic Planning and Development of Natural Resources in the Ministry of Environment. Regarding modalities of use, concessions, permits and authorisations, Decree 1090 does not specify requirements for approving and implementing General Management Plans and Annual Operative Plans (POAs), nor criteria for intensity of use. Relevant passages include:

- Art. 11 on forest management requires verification of stocks only for CITES-listed species, including mahogany.
- Art. 22 prohibits exports of logs (Equipo del Proyecto Transparencia y Gobernabilidad Forestal – Perú 2008).
- Art. 41 allows legality of products of controversial origin, to be in force from 01 January 2009 for CITES species and from 01 July 2009 for all other species; according to legal analysts, this provision will legalize products of illegal origin, permit their trade in 2008, and postpone control measures. This articles opposes the FTA forestry agenda (Equipo del Proyecto Transparencia y Gobernabilidad Forestal – Perú 2008) and contradict CITES requirement of legal origin (Foro ecológico del Perú, Foro ciudades para la vida, Colectivo forestal de la sociedad civil, 2008).

Final complementary dispositions mentions that the Ministry of Agriculture (current CITES Management Authority), in coordination with the CITES Scientific Authority (Universidad Nacional La Molina), will progressively develop technical

studies to determine timber yields to calculate conversion factors, technical analysis and periodic updating of inventories of forestry species, prioritizing CITES species and yield studies, which will be public. It states that participation of CITES Scientific Authority shall also be related to the sustainable use according regeneration/recuperation status of natural populations. The establishment of an annual export quota is an optional decision of the Ministry of Agriculture (Equipo del Proyecto Transparencia y Gobernabilidad Forestal – Perú 2008).

Decree 1090 has generated controversy around several issues. Environmental organisations have objected that some provisions run counter to commitments made by Peru under the FTA, especially Annex 18.3.4 regarding illegal timber trade and use rights, because it does not require inventories or silvicultural practices, nor does it strengthen control and concessions supervision systems, while the FTA obliges verification of timber origin through chain of custody. Decree 1090 does not address required changes in the concessions system. No consultation period was granted for Decree 1090, and the process is considered non-transparent (Chávez 2008, Pulgar-Vidal & Sandoval 2008). Further, it does not clearly define the institutional functions of the Ministry of Environment regarding conservation of forest resources and in relation to the role of the Ministry of Agriculture. Finally, it does not recognize the competences and roles of regional governments in forest control and fiscalisation (Foro ecológico del Perú, Foro ciudades para la vida, Colectivo forestal de la sociedad civil, 2008). Civil society concerns on Decree 1090 (based in Foro Ecológico del Perú *et al.* 2008) are summarized in Del Gatto & Ortiz (in press).

Some of the commitments from Peruvian and US governments under the Peru-USA Free Trade Agreement (FTA) include: improve law enforcement, forest management and control to combat illegal logging and trade through developing a plan against corruption; increase criminal penalties and suspend the right to export products associated with illegal logging and trade; develop a plan and policies to implement and monitor Appendix II implementation, including chain of custody and tracking systems; support community-based forest management; strengthen the legal, policy and institutional framework of the forest sector; improve management of forest concessions; and increase public participation and transparency (Foro ecológico del Perú, Foro ciudades para la vida, Colectivo forestal de la sociedad civil 2008; Del Gatto & Ortiz in press).

Sustainable use of biological resources is discussed in Chapter 18 of FTA. Appendix 18.3.4 outlines elements of Forest Sector Governance (analysed in Del Gatto & Ortiz in press). It stipulates the necessity to elaborate a Strategic Plan related to the implementation of the listing of big-leaf mahogany in CITES Appendix II. The plan (PAEC-PERU 2008–2012) was developed and approved through Resolución Suprema N° 040-2008-AG in July 2008.

Table 6. Peruvian legal framework for conservation and forest management.

Legislation	Regarding
CITES, 30/12/1974	Peru joined CITES.
Law N° 21080, 21/01/1975	Ratifies inclusion of Peru in CITES.
The International Tropical Timber Agreement (ITTA), 03/09/1995	The ITTA was signed to improve control of the tropical timber market with Peru as a member.
Organic Law N° 26821, 10/06/1997	Gives the right to the Nation to use natural resources in a sustainable manner. Establishes conditions and modalities of use. Article 5: gives citizens the right to be informed and participate in the definition and adoption of policies related to conservation and sustainable use. Article 12: conservation & use in & out of protected areas, threatened species, bans. Art. 16: supervision of sustainable use, including measures for adequate supervision of use in areas of difficult access. Art. 28: sustainable use shall take into account regeneration availability, avoid overexploitation, & qualitative & quantitative recovery. Art. 29: compliance with management plans.
Law N° 26834, Natural Protected Areas, 30/06/1997	Monitoring, use & regulation for all natural resources within Protected Areas.
Law N° 27308, Forestry & Wild Fauna, 05/10/2001 & Decreto Supremo N° 014-2001-AG	Within the Transitory Complementary Dispositions of this law, N° 7 defines mahogany as a species forbidden for exploitation. For 10 years no timber originating from territories inside of the Putumayo, Yavari, Tamaya & El Purus watersheds could be traded. N° 8 prohibits all exports of mahogany wood from regions mentioned in N° 7, except for value-added products, pieces or parts.
Law N° 28611	General Environmental Law & International Agreements; modified by Legislative Decree 1055.
PERU-USA Free Trade Agreement (FTA), 05/10/2007	Chapter 18 discusses sustainable use of natural resources. In article 18.8 regarding biological diversity, Appendix 18.3.4 stipulates the necessity to elaborate a Strategic Plan related to the inclusion of big-leaf mahogany in CITES Appendix II.

Law N° 29157	Grants the legislature 180 days to regulate PERU-USA FTA implementation. A set of normatives on several important issues were approved.
Resolution Decree N° 075, 18/03/2008	Approves harvesting percentages for mahogany & <i>Cedrela odorata</i> .
Legislative Decree N° 1013, 14/05/2008	Approves creation, organization & functions of the Ministry of Environment. Obligations include ensuring the constitutional mandate regarding conservation & sustainable use of natural resources, biological diversity, and natural protected areas.
Supreme Resolution N° 040-2008-AG, 14/06/2008	Approval of the Strategic Plan for the implementation of mahogany's listing in CITES Appendix II (PAEC-PERU 2008–2012).
Legislative Decree N° 1055, June 2008	Modifies Law N° 28611 regarding information obligations & citizen participation. Makes the Ministry of Environment the focal point for environmental issues derived from Peruvian commitments under trade agreements.
Legislative Decree N° 1056	For compliance with Regime for Trade origin in the framework of Trade Agreements signed by Peru.
Legislative Decree N° 1079, 27/06/2008	Establishes measures to be taken to guarantee patrimony of Natural Protected Areas. Provides mechanism for management of resources confiscated inside natural areas.
Legislative Decree N° 1085, 8/06/2008	Creates the Organizaiton for the Supervision of Forestry Resources & Wild Fauna (OSINFOR) with legal authority to supervise & control sustainable use & conservation of forests, wild fauna & natural forest services.
Legislative Decree N° 1090, 27/06/2008	Approves Law of Forestry & Wild Fauna for sustainable use & conservation. Derogates Law N° 28204 for transfer of seized timber. Makes the Ministry of Agriculture the national authority in charge of designing, executing, supervising & evaluating forest policy. In previous legislation the Ministry of Agriculture was the primary body for promoting sustainable use & conservation of forest resources & wild fauna; the National Institute of Natural Resources (INRENA) was in charge of forest management.

Appendix 2. Mahogany production chain in Peru.

The diagram summarizes stakeholders involved in use, processing, transport and export of mahogany, including producers, government agencies, CITES authorities, customs, transportation, exporters and the private sector (INRENA 2007)

