BRAZILWOOD (*CAESALPINIA ECHINATA*) IN BRAZIL

AUTHORS:
Elena Mejía*
Ximena Buitrón**
*UICN SUR consultant.
**Senior Biodiversity Officer, UICN SUR Regional Office for South America.

Acknowledgements
Doris Cordero, Forest Program Officer (UICN-SUR) for compiling available information and contacting the CITES Scientific and Management Authorities, and Claudia Mello and José Chaves, Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA, CITES Authority) for providing valuable information and data.

I. Background information on the taxa

Brazilwood (*Caesalpinia echinata*) is the national tree of Brazil, where it is commonly known as pau brasil. After many years of harvesting, this species is on the verge of extinction. Despite Brazilwood's inclusion on CITES Appendix II and the Brazilian threatened plant species list, exploitation continues due to its extremely dense hardwood ideal for making bows for stringed musical instruments (Global Trees 2008). Available information on the use of *C. echinata* for manufacturing bows is limited. Reliable figures on volumes exported from Brazil for this purpose are lacking, and volumes used by Brazilian bow-makers is also unknown (CITES 2007).

Brazilwood is a late secondary canopy tree whose natural habitat is mainly semi-deciduous seasonal forests occurring on sandy marine soils of Brazil's coastal Atlantic Forest (Mata Atlântica). Local ecologi-

cal factors lend a sclerophyllous aspect to this type of vegetation (Cardoso et al. 1998). Brazilwood's natural distribution is restricted to between Rio Grande do Norte and Rio de Janeiro (Borges *et al*. 2005).

Caesalpinia echinata was included on CITES Appendix II in September 2007 (violin bows were not included; CITES 2008). Since 1992 Brazilwood has been included on the official list of threatened Brazilian plants by IBAMA (Brazilian Institute for the Environment and Renewable Natural Resources), which has also established legislation on harvesting practices. Research on replanting opportunities is ongoing. Despite its high profile, little information exists regarding Brazilwood's ecology and life history, with limited data available on distribution, species variation, and population size (Newton, Oldfield, & Fragoso n/d).

IBAMA is the CITES Management and Scientific Authority in Brazil. IBAMA allows Brazilwood trade in material originating from property improvements such as fences, sheds, and houses so long as a license has been issued to this effect by the appropriate environmental agency. IBAMA may then authorize these materials for export (CITES 2007).

According to the CITES proposal for Brazilwood, information was gathered on international trade and use of *C. echinata* for the production of bows in 1997 (FFI 1997). Timber merchants are reluctant to divulge this information, but annual worldwide demand is estimated at around 200 m^3. Principal importing nations include the United Kingdom, France, Germany, China, Switzerland, Korea, Japan and the USA (CITES 2007). Within this importers framework the International Pernambuco Conservation Initiative (IPCI) was created, represented mainly by the USA and Germany along with members of other importer nations. The IPCI has supported the 'Pau-Brasil Program' through CEPLAC (Executive Commission of the Cocoa Planting Plan) with assistance from IBAMA and the Rio de Janeiro Botanic Garden since 2004. The Program's objectives include promoting conservation actions, production research, environmental education, and sustainable use of Caesalpinia echinata (Chaves & Mello comm. in lit. July 2008).

1. BIOLOGICAL DATA

1.1. Scientific & common names

Caesalpinia echinata Lam. is classified in the family Fabaceae and order Fabales. It is called pau brasil, brasileto, ibirapitanga, orabutá, pernambuco, or pau rosado in Portuguese; Brazilwood in English; and palo brasil in Spanish.

1.2. Distribution

Brazilwood is confined to the Atlantic Forest, an ecosystem recognized as a global biodiversity hotspot. It inhabits coastal regions with open forest and well-drained soils. Detailed information on the present geographical distribution of Brazilwood is scarce, but in the last ten years remnant populations have been found in nine Brazilian states, including populations in reserves in Bahia and Pernambuco. Determining the previous range of the species has been problematic due to errors in the literature caused by incorrect identification and confusion with related species. Fig. 1 shows the potential distribution on the basis of historic Atlantic Forest range according to WWF Global 2000 Ecoregions data (Newton, Oldfield, & Fragoso n/d).

Pau brasil occurs principally in low-lying coastal areas and wide plains (IPCI-Comurnat 2008) in Rio de Janeiro and the southernmost part of Bahia, where it is restricted to the Mata Atlântica (Atlantic Coastal Forest), which now covers less than 100,000 km^2, or 7.3% of its original extent in Brazil (IUCN & TRAFFIC 2007, UNEP-WCMC 2008). In the 16th Century, the Mata Atlântica covered practically all of the Atlantic seaboard from south of Rio de Janeiro to Rio Grande do Norte and extended 80 to 150 kilometers inland (IPCI-Comurnat 2008).

Table 1. Locations with botanical records where Brazilwood occurs (CITES 2007).

State	Locations where Brazilwood occurs
Rio Grande do Norte (RN)	Extreme south to near Cabo de Touros
Paraíba (PB)	Mamanguape & Camaratuba
Pernambuco (PE)	São Lourenço da Mata to Vitória de Santo Antão, Nazaré da Mata
Alagoas (AL)	Tracunhaém, Pau d'Alho, Timbaúba, Goiana, Junqueira
Bahia (BA)	Porto Seguro, Eunápolis, Itamaraju, Barrolândia, Jussari, Ipiau
Espírito Santo (ES)	Aracruz, Caraíva, Camacã, Guaratinga, Pau-Brasil, Ubaitaba, Tapera
Rio de Janeiro (RJ)	Cabo Frio, Búzios, São Pedro da Aldeia, Araruama, Iguaba, Saquarema, Itaipuaçú, Rio de Janeiro

Fig. 1. The Atlantic Forest (Mata Atlântica) in the 16th and 21st Centuries (IPCI-Comurnat 2008).

1.3. Biological characteristics

1.3.1. *General biology & life history*

Pau brasil is a medium-sized leguminous tree reaching around 12 m height with a maximum stem diameter of 70 cm. Brazilwood is semi-deciduous, heliophytic or sciophytic, typical of seasonal forests. It persisted through the glacial periods, preferring an arid climate and dry soils (CITES 2007). Its growth rate is slow and depends on several factors such as soil type, climate, and geographic location (Mello 2008). Many aspects of the biology of Brazilwood and the composition and structure of plant communities in which it occurs are poorly understood (IUCN & TRAFFIC 2007).

The flowering period of *C. echinata* growing in an experimental area in the state of São Paulo over 24 years was during

August–September at the beginning of the rainy season. Flowering by individual trees lasts 10–15 days; individual flowers are receptive for less than 24 hours. Flowers give off a scent of slightly sweetened citrus fruit, and tend to cluster in small terminal racemes, rarely sprouting from branch axils. The calyx is yellowish-green, and petals are intensely yellow with faint shades of red at the base. The medium-sized petal stands out from the others with its deep red central spot that nearly covers the entire surface. Fruit maturation occurs during the late rainy season and early dry season of the following year. Fruit are woody, 6–8 cm long and 2–3 cm wide, oblique, spiny, sublunate dehiscent, and contain 2–3 brownish seeds that are 1–1.5 cm diameter. Fruit pod valves twist after dehiscence, and their surfaces are pubescent with 5 mm woody spines (Borges *et al*. 2005).

1.3.2. *Habitat types*

C. echinata chiefly occurs on coastal plains and lowlands, on sandy or sandy-clay soils. Its patchy distribution along the Atlantic coast reflects this preference (CITES 2007).

1.3.3. *Role of the species in its ecosystem*

Little is known about the composition and structure of the plant community in which Brazilwood occurs. Floristic characteristics of three areas containing the species in the state of Rio de Janeiro have been studied, but not in great detail, so these studies do not provide sufficient data to reach any generalized conclusion (CITES 2007).

1.4. Population

1.4.1. *Population size*

The Pau-Brasil Program recorded 1,754 trees. Of these, 1,669 occurred naturally and the remaining 85 had been planted. These data include presence of three morphological variants of the species —rue-leafed, coffee-leafed, and orange-leafed forms— in southern Bahia where cocoa plantations are prevalent. *C. echinata* is known to be disappearing because of habitat loss associated with deforestation and illegal logging of trees to produce violin bows and for other purposes. The Pau-Brasil Program has verified examples of regenerating populations. These results were found for individuals in a *Caesalpinia echinata* sample covering an area of 3.6 ha, within five remaining hectares of the semi-deciduous seasonal forest in the Cabo Frio Diversity Centre, and for a small population surviving in the city of Rio de Janeiro. This evidence indicates the typical inverse *J*-curve, where the highest percentages of individuals in the sample were plants at the seedling or juvenile stage (coppices; CITES 2007).

1.4.2. *Current global population trends:*
___increasing _X_decreasing ___stable ___unknown

1.5. Conservation status

Brazilwood has been listed as threatened by IBAMA since 1992 (CITES 2007). This status has been re-confirmed recently (Ministério do Meio Ambiente, Instrução Normativa No 06/23 September 2008).

Table 3. Status of Caesalpinia echinata (CITES 2007).

Organization	Comment
CITES (PC14 09/2007)	Qualifies for CITES Appendix II
World List of Threatened Trees	Endangered
IUCN (2004 Red List)	Endangered (based on criteria A1 a, c, d)1
IBAMA (Brazil) (Resolution No 37 04/1992)	In danger of extinction

1.5.1. *Main threats*

The main threats are deforestation and illegal logging for exports. Deforestation of the Mata Atlântica has been accelerated by urban sprawl, agriculture and timber harvesting. Some regions have suffered considerable impact in recent years through tourism development. Detailed figures on the proportion of deforestation in the remaining forest areas where C. echinata occurs are unavailable (CITES 2007).

___No threats
_X_Habitat loss/degradation (human induced)
___Invasive alien species (directly affecting the species)
_X_Harvesting [hunting/gathering]
___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*

Caesalpinia echinata has been extracted from natural forests since 1500. Harvests have been illegal since 2001. No plantations are known (Mello 2008).

2.1.2. *Purpose of the management plan in place*

There is no possibility for approval of management plans for Brazilwood until a range-wide inventory is completed. Timber that is currently available for export was harvested before Brazilwood's Appendix II listing in 2007; these volumes are considered pre-convention (Mello 2008). The Pau-Brasil Program undertook a series of inventories in 2005. The objective was to gather information on the occurrence of the species by consulting with institutions and social bodies (government environmental agencies, NGOs, rural unions, forest exploration and management firms, and sawmills) as well as professionals associated with forestry activities, to identify locations where the species and its morphotypes prosper under natural and cultivated conditions. In the course of the inventory work, numerous rural properties in different edaphic-climatic and ecological regions were visited, and 1,754 individual Brazilwood trees were recorded on over 130 rural properties in the cocoa-growing region of southern Bahia (CITES 2007)

2.1.3. *General elements of the management plan*

N/A

2.1.4. *Restoration or alleviation measures*

The Pau-Brasil Program is coordinated by CEPLAC (Comissão Executiva do Plano da Lavoura Cacaueira) in partnership with several NGO and research institutions. The project, started in 2004, is financed by IPCI. The main objectives of the program are to develop conservation actions, production research, environmental education and sustainable use of *Caesalpinia echinata*. After four years of program implementation, the principal achievements have been the recognition of three different varieties of pau brasil and the establishment of a tree plantation of 140,000 plants growing under different forest canopy and soil conditions. Data obtained from the experimental plantation has provided new tools to improve the economic and environmental parameters for developing sustainable management of *C. echinata*. The Pau-Brasil Program in its new phase hopes to establish seedbanks and to recuperate legal reserves. In the medium term, the Program's principal objectives are to move Brazilwood off of the Endangered Species List, to resume its legal commercialization, and to create a new economic resource for producers and for those who will want to participate in the future. As well, on-going negotiations are aimed at establishing new strategic alliances (private sector) to extend the Program's efforts in the state of Bahia (Chaves & Mello 2008).

2.2. Monitoring system

Caesalpinia echinata cannot be legally harvested at present. All currently held material had to be declared and updated in the Forestry Origin Document (DFO). This system is used for monitoring forest-derived products; the DFO allows control of Brazilwood-derived products from point of origin until their export location. At this time, Brazilwood trade is currently permitted only for declared material (Mello 2008).

2.2.1. *Methods used to monitor harvest*

N/A

2.2.2. *Confidence in the use of monitoring*

Brazil's monitoring systems are displayed on-line. This process allows tracking all forestry products in a secure and trustworthy manner. The viability and confidence of this system is highly regarded (Mello 2008).

2.3. Legal framework & law enforcement

Brazilwood is protected under the Law for Bioma-Mata Atlântica. Its harvest is prohibited in natural forests. No plantations are known (Mello 2008). Under National Environmental Council (CONAMA) Resolution No 278/2001, all previously authorized concessions for felling and harvesting species threatened with extinction were suspended except for temporary harvesting for no direct commercial purpose, to be consumed on rural properties or holdings or on Indigenous peoples' landholdings and traditional settlements (CITES 2007).

Table 3. Brazil's legal framework for forest management & Brazilwood.

Legislation	**Regarding**
Law N° 4771, 15/09/1965 –	Forestry regulations for Brazil.
Resolution CONAMA 278	Prohibits harvesting & exploration of all species under threat of extinction in the Mata Atlântica.
Decreto N° , 10/02/1993	Regulates harvesting, exploration and suppression of primary vegetation in advanced & medium regeneration levels of the Mata Atlântica.
Law N° 11.428, 22/10/2006	Specific law for the Mata Atlântica.
Decreto N° 5.975, 2006	Establishes that the generation, issuance and control of documents for transportation & storage of forestry products & sub-products of native origin must be emitted through the National Electronic Integrated System.
Instrução Normativa N° 112, 21/08/2006	Empowers IBAMA to suspend authorizations granted directly or by other bodies within the National Environmental System (SISNAMA) for harvesting species officially listed as threatened with extinction, for natural populations in the Mata Atlântica.

3. UTILIZATION & TRADE

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

In accordance with the document produced in February 2002 by the Federal Ministry of the Environment, Department of Nature Protection and Nuclear Security of the Federal Republic of Germany, evidence indicates widespread use of *C. echinata* in global production of violin bows (CITES 2007).

3.2. Harvest

3.2.1. *Harvesting regime*

No harvesting is allowed for commercial purposes.

3.2.2. *Harvest management / control* (quotas, seasons, permits, etc.)

N/A

3.3. Legal & illegal trade levels

The extent and quantity of surviving Brazilwood stocks are unknown. According to IBAMA, hidden volumes remain available for illegal trade in spite of legal requirements that timber companies declare quantities of *C. echinata* under ownership. Illegal exports have declined since *C. echinata* was included on Appendix II (Mello 2008). While illegal logging is known to occur, the extent of such practice has not been determined because timber merchants are reluctant to divulge this information. Though annual worldwide demand is estimated at around 200 m^3, it is probably higher because a considerable amount of wood is wasted during the bow-making process. A single violin bow typically requires approximately 1 kg of wood (CITES 2007).

According to Mello (comm. in lit. August 2008), all companies with timber products were required to declare their stocks through the IBAMA electronic system in 2006. The system shows that 20,388 m^3 of Brazilwood were exported from 2006 to December 2007 from these stocks. However, the electronic system cannot adequately track the timber quantities during the transformation process; that is, most timber is transformed into violin bows and then exported without registration (violin bows are not included in the Appendix II listing). IBAMA is currently trying to increase control because the black market for Brazilwood remains active. The system has registered no exports in 2008.

II. Non-detriment finding procedure (NDFs)

Brazil does not allow extraction from natural forests and no plantations are known (Mello comm. in lit July 2008). The Brazilian government recognizes the need for adequate data on surviving natural stocks and other biological information before NDF can be provided. Steps currently underway to obtain the necessary information are outlined in this case study.

1. IS THE METHODOLOGY USED BASED ON THE IUCN CHECKLIST FOR NDFS?

__yes _X_no

REFERENCES

BORGES, I.F., Neto, J.D., Bilia, D.A., Figueiredo-Ribeiro, R.D. & Barbedo, C.J. (2005) Maturation of seeds of *Caesalpinia echinata* Lam. (Brazilwood). Pp. 851-861 in Endangered Leguminous Tree from the Brazilian Atlantic Forest. *Brazilian Archives of Biology and Technology*.

CARDOSO, M., Provan, J., Powell, W., Ferreiras, P. & Oliveira, D. (1998) High genetic differentiation among remnant populations of endangered Caesalpina echinata Lam. (Leguminosae Caesalpinioideae). *Molecular Ecology* 7: 601-608.

CHAVES, J. & Mello, C. (2008) Resumen del Programa Pau-Brasil. Brasília, DF, Brazil.

CITES (2007) Consideration of Proposal for Amendment of Appendices I & II. The Hague, Belgium.

CITES (2008) Appendices I, II and III. Valid from 01 July 2008.

Global Trees (2008) Retrieved 21 July 2008 from http://www.globaltrees.org/reso_tree.asp?id=25

IPCI-Comurnat (2008) Conservation Concerns. Retrieved from http://www.ipci-comurnat.org/eng04.htm

IUCN (2004) 2004 IUCN Red List of Threatened Species. Retrieved 20 July 2008 from IUCN Red list: http://www.iucnredlist.org/search/details.php/32293/all

IUCN & TRAFFIC (2007) IUCN/TRAFFIC Analyses of the Proposals to Amend the CITES Appendices at the 14th Meeting of the Conference of Parties.

MELLO, C. (2008) Feedback form: *Caesalpinia echinata*. 23 July 2008, Brasília, DF, Brazil.

Mello, C. (2008) Case Study: Pau Brasil. 29 July 2008, E. Mejia, interviewer.

MINISTÉRIO do Meio Ambiente (2008) Anexo 1: lista oficial das espécies da flora brasileira ameaçadas de extinção. Instrução Normativa No 06, de 23 de setembro de 2008.

NEWTON, A., Oldfield, S. & Fragoso, G. (n/d) Towards a Global Tree Conservation. Atlas, *UNEP-WCMC Biodiversity* Series 20.

UNEP-WCMC (2008) UNEP-WCMC Species Database: CITES-Listed Species. Retrieved 21 July 2008 from http://www.cites.org/eng/resources/species.html