Bigleaf mahogany (*Swietenia macrophylla*) in Peru, Bolivia, Brazil

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The species

- *Swietenia macrophylla* (Meliaceae)
- Emergent tree, wide distribution in the Americas
- Reproductive maturity attained at 70-80 cm diameter
- Growth varies with light condition, plant size, liana cover, geographical location, logging intensity
- Survival rate varies with size, light availability, forest type and logging intensity
- Used for timber production, overexploited
- Habitat loss

Mahogany & CITES

- Included in Appendix II of CITES in 2002 (after 7 years in Appendix III)
- Mahogany Working Group created, with 4 meetings (2001, 2003, 2006, 2008)

- 2007 Expert Workshop generated guidelines for making NDF
- guidelines have not been fully implemented

Mahogany & CITES

- Basic components of guidelines:

  1. **<u>Evaluate mahogany stocks</u>** at national or regional level as basis for defining export quotas and as requirement for:

  2. **<u>Population parameters</u>** such as structure & dynamics

  3. **<u>Management plans</u>** including measures towards sustainable planning of the forestry unit

  4. **<u>Silvicultural practices</u>**

  5. **<u>Control of mahogany harvests</u>** within planned forestry units, and mahogany exports based on export quotas

1. Evaluate mahogany stocks

- Historical and current stocking levels of mahogany in SA has not been possible:
  - Only remote populations survive intact: where are they? How large are they?
  - Logged areas have been converted to other land use options
  - Logged areas not converted have lower population size (most trees < 45 cm dbh)
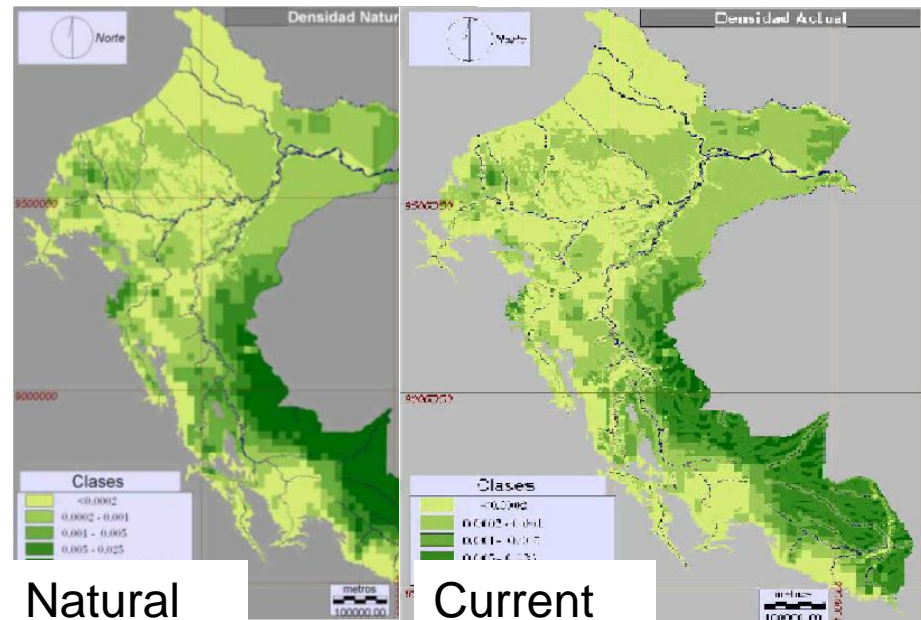
1. Evaluate mahogany stocks

- Peru
  - ITTO project sponsored a national inventory to describe natural distribution and quantify remaining commercial stocks
  - Model used to predict distribution of the species

Píxel: 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

Natural   Current

1. Evaluate mahogany stocks

- Bolivia
  - Data from different sources, collected using different methods
  - Data show a large variation in density depending on forest type and harvesting history
  - Need to carry out a better assessment at national level

- Brazil
  - Large-scale inventories in logged and unlogged forests across southern Amazonia
  - A national inventory to assess surviving stocks would be prohibitively expensive

2. Population parameters

- Is the rate of harvesting sustainable?

- Information needed to define harvesting levels:
  - Not much data on population dynamics
  - Very little data on logging effects
  - Very little data on silvicultural treatments required to enhance growth and survival of naturally established individuals
  - But data on forest enrichment available

- Two research-based cases: Bolivia & Brazil

2. Population parameters - Bolivia

- 12 plots of 27 ha each, 4 logging treatments (not mahogany)

- Plants > 1 cm in diameter surveyed in all plots
- Seedlings and saplings < 1.3 m height surveyed around 58 mahogany trees
- Plants have been monitored since 2002

- Population structure
- Survival, growth and recruitment rates

- Dynamic data used to construct population matrices
- Matrices models used to:
  – Calculate population growth rate
  – Determine which vital rates are the most important
  – Different logging scenarios

(Verwer et al. 2008. Journal of Applied Ecology)

2. Population parameters - Bolivia

-MDC = 70 cm
-Different harvesting intensities (50, 80, 100%)
-Different cutting cycles (20-100 years)
-Optimal conditions are maintained over time
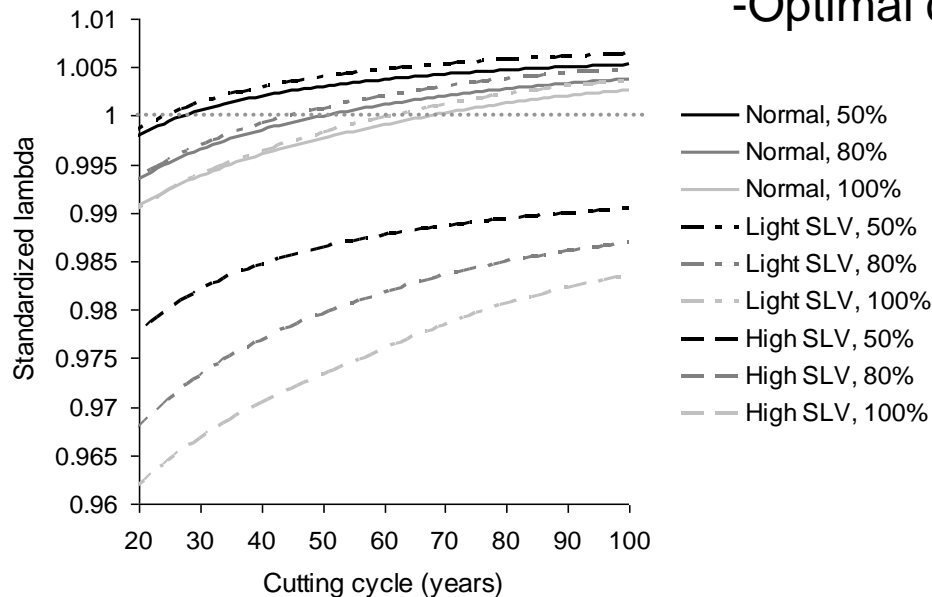
- Reduction of harvesting intensity, reduces cutting cycle length only for some treatments
- Conditions created by logging need to be maintained over time

2. Population parameters - Bolivia
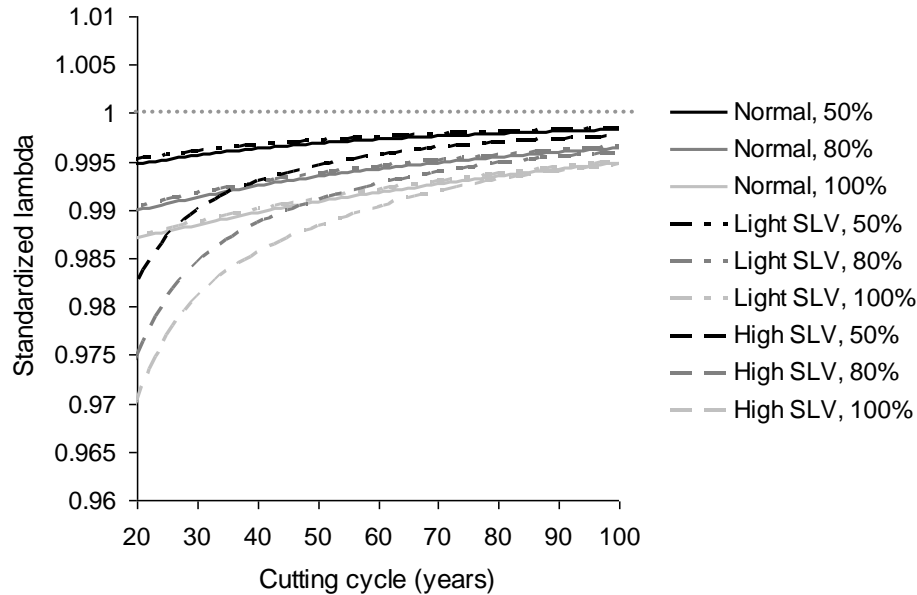
- When forest is allowed to return to initial status, mahogany can not be harvested sustainably

2. Population parameters - Bolivia

- Current practices defined for Bolivia are sustainable (MDC > 70 cm, harvesting intensity of 80%) only when longer cutting cycles are used (> 50 years)

- If harvesting intensity is reduced to 50%, it is possible to have shorter cutting cycles (at least 25 years) but ONLY when effect of treatment is maintained over time

- Without silvicultural treatments mahogany harvesting is not sustainable regardless of cutting cycle and harvesting intensity

- More long-term data is needed to assess the long-term effect of silvicultural treatments on mahogany population dynamics, and to quantify the proper intensity of silvicultural treatments

2. Population parameters – Brazil

- Population structures for trees >20 cm dbh from large-scale (200 - 11,000 ha) inventories at 8 sites across southern Amazonia

- Simulated population recovery during 30-yr cutting cycle, based on:
  - Observed growth & mortality rates from 2 long-term research sites
  - Conventional (predatory) logging practices (~5% retention rates & removal of sub-commercial trees)
  - Legal logging practices (60 cm MCD, 20% retention rate)
  - Variable selection criteria for seed trees under legal practices

(Grogan et al. 2008 Forest Ecology & Management)

2. Population parameters – Brazil

- Density varies by 2 orders of magnitude across range

- Only 1 site with high density of sub-commercial (<60 cm) trees

- Conventional logging removed 93-95% of commercial trees (>45 cm before new regulations), 31-47% sub-commercial trees

- 30-yr population recovery highly dependent on initial population structure, especially density of sub-commercial trees

- 30-yr recovery at 7/8 sites under legal harvest scenario (20% retention) ranged from 20-51% of initial density, 23-50% of initial volume

- Seed tree selection criteria impact recovery rates (that is, maximizing 1st cut financial yield vs. long-term seed production)

3. Management plans

- Technical recommendations provided by MWG 2003 are mainly followed by countries

3. Management plans

Recommended by mahogany working group	Situation in Bolivia as required by the forestry law and current technical norms
Commercial census	- 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 above minimum cutting diameter are included. - Results of the census are used to elaborate the annual operational logging plan (POAF)
Mapping of commercial and subcommercial trees	- Maps are elaborated based on the commercial census data, including topographic features, water courses, roads, and harvestable trees. Maps are a component of POAF. - Subcommercial trees are not mapped as they are not included in the census.
Selection of seed trees and minimum density of trees per ha alter logging	- 20% of harvestable trees are left behind. These trees are also mapped and tagged. They are also clearly marked in the field to assure its identification as a seed tree. - There is no selection criteria, the 5th tree found should be left as seed tree. - The minimum tree density alter logging depends on the initial density.
Minimum diameter for cutting (MDC)	70 cm for mahogany
Monitoring dynamics of future crop trees	Monitoring is not specifically required for the species. Although it is required to establish permanent plots to assess the effect of logging on forest dynamics and timber yields, not all companies have done so. - Mahogany is present in several permanent plots established but the number of individual is relatively low.
Improvement of regeneration	- 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. - There are several experiments that have looked at the regeneration aspects of mahogany. The most promising results are coming from enrichment planting in logging gaps.

3. Management plans

- Technical recommendations provided by MWG 2003 are mainly followed by countries

  – Several aspects already included in the existing forestry laws

  – Some specific aspects regarding the species have been included as requirements for mahogany harvesting (mostly in the case of Brazil, to some degree in the case of Peru)

Main problems for determining NDF

- Lack of information on the species, including long-term demographic data

- Authorities lack the capacity and resources to monitor and control harvest and commercialization

- Information flow among parties involved needs to be improved

- Lack of coordination between CITES Management and Scientific Authorities
  - Recommendations are not implemented

- Need to define sawing efficiency and other control and verification methods

Recommendations

- Incorporate recommendations of MWG into management plans of mahogany

- Criteria and parameters for formulating NDF must be reviewed

- Cost and monitoring time must be discussed

- Define if NDF will be based on management unit or export quotas

- Promote and fund research on topics required for defining NDF and for guaranteeing that mahogany is sustainably harvested

Thank you

Questions?