CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA

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Fourteenth meeting of the Conference of the Parties
The Hague (Netherlands), 3-15 June 2007

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

Cedrela odorata is proposed for listing in Appendix II of CITES in accordance with Article II, paragraph 2(a) of the Convention and Resolution Conf. 9.24 (Rev. CoP13) Annex 2 a, Paragraph B.

All other species in the genus *Cedrela* are proposed for listing in Appendix II of CITES for look-alike reasons in accordance with Article II, paragraph 2(b) of the Convention and Resolution Conf. 9.24 (Rev. CoP13) Annex 2 b, Paragraph A.

B. Proponent

Germany, on behalf of the European Community Member States acting in the interest of the European Community. (This proposal has been prepared by The Netherlands).

C. Supporting statement

1. Taxonomy

1.1 Class: Magnoliopsida

1.2 Order: Sapindales

1.3 Family: Meliaceae

1.4 Genus, species or subspecies, including author and year: *Cedrela odorata* L. (1759).
See Annex 1 for other *Cedrela* species

1.5 Scientific synonyms: See Annex 2. Taxonomic note: some authors have considered *C. odorata* only to include those trees originating from the West Indies and others to be of the species *C. mexicana*. In the revision of *Cedrela* by Smith (1960) *C. mexicana* was recognized as a synonym of *C. odorata*. This is the widely accepted convention used here, however, where *C. mexicana* is the synonym used in country information, this has been noted.

1.6 Common names:
English: cedar, Barbados cedar, cigar-box cedar, Central American cedar, Honduran cedar, Mexican cedar, Nicaraguan cedar, red cedar, Spanish cedar, West Indian cedar
French: acajou rouge, acajou-bois, cédrat, cèdre acajou, cèdre des barbares, cèdre rouge
Spanish: cedro amargo, cedro cebolla, cedro cubano, cedro hembro cedro macho, cedro real, cedro rojo

German: Zigarrenkitschenholz, westindische Zeder
See Pennington (1981) for an extensive list of local names.

1.7 Code numbers: ---

2. Overview

The native range of *Cedrela odorata* is in seasonally dry forests of Central and South America. Once a common tree, *C. odorata* has had a long history of over-exploitation for its valuable timber. Combined with extensive loss of habitat through deforestation (Section 4.1) this is a serious threat to the future of the species. The timber is valued locally for its resistance against rotting and insects and internationally as a quality wood (Section 6.1). As a result, it has been selectively cut for at least 250 years, both for domestic use and for export (Section 6.1). Cutting has continued such that many countries throughout its native range report that numbers have been reduced, some to the extent that it is threatened (Section 4.5). In many places, populations have been reduced to inaccessible areas (Section 4.4). Large, well-formed trees are now particularly uncommon. The species is intolerant of shade and natural regeneration is scarce in rainforest conditions, though better in semi-deciduous forest (Section 3.3). Logging of *C. odorata* from natural forests is not sustainable, particularly as the potential habitat available for the species has been greatly reduced by deforestation. The species has been listed in CITES Appendix III by Colombia and Peru since 2001. CITES trade reports provide evidence of international trade in the wood from range States. Plantations of *C. odorata* have been established both within and outside of the native range (Section 8.4). These provide a source of timber that may otherwise be sought from the wild.

This document suggests that *Cedrela odorata* meets the criteria for inclusion in Appendix II of CITES in accordance with Article II, paragraph 2(a) of the Convention and Resolution Conf. 9.24 (Rev. CoP13) Annex 2 a, Paragraph B:

> *It is known, or can be inferred or projected, that regulation of trade in the species is required to ensure that the harvest of specimens from the wild is not reducing the wild population to a level at which its survival might be threatened by continued harvesting or other influences.*

All other species in the genus *Cedrela* are proposed inclusion in Appendix II of CITES for look-alike reasons, in accordance with Article II, paragraph 2(b), of the Convention and Resolution Conf. 9.24 (Rev. CoP13) Annex 2 b, Paragraph A.

3. Species characteristics

3.1 Distribution

Cedrela odorata

The natural range is obscured by exploitation, forestry plantings, and escapes from cultivation (Pennington, 1981). *Cedrela odorata* grows throughout lowland Central America and South America to northern Argentina and most Caribbean Islands within a latitudinal range of 26°N and 28°S (Pennington, 1981; Cintron, 1990). The distribution is fragmented due to extensive deforestation in the neotropical region. In Central America and Mexico it only occurs on non-flooded sites, often on well-drained limestone, as in the semi-deciduous forests of the Yucatan peninsula. However, in Amazonian Peru and Brazil it is most common on fertile soils which are periodically flooded by the rise and fall of the Amazon and its major tributaries (Pennington, 2006).

Within the native range: **Antigua and Barbuda**: Reported to occur in Antigua (Grisebach, 1864). **Argentina:** Reduced localities (Zapater *et al*., 2004). The southern limit of the species (Lamb, 1968). Northern region (Pennington, 2006). **Barbados**: Formerly common and widespread, but becoming rare (Gooding *et al.,* 1965). **Belize**: Occurs scattered in primary rainforest but has a greater distribution in secondary rainforest (Stevenson, 1927). **Bolivia**: Specimen reported from Beni (Smith, 1960). **Brazil**: Specimens reported from the states of Acre, Amazonas and Pará (Smith, 1960). Occurs in Amazonian, central and eastern coastal region (Pennington, 2006). **Cayman Islands**: Found in Grand Cayman and Cayman Brac (Proctor, 1984). **Colombia**: Present

in warm lowlands and Valle de Magdalena (Cortés, circa 1900). Not listed in the national Red List (Calderon, 2003). **Costa Rica**: a widely distributed species (INBio, 1999). Occurs in an area of 42,978.5 km^2 from 0-1,000 m in the regions: Central Valley, North Pacific, Central Pacific, South Pacific, Northern Zone and Atlantic Zone. Found in forests in subtropical, humid tropical or seasonally dry areas (ITCR/EIF, 2006). **Cuba**: A prominent element of the upper canopy layer in semi-deciduous mesophytic forests (Borhidi, 1991). Found in all provinces (*C. mexicana*; Sauget and Liogier, 1951). **Curaçao** (the Netherlands): Specimens reported from Cas Cora (Smith, 1960). **Dominica**: Found on the West coast of Dominica at 30 m; specimen from Pointe Michel: may be cultivated (Nicholson, 1991). **Dominican Republic**: The species was included in lists of threatened plants in the Dominican Republic (Jiménez, 1978). **Ecuador**: Specimen reported from Esmeraldas (Smith, 1960). Introduced in the Galápagos Islands, where the risk of problems with invasion of the species has been identified (Brockie *et al*., 1988). **El Salvador**: Specimen reported from San Martin (Smith, 1960). **French Guiana**: Specimen reported from Carel Francois (Smith, 1960). **Grenada**: Specimen reported from Saint Georges (Smith, 1960). **Guadeloupe** (France): Specimen reported from Basse Terre (Smith, 1960). Local uses described (Questel, 1951). **Guatemala**: Common throughout most of the lowlands, in some places forming a substantial part of the forest (*C. mexicana*; Standley and Steyermark, 1946). **Guyana**: Rare to occasional in mora forest, seasonal forest and mixed forest on poorly drained soils throughout the country (Polak, 1992). **Haiti**: Specimens reported from Tortue Island, Morne Pedegral, Morne Fourrise, Saint Marc and Puerto Rata (Smith, 1960). **Honduras**: Specimens reported from El Paraíso, Zamorano, El Jacarito, Chahuite, Comayagua (Smith, 1960). **Jamaica**: Common in places where probably planted, especially pastures and roadsides (Adams, 1972). Common in the plains and lower hills (Grisebach, 1984). One of the most valuable timber trees of the island (Fawcett and Rendle, 1920). **Martinique** (France): Specimen reported from Rivière Pilot (Smith, 1960). **Mexico**: Found along the Pacific coast from the State of Sinaloa to Guerrero and Chiapas and on the subtropical Atlantic coast from Tamaulipas to Yucatán (Pennington, 1981). The pacific slopes form the most northerly limit of the distribution (Lamb, 1968). **Montserrat** (United Kingdom of Great Britain and Northern Ireland): Specimens reported from Roches (Smith, 1960). **Nicaragua**: Specimens reported from Jinotega and Chinandega (Smith, 1960). **Paraguay** (Pennington, 2006). **Panama**: The species is restricted to the Pacific side of the isthmus, and is nowhere common although it can be found regularly in secondary forests around Panama City (Condit & Pérez, 2002). **Peru**: Occurs in low and high forests, tropical Pacific forest (sub-humid mountain woodland), woods in the lifezones: subtropical; humid tropical; sub-humid or seasonally dry. Occurs up to 1,000 m in the departments of Tumbes, Amazonas, San Martin, Loreto, Ucayali, Madre de Dios (INRENA, 2006). **Puerto Rico** (United States of America): Occurs mostly as widely distributed trees in government-managed reserves [see section 8.1 (Gabel, 2006]. The native trees have been reduced to scattered remote areas, chiefly in moist limestone and lower Cordillera forest regions. In the Cordillera, restricted to steep rocky areas with soils in the Mucara group or in associated well-drained soils (Little and Wadsworth, 1964). **Saint Kitts and Nevis**: Occurrence reported (Americas Regional Workshop, 1998; WCMC, 1999). **Saint Lucia**: Specimen reported from La Perle (Smith, 1960). **Suriname**: Occurs in the rainforest regions (FAO, 2004)**. Trinidad and Tobago**: a fairly wide distribution, but confined to better soils (*C. mexicana*; Marshall, 1934). Found on hillsides, roadsides and cultivated land (*C. mexicana*; Williams, 1928). Widely distributed both in rainforest and drier, semi-deciduous types, but nowhere common (Marshall, 1939). **Venezuela (Bolivarian Republic of)**: Frequent in warm lowlands (Schnee, 1960). **Virgin Islands** (United States): Known only from a few trees on US National Park Service land on the island of Saint John (Acevedo-Rodriguez, 1996, Gabel, 2006).

The species has been widely introduced: **American Samoa, Bermuda, Bahamas, Cook Islands, Fiji**, **Micronesia (Federated States of), New Caledonia** (France), **Samoa**, **South Africa, Tonga, United States** (PIER, 2005) and in plantations elsewhere: **Australia** (Griffiths *et al*., 2001); **Côte d'Ivoire** (Dupuy, 1995), **Ghana** (Atuahene, 2001), **Madagascar**, **Malaysia**, **Singapore**, **South Africa**, the **Philippines, Uganda**, the **United Republic of Tanzania** and **Samoa** (Lemmens *et al*., 1995). **Indonesia** (Rachmatsjah and Wylie, 2001), **Solomon Islands** (Ngoro, 2001), **Sri Lanka** (Tilakaratna, 2001) and small or trial plantations in **Malaysia** (Khoo, 2001), **Papua New Guinea** (Dobunaba and Kosi, 2001) and **Thailand** (Eungwijarnpanya, 1997).

This species is so widely protected and cultivated for its timber that it is often difficult to be sure of the origin of roadside trees (Pennington, 2006).

Range of *Cedrela* species other than *C. odorata*: see Annex 1.

3.2 Habitat

C. odorata needs a plentiful supply of nutrients and is very intolerant of waterlogging (Cintron, 1990; Marshall, 1939; Lamb, 1968). Pennington (2006) notes that this intolerance applies mainly to Central America and that conversely in the Amazon basin the species is more or less confined to fertile, periodically flooded forest.

C. odorata is most successful in drier closed forest conditions, which generally have good aeration and an accumulation of bases in soils (Lamb, 1968). *C. odorata* is deciduous (Cintron, 1990). It is rare in evergreen forest types and prefers sites with a marked dry season (Lamb, 1968). Early failures in plantations have been attributed to overly wet and unsuitable soil types in experimental sites (Cintron, 1990). However, high mortality rates in trial plantations in dry forests of **Costa Rica** were attributed to susceptibility to long periods of drought during establishment (Piotto *et al.*, 2004). *C. odorata* is strongly light-demanding and will grow in a climate with an annual rainfall between 1,200-2,500 mm at altitudes between 0-1,500 m above sea level (Webb *et al*., 1984), although Pennington (2006) notes that the range is generally from near sea level to 800 m, with a few records up to 1,500 m, but these may be introduced as plants.

Grows in well drained soils and does not tolerate nutritionally imbalanced soils well. Tolerates variation in pH and requires good levels of light. In primary forest it is an emergent or member of the upper canopy. It grows often, but not exclusively in limestone and tolerates a long dry period. It does not prosper in areas with more than 3,000 mm precipitation or in areas with dense or waterlogged soil. In general individual trees are found in mixed forests dominated by other species. It grows in dry forest on the Pacific coast and in humid woods on both coasts, from sea-level to 1,200 m (ITCR/EIF, 2006). Very common in secondary forest derived from lowland evergreen rain forest and seasonal rain forest, and present on both volcanic and sedimentary formations (Pennington, 2006).

The temperature ranges are a mean maximum temperate of 27-36ºC during the hottest month and a mean minimum temperature of 11-22ºC in the coldest month, with a mean annual temperature of 20-32ºC (Webb *et al*., 1984).

3.3 Biological characteristics

C. odorata trees are moderately long-lived. Lamb (1968) gives an example of a tree in **Belize** with 110 rings and Marshall (1939) reports that trees with a girth of 13-14" (1m) have an average age of 125 years. Pennington (2006) disputes this, noting that *C. odorata* is a fast growing species and under optimal conditions will reach 1 m in diameter in 50-60 years, in terms of height it grows at a rate of 3 m per year.

C. odorata is a fast-growing and light-demanding monoecious species that is insect-pollinated and has wind-dispersed seed (Cavers *et al.,* 2004). Early growth of up to 2.3 m/year is possible in favourable conditions (Lamb, 1968). Trees bear fruit from the age of 10 years according to Lamb (1968) or 15 years according to Lamprecht (1989). Flowers appear early in the rainy season and fruits mature during the dry season when the leaves become deciduous. Seeds are wind-dispersed (James *et al.,* 1998).

The flowers show features associated with entomophily; bees and moths are believed to be the chief pollinators (Styles and Khosla, 1976). Allozymes on seedlings germinated from wild-collected seed used to produce outcrossing estimates for *C. odorata* revealed no evidence of self-fertilization (James *et al.*, 1998).

In spite of plentiful production of seedlings, natural regeneration of *C. odorata* was reported by Marshall (1939) to be 'extremely scarce' in rainforest conditions, though better in semi-deciduous forest. Marshall considered poor regeneration to be due to a combination of heavy shade, drips from branches in heavy rains and waterlogging of the soil preventing root establishment, leading to a very low survival rate for *C. odorata* seedlings. Opening of canopies

by felling led to weeds and vines quickly taking over and hindering seedling establishment. Good regeneration followed two incidents where the canopy had been opened considerably – a forest fire in 1912 and a cyclonic storm in 1933 (Marshall, 1939). Pennington (2006) notes that, like nearly all rainforest species, *C. odorata* occurs naturally at a distribution of less than one individual (mature tree) per hectare. This refers to forest undisturbed by man. Because of its strong competitive ability it flourishes in forest disturbed by man and under these conditions can be found at much higher densities.

INRENA (2006) list three national herbaria in **Peru** which have herbarium specimens of cedar in: Universidad Nacional Agraria la Molina; Universidad Nacional Mayor de San Marcos; Universidad San Antonio Abad del Cusco.

3.4 Morphological characteristics

C. odorata varies considerably in size and form, reaching 30 m or more in height (Anon., 2004; Rendle, 1969; Ricker & Daly, 1997) and has a diameter of about 2.5 m (Anon., 2004). The bark is yellowish or grey-yellowish (Anon., 2004). The size varies according to locality of growth, and it exhibits a wide variation in its general character due to the age and conditions of growth of individual trees (Farmer, 1972). It is ecologically very variable, with the largest trees developing in lowland evergreen rain forest and in seasonal rain forest. It is also widespread in much drier semi-deciduous forest, but here it develops as a much smaller tree (Pennington, 2006).

The timber has a pleasant smell, similar to cedar, and varies considerably according to origin and growth conditions (Titmuss and Patterson, 1988). The colour ranges from pale to medium red-brown but darkens on exposure (Rendle, 1969). The timber of vigorous growth tends to be paler and lighter in weight than that from more slowly grown trees (Rendle, 1969). The grain may be either straight or irregular (Titmuss, 1971). The texture was described by Titmuss (1971) as being moderately coarse and uneven and by Echenique-Marique & Plumptre (1990) as being fine to medium. Growth rings are distinct, marked by differences in pore size and initial parenchyma (Lemmens *et al*., 1995). The heartwood is durable with termite resistance, but the sapwood is non-durable and prone to staining and powder-post beetles (Lemmens *et al*., 1995).

3.5 Role of the species in its ecosystem

C. odorata was reported by Cho (Pers. Comm.) to be a dominant component of various dry forest types. *C. odorata* is often associated with other Meliaceae (*Swietenia* and *Guarea* sp.) and leguminous trees (Pennington, 1981). Seeds are wind-dispersed (Cintron, 1990). The seeds of *C. odorata* are generally ignored by parrots, in spite of appearing ideally suited for predation. Janzen (1983) speculates that this may be due to chemical defences in the seeds. Macaws, however, which specialize in eating unripe seeds and fruits avoided by or toxic to other animals (Renton, 1990) are known to eat the seeds of *C. odorata* (Matuzak and Dear, 2003).

It is strongly demanding of light and frequently appears as a fast-growing pioneer species in secondary forest (Pennington, 1981). It is a source of pollen and nectar for bees (Sandker, and Totaro, L. no date), though it is considered to be without significant ecological value (Mostacedo & Fredericksen, 1999).

4. Status and trends

Cedrela odorata is listed in the IUCN category VU A1cd + 2cd, i.e. the species faces a high risk of extinction in the wild in the medium-term future. (Americas Regional Workshop, Conservation and sustainable management of trees project, 1998). For threat category definitions, see http://www.iucnredlist.org/info/categories_criteria1994.

Vulnerable in **Peru** according to scientific reviews for the categorization of threatened wild flora in Peru, approved by Decreto Supremo No. 043-2006-AG (INRENA, 2006)

4.1 Habitat trends

C. odorata colonizes secondary forest, abandoned pastures and agricultural land (INBio, 1999). It occurs in humid or dry tropical and subtropical forest (Anon., 2004), preferring well-drained soils, up to an altitude of 1,200 m (Pennington, 1981). Of these habitat types, tropical dry forests have suffered an enormous decline in area, particularly during the 20th century. Once the most common forest type along the Pacific coast of Central America, now less than 2 % of the original forest remains intact (Janzen, 1986). Deforestation is also a problem generally in Central and South America (Laurance, 1999; Mayaux *et al.*, 2005; Myers, 1994 for example).

Habitat loss alone will underestimate the loss of natural populations due to selective logging. Although the greatest threat to natural forests in the Central American region is conversion of the land to other uses, selective harvesting of timber is particularly threatening native species including *C. odorata* and *S. macrophylla* (UNEP, 2003).

Exploitation of the timber by selective logging causes an increased risk of forest fires as the slash is left on the ground and the forest canopy is opened, warming and drying the slash (Uhl and Viera, 1989). *C. odorata* has no fire tolerance (USDA, no date).

Occurs in well-drained soil, often but not exclusively in limestone ground. Tolerates a long dry season but does not flourish in areas with more than 3,000 mm precipitation., or in areas with dense or waterlogged soils. Found in sub-humid mountain woods, humid woods in meandering plains and woods in dissected terraces. Individual trees are in general found scattered in mixed semi-evergreen or semi-caducifolious dominated by other species (INRENA, 2006).

Cedar develops best in humid tropical forests.. Reaches greatest prominence with 1,200 to 2,400 mm precipitation, with a dry season of two to five months. The growth of the tree and its reproduction are synchronised to the start of the rains. Cedar survives in areas with less precipitation (up to c. 1,000 mm per year) but grows slowly in a contorted form. Also grows sporadically in areas that receive more than 3,500 mm precipitation, but only in very well-drained sites (INRENA, 2006).

Cedar may be very demanding in terms of soil requirements, but these demands are not known with certainty. The common denominator appears to be the drainage and aeration of the soil, but not the pH. It is common in well-drained soils; soil fertility can also be important, and it grows better in soils enriched with burnt remains of the secondary forest (INRENA, 2006).

4.2 Population size

Estimates of current total population are not available. *Cedrela odorata* is reported to occur in abundance, most notably in Central America (Americas Regional Workshop, 1998; Arce Benavides, 1998). However, Navarro *et al.,* (2004) reported that although widespread, *C. odorata* was not common throughout moist tropical American forests and that its numbers continued to be reduced by exploitation without successful regeneration. The species is included in the IUCN Red List of threatened species in 1998 under the category VU A1cd + 2cd (Americas Regional Workshop, 1998).

4.3 Population structure

Cavers *et al.,* (2004) used a combination of genetic markers (chloroplast sequence and Amplified Fragment Length Polymorphism, AFLP) and morphological characters to describe variation in *C. odorata* throughout Mesoamerica. They found three separate units: **Mexico**, **Belize** and **Guatemala**; **Honduras** and **Nicaragua**; **Costa Rica** and **Panama**. Variation can be further divided within each country. Molecular genetic markers (Random amplified polymorphic DNA, RAPDs) found a high level of genetic differentiation between populations of *C. odorata* from northern and southern regions of **Costa Rica** (Gillies *et al*., 1997).

Population density varies considerably. Rio San Juan, **Nicaragua**, has a density of 1 *C. odorata* tree per 100 ha (Paniagua, no date). A density of 2.9 stems of cedar per 100 ha was estimated in the Bladen Reserve of **Belize** (Johnson and Woods, 1976, cited by Newman, 2004). In

Guatemala, average densities of 7.9 trees per 100 ha were recorded in the Multiple Use area of the Peten Biosphere Reserve (Szejner, 2005). However in some regions, almost pure stands are to be found, such as in successional forests on intermediate-age river terraces of Manu National Park, **Peru** (Gentry, no date).

The age distributions of some *C. odorata* populations have been skewed by logging of the largest trees (Bird, 1998; Marshall, 1939) and there have been reports of trees being felled before they reach maturity (Americas Regional Workshop, 1998).

Logging in natural forests selectively destroys those trees with the best growth form (dysgenic selection), leaving behind a population depleted in the most favoured genotypes (Mejía, 2001). Maintenance of genetic variation is essential for ensuring a future supply of the wood. However, *Cedrela* species have suffered substantial genetic degradation, particularly in the dry zone (Mejía, 2001).

4.4 Population trends

Although *C. odorata* is widespread, it is seldom common in moist tropical forests and its numbers are being reduced by exploitation without successful regeneration (Cintron, 1990). Exploitation of *C. odorata* for timber has had a long history. In 1756, Browne described the tree as one of the largest timber trees in the woods of Jamaica and reported that the tree "was very common and still continues to grow in many parts of the island." This was taken by Smith (1960) to imply that even by 1756, populations of *C. odorata* had already suffered from over-exploitation.

Marshall (1939) described cedar as having been heavily cut over, large trees being only found in the more inaccessible regions. They were once, however, fairly common and Marshall continued that the large stumps "bear evidence of the past magnificence of these species".

Smith (1960) reported a reduction in the volume of timber being cut in the West Indian Islands owing to the heavy culling of accessible forest, particularly in **Cuba**. Smith (1960) also reported selective cutting of *C. odorata* in **Panama** and **Venezuela** and heavy logging in **Mexico**, with small trees having been harvested before they had even produced a full seed crop. In **Brazil**, Brune and Melchior (1976) reported strong selective cutting for *Cedrela odorata* in the várzea (seasonally flooded lowland by the rivers) of the Amazon.

Due to significant over-exploitation, genetic erosion of this species has already occurred throughout its natural distribution and trees of good form are now rarely found except in isolated areas (Cavers *et al*., 2004).

4.5 Geographic trends

Within its native range, *C. odorata* has suffered large declines due to logging and a reduction in habitat availability. The species was included in a list of threatened plants by the FAO (1986). There are genetically distinct units throughout Mesoamerica (Section 4.3).

It has been severely extracted in natural forests and is considered endangered in Mesoamerica (Navarro *et al*., 2004). A trend towards rarity has been reported in several countries and territories, including **Argentina**, **Barbados** and **Puerto Rico** (Section 3.1). Populations of *C. odorata* remain in **Peru**, and many of the Protected Areas in the country contain individuals of the species. However, some populations are drastically being reduced (Reynel, 1988). It is threatened in **Costa Rica** where it is exploited heavily (INBio, 1999).

In **Belize** it is threatened by illegal exploitation, over-harvesting and some habitat loss (Cho, Pers. Comm.).

In **Bolivia**, the species's rarity has resulted in trees only being cut opportunistically while mahogany, *Amburana* and *Machaerium* are being sought (Americas Regional Workshop, 1998; Killeen, 1997).

In **Costa Rica** its habitat has been reduced by 56.7 % (ITCR/EIF, 2006). The species is in a vulnerable condition because of: the reduction in habitat; its extraction for its valued timber; its current scarcity; and its limited State protection (ITCR/EIF, 2006).

By 1946, numbers in **Guatemala** had been greatly reduced by intensive lumbering operations (Standley and Steyermark, 1946). Standley and Steyermark (1946) warned that about 10 million board feet of the wood are used in the United States every year, but nowhere had any significant attempt been made to replace the supply, which was being rapidly exhausted. It is still present in some national parks in the country (Section 8.5).

In **Nicaragua**, it is threatened by unsuitable procedures and, especially, uncontrolled forest fires (Pommier, no date).

In **Panama**, most trees are less than 50 cm in diameter with only small buttresses. It is rare in the Canal area (Condit & Pérez, 2002). This species may have been once more common on the Pacific slope but large individuals probably would have been harvested (Condit & Pérez, 2002). It is included in lists of threatened plants in **Panama** (Asociación Nacional para la Conservación de la Naturaleza, 1990).

C. odorata has been extensively introduced outside of its native range (Section 3.1). Cultivation in plantations has been undertaken in trials over a wide geographical range (Floyd and Hauxwell, 2001; Section 8.4). *C. odorata* is sometimes an invasive species, for example in **South Africa** (PIER, 2005).

5. Threats

Cedrela odorata has been of great commercial interest for over 200 years and in this time its distribution has been diminished by excessive exploitation over its entire range to the extent that large trees of good form and size are now rarely found (Pennington, 1981).

Inefficient timber processing and logging cause much of the potential timber harvest to be wasted. Chainsaw cutting is particularly wasteful and, in spite of being banned, it is common in El Sira, **Peru** (Parkswatch, 2003c) and Pilón Lajas, **Bolivia** (Pauquet, 2005b). Inefficient sawmills have been identified as common in **Belize** (Newman, 2004), **Panama** (Parker *et al*., 2004) and **Trinidad and Tobago** (Applewhite and Billings, 2000) and it is likely that inefficient sawmills are also prevalent in the other range States.

Populations have been reduced on private and lease lands surrounding communities. The demand for cedar timber on the local market is still high and depletion of mature trees represents a threat to the existing population (Cho, Pers. Comm.).

Natural regeneration of the species following logging is scarce (Section 3.3) and selective removal of *C. odorata* has left the forest in some parts of the neotropics with insufficient stock of seed trees (Cintron, 1990). Attack by the shoot boring moth *Hypsipyla* sp. has severely restricted reforestation programmes with *C. odorata* (Watt *et al.,* 2001 and references therein).

Illegal logging further threatens the remaining stocks of the species and has been reported in National Parks in several countries (Section 8.5).

C. odorata is vulnerable to the isolating effects of habitat fragmentation and reduction in population density. In a study of the influence of reproductive isolation and fragmentation on progeny growth rates in **Costa Rica**, isolated mother trees were found to produce inferior progeny when compared to trees from continuous forests and pastures (Navarro, 2002).

Deforestation and the associated habitat loss threaten the species. In Latin America, this is driven by a number of factors, including: migration, road building, land speculation, settlement, government policy and a lack of support for parks and reserves (Mahar and Schneider, 1994).

6. Utilization and trade

6.1 National utilization

Cedrela is used on a massive scale locally, especially in Peru (Pennington, 2006).

Considered to be of high economic value (Mostacedo & Fredericksen, 1999), *C. odorata* produces the most valuable timber within the genus. The wood is aromatic, weather-resistant and durable. By virtue of its durability, excellent working qualities and appearance, it was reported to be perhaps the most important local timber for domestic use in tropical America (Rendle, 1969). The wood is also in high demand in the American tropics because of its natural resistance to termites and rot (Cintron, 1990).

It has been used for all kinds of building work, with the exception of heavy construction, and in joinery and cabinet work (Rendle, 1969). The wood is suitable for making non-structural elements for exteriors and interiors, quality furniture and novelty and craft items (Anon., 2004; Echenique-Marique & Plumptre, 1990). Used for cigar-boxes, insect-resistant chests and wardrobes (Little and Wadsworth, 1964; Titmuss, 1971), roofing shingles, canoes, pencils (Titmuss, 1971), and musical instruments (Ricker & Daly, 1997) particularly guitars (INBio, 1999). In **Jamaica**, it is recommended for wainscoting rooms, chests, the inside work of clothes presses and drawers and shingles to cover houses (Fawcett and Rendle, 1920).

The bark is used as a febrifuge and tonic in some localities in **Guatemala** and as an infusion to treat eruptions in the mouth (Standley and Steyermark, 1946). The plant is used in traditional medicine in **Sao Tome and Principe** mainly for treatment of malaria as well as a febrifuge and against diabetes (Martins *et al*., 2003). Anti-malarial activity has been found in extracts from *C. odorata* wood (MacKinnon *et al*., 1997) and has been found to be effective in *in vivo* trials (Omar *et al*., 2003).

C. odorata is a honey plant (Little and Wadsworth, 1964). It is a primary source of pollen and a secondary source of nectar. Pollen collection by several species of bees has been reported and it is an important nectar source for the honey bee [*Apis mellifera*; Sandker and Totaro (no date and references therein)] and has been part of a reforestation programme by Proyecto de Manejo de Abejas y del Bosque (PROMABOS) for the purpose of beekeeping.

It has been used as a shade tree in coffee and cacao plantations (Cintron, 1990; FAO, 1986; Little and Wadsworth, 1964; Pennington, 1981). In **Papua New Guinea**, the bark has been used for twine (Lemmens *et al*., 1995).

On the Yucatan Peninsula, **Mexico**, individual mature trees of *Cedrela odorata* are often observed outside private houses; the owners consider that the tree represents a type of 'savings' account for the future (Valera, 1997).

6.2 Legal trade

The timber is usually considered next in value in the New World after mahogany *Swietenia mahagoni* (Condit and Pérez, 2002). Throughout the species's range, Spanish cedar has played a major role in the timber trade (WCMC, 1999). Trade in *C. odorata* and *Cedrela* sp. reported to CITES between 2000 and 2004 is shown in Tables 1-3 in Annex 3. Trade in *Cedrela odorata* reported by INRENA, Peru, is shown in Table 4 in Annex 3.

Between 1986 and 1987 three species, one of which was *C. odorata*, accounted for 58 % of the sawn wood produced in **Belize** (Harcourt & Sayer, 1996). Export trade from **Belize** is difficult to quantify since it is usually classed along with mahogany (*Swietenia macrophylla*). However, the majority of local production is destined for the local market (Cho and Quiroz, 2005). In 1994, **Brazil** exported 97,000 m³ of *Cedrela* sp., selling at an average price of USD 260.00/m³. It was one of the most exploited woods in northern **Costa Rica** (Harcourt & Sayer, 1996) and although it remained one of the most valuable trees in the **Costa Rican** market, it was traded only in the domestic market (Arce Benavides, 1998). In 1995, **Ecuador** was reported to have exported 6000 m³ of *C. odorata* sawn wood at an average price of USD 584/m³. **Guatemala**

authorized extraction of 3,248.66 m³ from forests in the Peten in 2003 and in 2005, 35.45 m³ of sawn wood were exported (Szejner, 2005). In **Honduras,** *C. odorata* is used mainly for local construction, but also for sale (Mejía, 2001 and references therein). In spite of the high value of *C. odorata* in the international market, carpenters from communities in **Honduras** receive a very low price that does not vary greatly with species (Mejía, 2001). Based on information in the management plan for the Atlantic forest region of **Honduras**, the potential annual productivity of this species in this region is 342 m³ (Anon., 2004). Records from 1994 indicate that **Honduras** exported logs, sawn wood, plywood and veneer sheets of *C. odorata* and that **Peru** and **Colombia** were exporting sawn wood (ITTO, 1995). For **Mexico**, the ITTO (2004) trends show an expected 200 % increase in trade of high commercial value tropical timber species (*C. odorata, S. macrophylla*, etc.) from the next decade onwards. In **Puerto Rico** some harvest from privately owned land may occur for local domestic use (Gabel, 2006). The United States imported a total of 23,000 m³ *Cedrela* sp. plywood at USD 474/m³ in 1995 (ITTO, 1997). **Peru** and **Trinidad and Tobago** exported sawn wood (ITTO, 1997). There is currently no commercial harvest in **Panama** (Condit & Pérez, 2002).

In Southeast Asia, plantations of *C. odorata* are of small scale and most of the timber is consumed locally. International trade of the species from these countries is of no importance (Lemmens *et al*., 1995).

6.3 Parts and derivatives in trade

Cedrela odorata is valued for its timber, which is traded internationally.

It is used for furniture construction and other specialist uses. Being a wood with high mechanical, physical and resistant properties it has for a long time been used in construction work. However, due to its vulnerability to extinction its use has been substituted by other species, grown in forestry plantations (ITCF/EIF, 2006).

There is evidence on the Internet of international trade in specimens of *C. odorata* harvested in Suriname for medicinal purposes as tincture, bark and seeds (www.tropilab.com).

The timber of *Cedrela odorata* is one of the most widely-used tropical hardwoods both locally in Central and South America and in international trade, second only to true mahogany (*Swietenia macrophylla*). The characteristics which make the timber so prized are the attractive reddish-brown colour, its stability and resistance to fungal and insect attack. It is light in weight, easy to work, aromatic and with an attractive grain which takes a fine polish and is used for furniture, cabinet making, panelling and joinery in general. It is now probably the most widely used timber in houses, hotels and offices in tropical America. The fragrant wood is still preferred above all others for lining cigar boxes. In the forest it is most frequently used for canoes and paddles due to its light weight and resistance to decay (Pennington, 2006).

6.4 Illegal trade

A recent report revealed that the National Institute of Natural Resources of Puno seized, among other species, 3,035 board feet of Spanish cedar at the inter-oceanic highway in southern **Peru**, which were supported by fake documents. The trucks were confiscated and charges are to be pressed against the companies and personnel involved (ITTO, 2006).

There are many reports of illegal logging, even within protected areas (Section 8.5). Globally, it is difficult to quantify, however Griffiths (2005) refers to a recent estimate suggesting that 90 % of timber extraction in the Peruvian Amazon is illegal and that most Peruvian hardwood timber is exported to Mexico, the United States, Canada and Belgium. Del Gatto (2004) cites an estimate that 75-85 % of broadleaf timber extracted from **Honduras** (including *C. odorata*) is removed illegally. Most logging in **Nicaragua** is either partly or totally illegal (Pommier, no date). Illegal logging of *C. odorata* in **Guatemala** has also been reported (WRM, 2000). Illegal logging has been reported from protected areas in several of the range States (Section 8.5).

6.5 Actual or potential trade impacts

Given the extent of habitat loss and the effect of the long history of over-exploitation, steps must be taken to ensure that trade is limited to sustainable levels. Since unsustainable logging is promoted by international trade, the requirements of CITES Appendix II could be used to achieve sustainability.

7. Legal instruments

7.1 National

C. odorata was added to CITES Appendix III by **Peru** (12/06/01) and then **Colombia** (29/10/01). Both listings have the annotation: "Designates logs, sawn wood and veneer sheets". In **Peru**, forestry law since 2001 has aimed to promote sustainable timber harvesting [though Griffiths (2005) claims this is flawed legislation]. The species has been protected in **Nicaragua** since 1997 by Decree No. 30-97, however Nicaragua's forestry law has been criticized for discouraging small landowners from allowing cedars to regenerate naturally on their farms, due to the bureaucracy involved to gain permission to cut them at a later stage (Mendoza Vidaurre, 2002). The species is present in protected areas in **Bolivia**, the **Bolivian Republic of Venezuela, Costa Rica**, **Guatemala**, **Mexico**, **Peru** and the **Virgin Islands of the United States** (Section 8.5).

7.2 International

No national export quotas for this species have been reported to CITES. The FAO Panel of Experts on Forest Gene Resources listed *Cedrela* species as a high priority for genetic conservation in priority lists elaborated by the Panel in 1985, 1990 and 1994 (Valera, 1997).

8. Species management

8.1 Management measures

Much attention has been paid to management of *C. odorata* in **Belize**; there have been some un-evaluated attempts at plantations (Cho, Pers. Comm.). There are currently no felling restrictions in **Belize** on this species, except for the minimum girth limit of 72 inches (Cho, Pers. Comm.).

Regeneration was reported to be problematic in **Bolivia** due to poor or irregular seed production and a lack of large clearings with adequate light availability (Mostacedo & Fredericksen, 1999). Evidence from nurseries suggests that more than 80 % regeneration can be achieved (INBio, 1999). Although knowledge is available on how to establish regeneration, available techniques are costly or otherwise difficult to implement (Mostacedo & Fredericksen, 1999).

In Pará, **Brazil**, CEMEX (Comercial Madeiras Exportação, S.A.) began two reforestation/forest enrichment projects in 1989. 71,875 *C. odorata* seedlings were planted each year and 200 ha were planted with a mixture of valuable timber trees by the end of 1992 (Smith *et al.,* 1995).

The species has existed in plots established for genetic improvement in **Costa Rica** since 1991 (Piotto *et al*., 2004). CATIE are developing micropropagation technologies with *C. odorata* for multiplication, conservation and genetic improvement programmes (CATIE, no date).

In response to the genetic degradation of dry zone tree species in **Honduras**, CONSEFORH (Conservation and Silviculture of Honduran Dry Forest Species; a bilateral project between the Governments of **Honduras** and the **United Kingdom**) has established a process of evaluation and seed orchards to conserve genetic material that could be used in future reforestation activities.

The species occurs in the following reserves managed by the Government of Puerto Rico: Carite, Guajataca, Guilarte, Maricao, Rio Abajo and Toro Negro. Limited harvest perhaps opportunistically, may occur on those lands, and possible on private owned lands. For many years the US Forest Service has extensively planted seedlings of *C. odorata* in secondary forests in the Luquillo Mountains in **Puerto Rico**. However, no harvest is occurring from those lands, nor is there a current emphasis to harvest trees from the National Forest (Gabel, 2006).

Worldwide, 19 enterprises producing *C. odorata* have been issued with forest management certificates from the Forest Stewardship Council (FSC, 2006).

A study of the neutral genetic variation of the species identified conservation units within Mesoamerica for each of which a conservation strategy should be devised (Cavers *et al*., 2004).

8.2 Population monitoring

No population monitoring reports have been published for this species.

8.3 Control measures

No population monitoring reports have been published for this species.

8.3.1 International

Listed by Colombia and Peru on CITES Appendix III since 2001.

8.3.2 Domestic

No information.

8.4 Artificial propagation

Although plantations of *C. odorata* have had mixed success, with careful management they have the potential to meet at least some of the demand that would otherwise be met from wild specimens.

The species has been planted in various countries in pure plantation trials but results have not always been satisfactory (Navarro *et al*., 2004). Plantations are difficult to establish because of the severe attack of the shoot borer *Hypsipyla grandella* on the apical buds of seedlings (Navarro *et al*., 2004; Cintron, 1990) and it is for this reason the species is not grown in pure stands. Some success has been achieved in Manu, **Peru,** where seedlings are planted at a distance from one another (Americas Regional Workshop, 1998). More recently, agroforestry systems using *C. odorata* as shade for coffee have been shown to be an economical option for conservation of endangered populations of this species (Navarro *et al*., 2004). In trials in dry tropical region in **Costa Rica**, it was considered a slow growth species that had the lowest survival rates (11-12 % survival) of seven native species planted, due to drought susceptibility and attacks of *H. grandella* (Piotto *et al*., 2004). It exhibited good growth in mixed plantations but poor growth in pure stand plantations (Piotto *et al*., 2004). Due to the wide distribution and the morphological variability of this species, provenances of good growth that are more resistant to the attack of the shoot borer can be obtained (Navarro *et al*., 2004). Navarro *et al.,* (2004) found that provenances from dry areas presented lower growth but also lower frequency of attack than those from wet areas.

C. odorata has been widely introduced into plantations throughout the world (Cintron, 1990). Webb *et al.,* (1984) report that *C. odorata* plantations worldwide produce yields of 11-22 m^3/ha/an. Yields in 40-year-old plantations in Africa of 455 m^3/ha and 150 to 270 m^3/ha in **Suriname** are far greater than annual yields of 0.004 m^3/ha in natural forests in **Mexico**, which reflect the low stocking of the tree in natural forests, partly due to past exploitation and lack of regeneration (Cintron 1990; Lemmens *et al*., 1995 and references therein). Forestry plantations of *C. odorata* in **Mexico** yield between 15 and 20 m^3/ha/yr (Fernandez *et al*., 2002). By optimizing growth parameters, the average height growth after 17 months was increased 2.7-fold, from 55 to 147 cm (Ricker *et al*., 2000). During the first nine years of trial plantations in **Java**, yields of 17 m^3/ha/an were observed at 650 m altitude and 28 m^3/ha/an at 800 m altitude (Lemmens *et al*., 1995 and references therein).

This species is shade-intolerant (Mostacedo & Fredericksen, 1999). One study in Veracruz, **Mexico**, found that *C. odorata* grew best under maximum canopy openness, and so is most suitable for reforestation in the open (Ricker *et al*., 2000).

Plantation experiments in **Puerto Rico** using native seeds were not promising, although seeds from continental America (of *C. mexicana*, "formerly regarded as a distinct species") had mixed results: most trees died, though a few grew rapidly (Little and Wadsworth, 1964). Plantations of *Cedrela odorata* have been established in the States of **Campeche** and **Yucatan**, **Mexico**, totalling close to 3,500 ha (Valera, 1997). *Cedrela odorata* is included in plantation schemes in Antioquia, **Colombia** (ITTO, 2004).

Outside of the native range, it is one of the most important plantation species in **Solomon Islands** (Ngoro, 2001). However, it has not gained popularity since its introduction into plantations in **Sri Lanka** (Tilakaratna, 2001).

8.5 Habitat conservation

Cedrela odorata is present in protected areas of several countries. However, the protection provided for the species is often threatened by illegal activities, as outlined in some examples below.

In **Peru**, commercial logging is prohibited within National Reserves by Supreme Decree No. 038-2001-AG. *C. odorata* is present in Tambopata National Reserve but illegal logging, agriculture and land conversion are pressing problems (Parkswatch, 2002a). All valuable wood, including *C. odorata*, has already been extracted in accessible places of Alto Mayo Protection Forest (Parkswatch, 2003a). The species is considered to be vulnerable in Machu Picchu Historic Sanctuary (Parkswatch, 2004a). It is one of the most prominent species in Alto Purús Reserved Zone, where illegal logging is increasing (Parkswatch, 2003b). Excessive logging in El Sira Communal Reserve has meant that *C. odorata* is no longer easily found in accessible areas (Parkswatch, 2003c).

In **Bolivia**, in spite of a total logging ban, extraction of valuable timber including *C. odorata* is a great threat in Amboró National Park (Pauquet *et al.,* 2005). Extraction of *C. odorata* continues in Madidi National Park and large volumes of timber are illegally extracted (Pauquet, 2005a). In Pilón Lajas Biosphere Reserve, *C. odorata* remains only in poorly accessible areas. Chainsaw logging has diminished due to exhaustion of supply but illegal logging threatens the remaining stands (Pauquet, 2005b). Illegal settlements, land invasions, agriculture and illegal timber extraction are serious threats in Carrasco National Park, which has important reservoirs of commercially valuable species such as *C. odorata* (Lilienfeld and Pauquet, 2005).

In **Costa Rica,** *C. odorata* is found in the following conservation areas: Amistad Caribe, Amistad Pacifico, Huetar Norte, Arenal, Cordillera Volcánica Central, Guanacaste (including Santa Rosa and Guanacaste National Parks), Osa (including the Golfo Dulce Forest Reserve), Pacifico Central (including the El Rodeo protected zone, and the Carara Biological Reserve), Tempisque (including Palo Verde National Park and Lomas de Barbudal Biological Reserve), and Tortuguero and it probably occurs in other areas of conservation (INBio, 1999). According to ITCR/EIF (2006), State protection is limited.

In **Guatemala**, large numbers of *C. odorata* are present at San Miguel la Palotada Protected Biotope, however the area is threatened with forest fires, illegal extraction of forestry products and road construction (Parkswatch, 2002b). *C. odorata* is favoured by illegal extractors in Cerro Cahuí Protected Biotope (Parkswatch, 2003d). It is found in San Miguel la Palotada Protected Biotope, though some logging continues (Parkswatch, 2002c). It is common in Ceibal Cultural Monument, although illegal deforestation threatens this area (Parkswatch 2002d).

In **Venezuela**, there are reports of illegal trafficking of *Cedrela* sp. for commercial purposes in Guatopo National Park (Parkswatch, 2004b).

In **Mexico**, *C. odorata* is protected from logging in Montes Azules Biosphere Reserve. The biggest threats here include forest fires, deforestation and land invasions (Parkswatch, 2004c).

In the **Virgin Islands of the United States**, the species only occurs on US National Park Service land, where harvest of all trees is prohibited (Gabel, 2006).

8.6 Safeguards

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9. Information on similar species

Cedrela odorata is proposed for listing on the basis that regulation of trade in the species is required to ensure that the harvest of specimens from the wild is not reducing the wild population to a level at which its survival might be threatened by continued harvesting or other influences. All other species in the genus are proposed for listing for look-alike reasons. Information on these species is provided in Annex 1.

Swietenia macrophylla, *S. mahagoni* and *S. humilis* are all included in CITES Appendix II. The wood of *C. odorata* may be confused with *S. macrophylla*; distinguishing characteristics are the absence of fragrance, greater hardness and finer texture in the latter. Microscopy can reveal septate fibres, which distinguish *S. macrophylla* from *C. odorata* (Baas and van Heuven, 2002).

Record and Mell (1924) found it impossible to distinguish between the woods of the different species within the genus *Cedrela*.

Titmuss (1971) reported that it should not be confused with the Honduras cedar, which sometimes reaches the market under the description of West Indian cedar.

According to the wood anatomist at the Royal Botanic Garden Kew, *Cedrela* is fairly straightforward to identify to genus, but even separating the taxonomically distinct *C. odorata* from *C. fissilis* is problematic from the wood anatomy point of view.

The wood of C. odorata is ring-porous and therefore easily separated from that of *Swietenia* which is diffuse porous. *Swietenia* and *Cedrela* often grow together as they require similar conditions; fertile, periodically flooded soils. As *Cedrela* is much more plentiful than *Swietenia* it is more commonly used (Pennington, 2006).

10. Consultations

The document was discussed at the 16th meeting of the CITES Plants Committee. The Netherlands sent a draft proposal to include *Cedrela odorata* in Appendix II to all Parties within the range of this species. Comments received by 14 December 2006 are incorporated in the text. These comprise responses from: Costa Rica (ITCR/EIF, 2006); Peru (INRENA, 2006); the United States (Gabel, 2006). Mexico responded noting their forest authorities are compiling information on the species and that this will be sent once it is integrated (Benitez Diaz, 2006).

The United States (Gabel, 2006) noted that to better estimate the extent of trade and its effect on the species in the wild, it would be useful to have additional data, on: harvest from the wild v. plantations; international v. national trade; harvest from third party certified forests; forests with *C. odorata* with protective status; conservation status of the species in each range State; domestic control measures.

Brazil expressed there strong support for the inclusion of *Cedrela* spp. in Appendix II. If it had been possible in the time available before the deadline Brazil would have submitted the proposal as a co-proponent.

11. Additional remarks

This proposal was developed as a consequence of a series of activities, dating back to 1998, to identify timber trees in international trade of conservation concern, and to recommend appropriate long-term strategies to ensure their sustainable use (see Decision 13.54). Initial activities are outlined in document PC13 Doc. 14.2 (Rev. 1), and later reported in the Summary report (item 11.2) of the 14th meeting of the Plants Committee. The first workshop for Mesoamerica was subsequently held in 2005 and the outcome included the suggestion that *Cedrela odorata* should be considered for inclusion in CITES Appendix II (UNEP-WCMC, 2005). This suggestion was reported to the 15th

meeting of the Plants Committee (Summary Record item 22), which agreed to consider reviewing the listing of the species at its following meeting, based on a document to be provided by the Netherlands. The draft proposal was subsequently presented at the 16th meeting of the Plants Committee which encouraged the Netherlands to continue collecting information on these species and urged the range States to collaborate with the Netherlands in this matter. As a result the Netherlands wrote to all range States in 2006, including a copy of the proposal and requesting feedback.

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CEDRELA SPECIES (OTHER THAN *C. ODORATA)* AND DISTRIBUTION

The genus Cedrela has undergone major systematic revisions since 1960.

The genus *Cedrela* was described by P. Browne in 1756. In 1759 Linneaus described *C. odorata*. Since then, 69 species have been placed in this genus, including species which occur in the Americas, India, Southeast Asia and Australasia. In 1960 Smith carried out a review of the genus and, based on this study, the Asian and Australasian species were placed in the genus *Toona*, leaving the genus *Cedrela* with only nine species, all of them occurring in the Americas (Patiño Valera, 1997).

1981 Revision

In 1981 Styles (in Pennington, Styles and Taylor, 1981) reviewed the genus with M.T. Germán. These authors recognize seven species:

C. fissilis Vellozo;

C. lilloi C. De Candolle;

C. montana Moritz ex Turczaninov;

C. oaxacensis C. De Candolle & Rose;

C. salvadorensis Standley; and

C. tonduzii C. De Candolle.

The same authors consider four species insufficiently known: *C. angustifolia* Moçiño and Sessé Ex P. de Candolle; *C. discolor* S.F. Blake; *C. imparipinnata* C. de Candolle and *C. weberbaueri* Harms. In 1990, Calderón de Rzedowski G. and Germán M.T., in reporting on the Meliaceae of the Bajío region (Mexico), recognized the existence of *Cedrela dugesii* Watson, which is considered by various authors a synonym of *C. odorata* (Patiño Valera, 1997).

The distribution of the principal species of *Cedrela* in the neotropics is as follows:

– *C. oaxacensis* is endemic to the Balsas River basin in Mexico, occurring in dry areas of the States of Morelos, Guerrero and Oaxaca. In certain areas it is associated with *Pinus* species. Populations consist of small trees of no actual economic importance (Standley and Steyermark, 1946; Lamb, 1968; Pennington, 1981).

– *C. salvadorensis*, occurs in dry tropical forests, from the State of Jalisco to Chiapas in Mexico, continuing through Central America to the north of Panama, generally in dry tropical or deciduous humid forests, on stony and calcareous soils, and generally at altitudes of less than 1,000 meters above sea level, although occasionally the species has been reported to grow at 1,500 meters (Standley and Steyermark, 1946; Lamb, 1968; Pennington, 1981).

– *C. tonduzii* is found from Oaxaca and Chiapas in Mexico through to Panama in Central America. It is a large tree, with good wood properties; on occasion it grows in association with *Pinus* and *Liquidambar* species, at altitudes of 1,100 to 2,800 meters above sea level, generally on soils that are volcanic in origin, fertile and well drained. It is of potential importance in plantations (Standley and Steyermark, 1946; Lamb, 1968; Pennington, 1981).

– The distribution of *C. lilloi* C.D.C is confined to South America. It is found in Bolivia, Peru, Brazil and Argentina. In Bolivia and Argentina the species is found in mountain forests, at altitudes from 1,000 to 3,400 meters above sea level, but is also reported to occur at altitudes as low as 800 meters. In

Peru, it is found in high valleys where it forms extensive forests and is also planted for shade. It is a cold-resistant species, deciduous in winter, and is of importance as a producer of wood for local use (Standley and Steyermark, 1946; Lamb, 1968; Pennington, 1981).

– *C. montana* is a species found in the cloud-forest belt and in the 'paramo' areas. It can be seen frequently in open pastureland and in abandoned agricultural areas. In South America, it occurs in the same areas as *C. lilloi*, with which it is associated in the highlands of Venezuela and Peru (1,400 to 3,100 meters above sea level). It is a locally important species (Standley and Steyermark, 1946; Lamb, 1968; Pennington, 1981).

– *C. fissilis* is found from Costa Rica in Central America to southern Brazil and northern Argentina in South America. The wood of this species is considered inferior to that of *C. odorata*, nonetheless in some areas wood of the two species is marketed interchangeably. *C. fissilis* is extremely variable especially in terms of leaf morphology. This has been reflected in a large number of synonyms and varieties that have been described for this species (Standley and Steyermark, 1946, Lamb, 1968; Pennington, 1981).

SCIENTIFIC SYNONYMS OF *CEDRELA ODORATA*

Synonyms according to Pennington, T. D. (In prep.) Monograph on *Cedrela*

Cedrela adenophylla Martius, 1878;

Cedrela brachystachya (C. de Candolle) C. de Candolle, 1907;

Cedrela brownii Loefl. 1891;

Cedrela ciliolata S.F. Blake, 1921;

Cedrela cubensis Bisse, 1974.

Cedrela glaziovii C. de Candolle, 1878;

Cedrela guianensis Adr. Jussieu, 1830;

Cedrela hassleri (C. de Candolle) C. de Candolle, 1907;

Cedrela longipes S.F. Blake, 1922;

Cedrela mexicana M.J. Roemer, 1846; *C. mexicana* var. *puberula*

Cedrela mourae C. de Candolle, 1907;

Cedrela occidentalis C. de Candolle & Rose, 1905;

Cedrela odorata L. var. *xerogeiton*

Cedrela palustris Handro, 1962;

Cedrela paraguariensis Martius, 1837; *C. p.* var. *brachystachya*; *C. p.* var. *multijuga*; *C. p.* var. *hassleri*

Cedrela rotunda S.F. Blake, 1920;

Cedrela sintenisii C. de Candolle, 1907;

Cedrela velloziana M.J. Roemer, 1846;

Cedrela whitfordii S.F. Blake, 1920;

Cedrela yucatana S.F. Blake, 1920;

Surenus brownii (Loefling ex O. Kuntze) Kuntze, 1891;

Surenus glaziovii (C. de Candolle) Kuntze *[DATE?]*

Surenus guianensis (Adr. Jussieu) Kuntze, 1891;

Surenus mexicana (M.J. Roemer) Kuntze, 1891;

Surenus velloziana (M.J. Roemer) Kuntze, 1891;

TRADE DATA FOR *CEDRELA ODORATA*

Table 1. Reported trade in *Cedrela odorata* from range States (wild source material)[1]

Range State	Term/units	Reported by:	1999	2000	2001	2002	2003	2004	2005	Total
Bolivia	m^2	Importer					9			9
	m^3	Exporter			1,372	47,038	23,391	14,159	10,949	96,909
		Importer				62	38	158	84	342
	timber pieces	Importer							4,657	4,657
Brazil	kg	Importer					25,800			25,800
	m^3	Importer				739	1,195	1,697	1,516	5,148
	sawn wood	Importer					1,408			1,408
Colombia	g	Importer				100				100
Ecuador	m^3	Importer				81				81
Guatemala	m^3	Exporter						26		26
Nicaragua	m^3	Exporter					108	38		146
		Importer				6				6
Peru	m^3	Exporter	3,675	1,473	2,936	8,680	11,627	29,391		57,783
		Importer			308	4,581	10,363	24,652	10,387	50,290
	carvings	Exporter				4	226			230
Suriname	m^3	Exporter						23		23
		Importer						18		18
Venezuela	m^3	Exporter						16		16
		Importer						16		16
	carvings	Exporter						50		50

[1] *Data taken from CITES Trade Database, 27 November 2006. Excludes pre-Convention data and re-exports. NB:* Cedrela odorata *was included in CITES Appendix III in 2001 by Colombia and Peru, see Section 7.1.*

Table 2. Trade in *Cedrela* sp. reported to CITES

Exporter	Term	1999	2001
Bolivia	Veneer		49,603 m^2
	Sawn wood		2,069 m^3
Peru	Sawn wood	1,900 m^3	

(Data taken from CITES Trade Database 27 November 2006)

Table 3. Exports of *Cedrela* sp. from Brazil, 1993-1995 (Source: IBAMA, 1996)

Year	Sawn wood		Veneer	
	Tonnes	USD FOB[#]	Tonnes	USD FOB
1993	37.197	21,609	1.098	807
1994	32.598	22,165	833	616
1995	22.125	16,510	416	655

[#] FOB – Free On Board – includes cost of delivery to specified point

Table 4. Exports of *Cedrela odorata* from Peru, 2000-2001 (Source: INRENA, 2006)

Year	Number of permits	Volume m^3	Value FOB $	$. m^3
2000	92	5,550.18	3,538,619.60	637.57
2001	38	2,998.82	1,846,520.83	617.81
2002	111	8,760.97	5,638,073.00	643.54
2003	184	11,588.05	6,865,184.10	592.44
2004	402	29,390.87	19,339,143.77	658.00
2005	405	29,163.48	18,825,504.07	645.52