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

Fifteenth meeting of the Conference of the Parties
Doha (Qatar), 13-25 March 2010

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

Inclusion of *Aniba rosaeodora* Ducke in Appendix II, in compliance with the provisions of Article II, paragraph 2 (a), of the text of the Convention, and paragraph A of Annex 2 a.

Annotation

#11 Designates logs, sawn wood, veneer sheets, plywood and essential oil.

B. Proponent

Brazil*

C. Supporting statement

- Disappearance of the wild populations of the Brazilian rosewood in the States of Pará and Amapá, and in large parts of the State of Amazonas, owing to its heavy exploitation.
- Slow regeneration.
- Most of the trade is for export.

1. Taxonomy

Division: Magnoliophyta
Class: Magnoliopsida
Order: Laurales
Family: Lauraceae
Genus: Aniba
Species: *Aniba rosaeodora* Ducke
Synonym: *Aniba duckei* Kost
Common names:
English: Brazilian rosewood, rosewood tree
French: bois de rose, bois-de-rose-femelle, carcara
German: Rosenholzbaum
Italian: legno di rose
Portuguese: pau-rosa
Spanish: palo de rosa, palo de rose

2. Overview

The Brazilian rosewood (*Aniba rosaeodora* Ducke) has historically been subject to unsustainable exploitation to obtain linalool-rich essential oil from its timber. The essential oil is used as a fragrance ingredient in fine perfumes and as a fixative for perfumes (Homma, 2003). Linalool is also a precursor of several highly valuable compounds for the perfume and fragrance industry (FAO, 1995).

* *The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat or the United Nations Environment Programme concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.*

The first records of the exploitation of the Brazilian rosewood date back to 1883, when the species was harvested in French Guiana and the oil was distilled in Paris (Homma, 2003). Distillation only started to take place in French Guiana when World War I made transport difficult (Homma, 2005). The species was harvested to such an extent that the natural populations of the species in French Guiana became depleted. The same depletion process happened later in the Brazilian Amazon (Homma, 2003). The species was discovered in Brazil in 1925 in Juriti Velho, in the federal State of Pará (Braga, 1971) and the harvest began in 1926, when the global market was still dominated by French Guiana. The uncontrolled harvest of the species led to its extinction in French Guiana, which caused the expansion of the Brazilian production.

When the species started to be harvested in Brazil, the Amazon was marked by a lack of economic prospects, given that the prices of rubber on the international market had collapsed after rubber plantations in Malaysia had become productive. In spite of this, the availability of natural standing stocks of the Brazilian rosewood was a disincentive to making any efforts to grow the species. The indiscriminate harvest of the Brazilian rosewood led the species to hold the third position in the goods exported from the Northern Region of Brazil. Occasionally, the harvest of the species produced larger volumes than the market could absorb. In 1927, out of 200 tons harvested, 80 tons remained in stock. Competition among harvesters for access to natural standing stocks led to a price fall and to the regulation of harvests (Homma, 2005).

In 1932, the Government of the State of Amazonas enacted Decree 1455, which set the amount of essential oil that was to be produced annually and established the obligation of replanting trees where they had been logged. Producer cooperatives were created in Amazonas in 1932 and in Pará in 1935. The cooperatives worked jointly with the government to determine the amounts to be harvested and exported and the quotas for each of their members. Following the obligation to replant the species after the harvest, close to 28,000 seedlings were planted between 1933 and 1943. The consortium existed until 1944, when the growing demand of natural rubber from the United States and the Allies in World War II attracted all the labour available to harvest latex, overshadowing the Brazilian rosewood (Homma, 2005). In that decade, the main importing countries were the United States of America, the Netherlands, Japan, France and Argentina (IEA, 1993).

Until the 1950s, the harvest of the Brazilian rosewood increased and gradually reached new areas. The most accessible and productive populations became depleted. The unsuccessful attempts to grow the species, the preliminary nature of results of the research carried out in the 1930s and 1940s, and uncertainty raised by the development of a synthetic substitute led to continuing extraction (Homma, 2005). In that decade, the mean annual production of Brazil almost reached 300 tons. In Peru, the species was harvested in the 1940s and 1950s in Pucallpa and near Iquitos. Owing to the low amount of raw material available, the existing operations were finally forced to close (Pagán, 2003).

In the 1960s, harvests reached the level of about 500 tons annually (FAO, 1995). Yet, with the advent of synthetic linalool, which was cheaper, demand dropped and part of the production remained in stock in Manaus. Rosewood oil started to be replaced by synthetic linalool in cheap perfumery and the depletion of the most accessible standing stocks of raw material started to affect the sector. During this period, prices were relatively low, and the scarcity of the natural product did not lead to a price increase due to the availability of the synthetic equivalent. It is important to highlight the research carried out at the time by the Brazilian National Institute for Research in the Amazon (INPA, *Instituto Nacional de Pesquisas da Amazonía*) on the propagation of the species and the use of the whole plant to extract essential oil (Homma, 2005).

The introduction of chainsaws in the region in 1971 and the opening of new roads made labour more productive and new areas accessible. The 1973 oil crisis and the resulting rise in oil prices at the end of the year paralyzed the units that produced synthetic linalool and led to a sudden increase in the global demand of essential oil and to a speculative price increase, reaching the level of USD 5,148.00/drum in early 1974. In real terms, the price reached in 1974 was the highest since the 1950s. However, the situation did not last long, since production of the synthetic substitutes was resumed later that year. The speculative euphoria originated by the high prices led to a production of more than 500 tons of rosewood essential oil – about 3,000 drums – which were not sold because of a lack of demand. In 1975, the global market of essential oils experienced a sharp depreciation, which destabilized the sector. From that year, the competition of synthetic substitutes caused a retraction in demand, a drop in prices, an accumulation of stocks and an increase in production costs. All these factors, added to the depletion of the most accessible standing stocks, led the sector to a deep conjunctural crisis (Homma, 2005).

In the 1980s, the commodity suffered a further drop in demand due to the introduction of Ho wood and Ho leaf oil (*Cinnamomum camphora*) in the market. Ho wood and Ho leaf oil replaced rosewood oil as a natural source of linalool in mid-range perfumery, restricting its use to the most expensive fragrances. During that decade, however, essential oil production was restructured and controlled by producers to match demand, around 100 tons annually (Benchimol, 2001). Production remained constant and the expansion of the agricultural frontier in the Brazilian Amazon provided access to previously unexploited standing stocks, keeping the industry competitive (Homma, 2005).

The 1990s brought about another dramatic decrease in the production of the commodity. In 1994, Brazil only produced 59 tons of essential oil (Lopes *et al.,* 1999). The main importing countries of the product from the State of Amazonas at the time were the United States, France, Spain, the Netherlands and the United Kingdom of Great Britain and Northern Ireland. In the markets of Manaus, a litre of essential oil reached the selling price of USD 80.00 (Sampaio, 2000). The drop in supply was due to several reasons: decades of unsustainable harvests (Lopes *et al.,* 1999); progressive decrease in the profit margin of harvesters because of the growing distance to mature trees on river banks; difficulty to transport the material, and the growing intervention of IBAMA, the Brazilian Institute of Environment and Renewable Natural Resources. This drop was the first one caused by supply-related rather than demand-related problems (Benchimol, 2001).

In 2003, despite the high demand for rosewood essential oil, only seven distilleries were active in the State of Amazonas. Harvests took place on State-owned public land, especially in the basins of the rivers Jatapu and Nhamundá and the Alto Río Trombetas, in the State of Pará. Technological improvements were made with the use of log-dragging equipment and machinery to open new roads, which made it possible to harvest the product beyond river banks (Homma, 2005). In those years, the harvest of the species was regulated by IBAMA in 2002 and by the Ministry of Sustainable Development of the State of Amazonas in 2006, when forest management became decentralized in Brazil. Since 2007, with the implementation of the 'DOF System' (*Documento de Origem Florestal* – document of forest origin), the control of the chain of custody of this and other species has become stricter.

The depletion of the standing stocks can be estimated by considering that close to 13,000 tons of rosewood essential oil were exported from 1937 to 2002. It is known that between 18 tons and 20 tons of timber are needed to produce one drum of essential oil (180 kg) and that a tree of appropriate size weighs about 1.75 t. The DBH of harvested trees ranged from 30 to 60 cm. Yield estimates range from 0.7 % to 1.1 % of oil per weight of rosewood trunk. Therefore, one ton of trunks is necessary to produce 10 kg of rosewood essential oil. The mean density estimated for the species is 0.2 trees per hectare. Considering that at least 825,000 trees were logged, it is possible to conclude that over 4 million hectares of forests were exploited (Homma, 2005).

The production of rosewood essential oil in Peru, Colombia and the Guianas, where the species also occurs, declined to negligible amounts after the advent of synthetic linalool. Brazil is currently the only producer (FAO, 1995), with harvests and extraction plants concentrated in the State of Amazonas. In Brazil, the State of Pará produced rosewood essential oil until the early 1980s, although its part in the total production was always smaller than that of the State of Amazonas.

3. Species characteristics

3.1 Distribution

The range of the species includes the Bolivarian Republic of Venezuela, Colombia (IEA, 1993), Ecuador, the French Guiana, Guyana, Peru and Suriname. In Brazil, the species occurs in the federal States of Amazonas, Pará (USDA, 2003) and Amapá (Sampaio, 1988).

At present, the species can be found relatively frequently in the interior of Amapá, near the border with Guyana, and in the most 'central' regions of the forest, which are preserved because of their difficult access. The areas with the highest concentration of the species run from the source of the Curua-Una River to the Peruvian border in the south and from the Trombetas River to the Colombian border in the north. The species is also found around Belém and on Marajó Island, although in smaller quantities (IEA, 1993).

3.2 Habitat

The species grows on yellow and red clay or sandy latosol, essentially on firm soil in high areas, preferably around headwaters of small shallow rivers called 'igarapés' (Carvalho, 1983). Productivity is highest in soils originated from formations of the Upper Carboniferous Period (Leite & Lleras, 1993; Costa *et al.,* 1995). The Brazilian rosewood prefers the high tropical rainforest but may occur sporadically in flat white-sand forests in the Río Negro region ('campinas' and 'caatingas') and seasonally flooded forest areas (Leite & Lleras, 1993). It occurs preferably in the interior of dense old-growth forest in areas of high and medium elevation, in deep and well-drained soil (Lorenzi, 1998). Areas around the Upper and Middle Amazon are considered as the adequate habitat for the Brazilian rosewood (IEA, 1993).

3.3 Biological characteristics

Evergreen plant (Lorenzi, 1998) of late secondary succession (Santana, 2000). Heliophilous tree with natural regeneration that grows in clearings (Costa *et al.,* 1995) and also occupies an intermediate position in the forest (Sampaio, 2000).

The Brazilian rosewood is a species with occasional occurrence and discontinuous and rather irregular distribution (Lorenzi, 1998). It often occurs in groups of 5 to 8 trees growing at a distance of 50-100 m from each other; the distance between groups is usually 300-400 m, although isolated trees can also be found (Alencar & Fernandez, 1978). Mean estimated density ranges from 0.17 adult trees per hectare (Barata & May, 2004) to 0.20 adult trees per hectare (Homma, 2005).

In the Brazilian rosewood, cross-pollination is ensured through differential timing of stigma receptivity and anther dehiscence. Some trees are 'Type A' while others are 'Type B'. In Type A trees, the stigma is receptive only in the morning, and anther dehiscence only occurs in the afternoon. The pattern is the opposite in Type B trees. Representatives of the family Meliponinae have been observed visiting flowers at times of receptive stigma and pollen availability, which suggests they act as pollinators (Sá, 1987).

According to Lorenzi (1998), flowering takes place between May and June and fruits ripen between September and October. Alencar & Fernandez (1978) state that in Reserva Ducke flowering takes place between October and February and fruiting occurs between November and March. At Curuá-Una Experimental Station (Pará), the species flowers from October to November and fruits from December to June (Sampaio, 2000). Variations in flowering and fruiting periods are explained by the different types of soil, rainfall regimes, relief, altitude and latitude. Flowering is annual or supra-annual; the species only flowers annually in plantations, not in the wild (Barbosa, 2008). Leaf change takes place annually and always in the dry season; flowering is irregular, always in the wet season. Both flowering and fruiting are rather irregular, which appears to be a mechanism to escape the intense predation on fruit by parrots, correlated with the population control of the birds (Magalhães & Alencar, 1979). Seed dispersal is driven by barochory (gravity) and zoochory, mainly birds (Santana, 2000). Seeds suffer intense predation by parrots, which attack the fruits before they are ripe, as well as toucans (Alencar & Fernandez, 1978). Additionally, from the intermediate development stage until full maturation, fruits are highly infested by a species of coleopter (Curculionidae) of the genus *Heilipus* and a lepidopter (Sampaio *et al.,* 2003).

3.4 Morphological characteristics

Large tree, sometimes reaching a height of 30 m and a diameter of 2 m, with a straight and cylindrical trunk and a yellowish-brown or reddish bark that comes off easily in large pieces. Narrow or oval-shaped crown that occupies the intermediate layer or the canopy of the forest. Leaves obovate-elliptic or lanceolate, with great variations in size, usually about 14 (6-25) cm long and 5 (2.5-8) cm wide; leaf base obtuse and immediately rounded; apex very acuminate, with flat or slightly curved margins; upper surface glabrous, coriaceous and dark green; under surface slightly pubescent and pale yellow; secondary veins diverging from primary veins at an angle of 45º to 60º; petioles thick, canaliculate, 0.8 to 1.7 cm long; leaves distributed alternately along the lesser branches or concentrated at the tips. Panicular subterminal inflorescence with multiple flowers located on the axils of deciduous bracts or persistent leaves, densely ferruginous-tomentose, 4 to 17 cm long; flower hermaphrodite, small (1.5 mm long), brownish-tomentose; perianth with 6 erect sepals, all the same size or outer ones smaller; generally 9 stamens, with filaments as long as those of the anthers or shorter; anthers generally with upward-turning valves to release the pollen; pistil minutely tomentose; ovary ellipsoid or ovoid, glabrous or pilose, included in the floral tube; pedicels inconspicuous and filaments short. Fruit berry-like, with a cup-shaped receptacle; receptacle chronic, thick, with outer surface rough and greenish-brown and inner surface glabrous and brown; berry obovoid to ovoid in shape, green when immature and turning dark violet when mature, with only one seed. Seed ovoid, tegument thin, smooth and opaque; light brown with longitudinal dark brown grooves; tegument brittle when dry; seed with two cotyledons, large, convex, hard, smooth, and cream-coloured (Sampaio *et al.,* 2003).

3.5 Role of the species in its ecosystem

The species is a component of the highland forests of the western Amazon. Its fruit provides food to birds, especially parrots and birds of the family Ramphastidae (toucans), and is attacked by coleopters and lepidopters. Pollination is mainly carried out by native bees.

4 Status and trends

Although no forest inventories are available for the remaining populations of this species, it is estimated that at least 825,000 trees have been logged, which amounts to over 4 million hectares of forests exploited (Homma, 2003). According to Benchimol (1988, *apud* Homma 2003), the decrease in harvests has allowed for partial regeneration of the species. Currently, the opening of new areas with the expansion of the agricultural frontier is exposing new populations to the harvest. There is evidence that small trees are being logged in the oldest harvest areas (Carvalho, 1983). The reduction of the production of essential oil in the last few years in spite of the price increase is attributed to the depletion of the wild populations (Benchimol, 2001). Therefore, the protection of the species is considered necessary and urgent to avoid greater genetic erosion and population decline.

4.1 Habitat trends

The Brazilian Amazon contains close to 40 % of the remaining tropical forests of the world (INPE, 2004). Large expanses of primary forest are degraded by habitat fragmentation, the edge effect, selective logging, fires, over-hunting, illegal gold mining and other activities (Laurance & Peres, 2005). Large-scale economic exploitation of resources in the Brazilian Amazon has significantly grown, leading to a decline in the population of the Brazilian rosewood.

4.2 Population size

The presence, abundance and distribution of the Brazilian rosewood have never been determined. The species has only been the subject of expeditions aimed at scientific and commercial harvest, with no attempts to estimate the existing volume of timber (Carvalho, 1983). The increasing scarcity of the product is attributed to the depletion of the populations in sites accessible to harvest. There are speculations that intact populations of the species may exist in areas far from navigable rivers, but this hypothesis remains to be verified.

4.3 Population structure

The species has the typical characteristics of late secondary and climax forests: very dense timber, slow growth, shade tolerance in the juvenile stage, medium size of seeds and abundant regeneration with high mortality.

In the interior Amazon rainforest, the Brazilian rosewood occurs with occasional frequency and has discontinuous and rather irregular distribution (Lorenzi, 1998). It occurs in low densities (Carvalho, 1983), often in groups of 5 to 8 trees growing at a distance of 50-100 m from each other; the distance between groups is usually 300-400 m, although isolated trees can also be found (Alencar & Fernandez, 1978).

4.4 Population trends

The population is undergoing a worrying decline because it is subject to a harvest rate greater than its replacement rate.

4.5 Geographic trends

In French Guiana, the population of the Brazilian rosewood was totally depleted due to ruthless exploitation (Homma, 2003). Attempts to industrialize the production of essential oil from the species in Peru in the 1940s and 1950s were unsuccessful because of the low availability of raw material (Pagán, 2003), which suggests that the existing standing stocks were also depleted. In Brazil, although there are reports of the occurrence of the species in Amapá, no information is available about its status in this area. In the State of Pará, populations remain only in inaccessible areas and the regeneration of the species has been documented in some protected areas (Carvalho, 1983). In the State of Amazonas, where the occurrence of the species is greater, populations have considerably declined (Benchimol, 2001).

5 Threats

Commercial exploitation of the species is intense. Its natural regeneration is poor, since it is slow-growing and seeds are intensely predated upon by birds and insects. The harvest of the best phenotypes of the natural populations has led to a negative selection pressure on the species. Preliminary data suggest signs of illegal harvests associated to the international trade of essential oil.

6 Utilization and trade

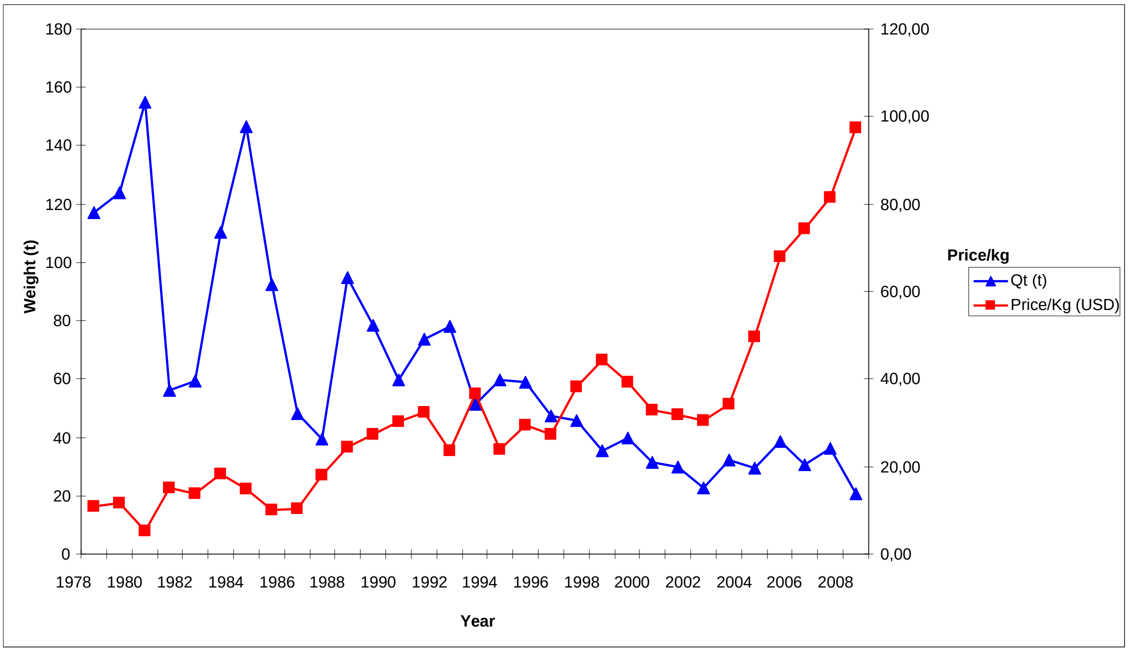
The product is not consumed in the Amazon region because no fine perfume industry exists there. All the essential oil is transported elsewhere; 15 % is sent to the south of Brazil and the remaining 85 % is exported (Alencar & Fernandez, 1978). Annual domestic consumption was estimated to amount to 20 to 30 tons by FAO (1995). However, these figures are unlikely to be reached at present, given that most consumption is external and exports have never exceeded 39 tons since the year 2000.

Besides consumption by the perfume industry, there is a small popular market for ‘baths’ and ‘scents’ in the Northern Region of Brazil that uses pieces of rosewood bark and timber instead of essential oil.

6.2 Legal trade

The chart below shows large fluctuations both in prices and volumes produced annually. Chart 01 clearly shows a declining trend in production and a parallel price increase since the late 1980s.

Chart 01: Prices (USD/kg) and quantities of rosewood exported (t) between 1978 and 2007



Source: Ministry of Foreign Trade – Aliceweb and IBGE – Statistical Yearbook

6.3 Parts and derivatives in trade

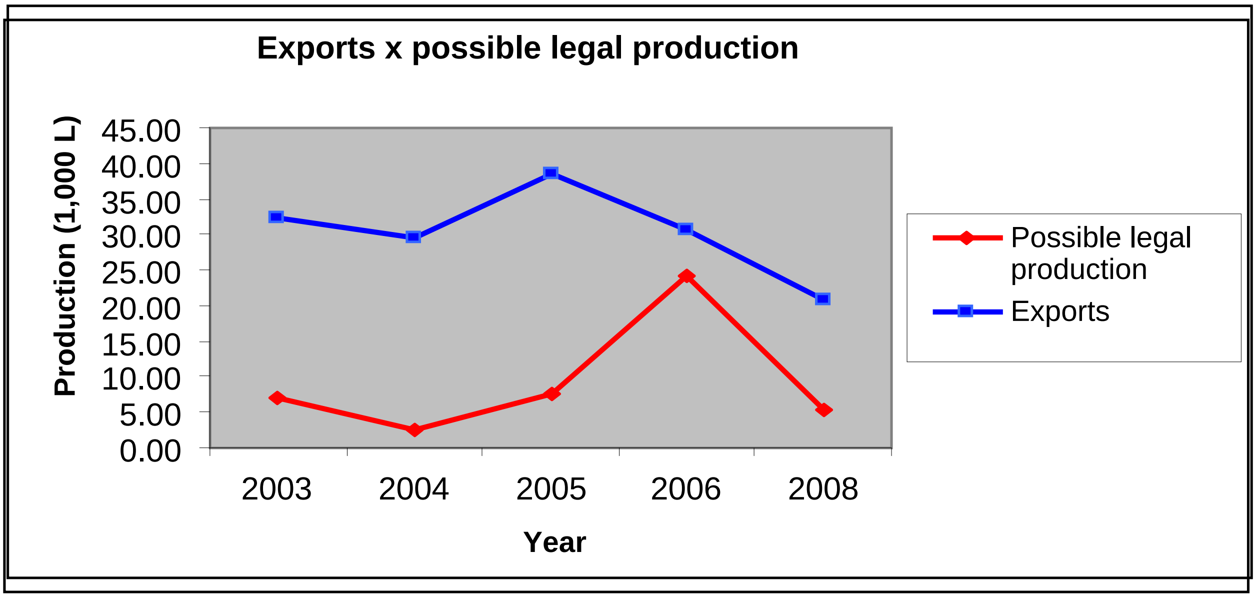
The main product is essential oil. Timber can also be used to make furniture and canoes but is rarely used for these purposes owing to the high commercial value of the essential oil. Recently, leaves and shoots of adult trees and young plants have started to be used to extract essential oil. Just under two drums of essential oil from leaves were exported in 2008. Pure linalool can also be extracted from the timber or the leaves. Hydrolate, a by-product of the distillation of rosewood, does not have any commercial value yet.

6.4 Illegal trade

Data on the volume of trunks authorized for harvest were collected between 2003 and 2008. Data for the 2003-2006 period were reported by the IBAMA Superintendency in the State of Amazonas. No data are available for 2007 because powers were decentralized on that year and fell to the State government. Data for 2008 are those recorded in the DOF timber transport permit, whose issuance depends upon the delivery of a timber harvest authorization known as 'ACOF' (*Autorização de Colheita Florestal*).

Chart 02 shows a great difference between authorized volumes of timber and amounts of essential oil exported, without even considering that part of the oil harvested is consumed domestically. Applying the conversion parameter of 1 ton of timber per 10 kg of essential oil (Homma, 2005), a timber density of 850 kg/m³ (Pagán, 2003) and a density of essential oil of 0.87g/cm³ (Pagán, 2003), the result shows that, during the whole period analysed, the total amount of oil exported cannot have originated from the total amount of legally harvested timber. Even considering the possible existence of stocks, the scope of this discrepancy – in the order of 513 % on average – suggests irregularities in the process of obtaining and trading in the raw material.

Chart 02: Possible production of oil from legally harvested timber compared to exports



6.5 Actual or potential trade impacts

The harvest of the species has been unsustainable from its onset, first depleting the standing stocks of the Guianas, followed by those of the State of Pará, in Brazil. Today, harvests are restricted to the State of Amazonas. Over the last few years, harvest has been lower than demand, since the populations continue to decline. The obligation to plant new trees to replace logged trees of the species has been inconclusive, considering that plantations have not been monitored and that the difficult identification of the species may have led to planting species of *Aniba* other than *A. rosaeodora*.

7 Legal instruments

7.1 National

Legislation on the conservation of the Brazilian rosewood includes a series of legal instruments and more general measures that regulate the harvest and transport of Brazilian native plants and their products. They are the following:

- Normative Instruction No. 06 of September 2008 of the Ministry of the Environment, which lists *Aniba rosaeodora* among the plants considered threatened in Brazil;
- Normative Instruction No. 002/2006 of the Ministry of Sustainable Development of the State of Amazonas, setting the procedures and requirements for the harvest of the Brazilian rosewood in areas of sustainable forest management, plantation areas, and parameters to consider in the processing of raw material into essential oil;
- Normative Instruction No. 112 of 21 August 2006, setting the rules for the control of transport and storage of forest products and by-products from native species;
- Act No. 4771 of 15 September 1965, Art. 14, paragraph “b”, granting powers to federal and State authorities to prohibit or restrict the harvest of species threatened with extinction;
- Act No. 11284 of 2 March 2006, Art. 83 and CONAMA (National Environmental Council) Resolution No. 378 of 19 October 2006, which deal with powers to authorize access to native forest products and transfer of most of these powers to State environment bodies. The inclusion of the Brazilian rosewood in CITES Appendix II will mean that the harvests will require the approval of IBAMA, the federal governing body, through a sustainable management plan and the endorsement of the CITES scientific authority.

7.2 International

The species is included in the official lists of endangered species of Colombia and Suriname (Pagán, 2003). It is classified as Threatened in the IUCN Red List. However, it is not part of any international agreement of which Brazil is a member yet.

8 Species management

8.1 Management measures

Prospecting activities aimed at discovering new standing stocks occur in parallel to harvests. There is no forest inventory or systematic information about the occurrence of the Brazilian rosewood at the government planning level. This lack of surveys and inventories leads to higher costs for harvesters and to the unsustainable use of existing reserves (Homma, 2005). Plantations and care of planted trees are necessary to ensure the survival of the species.

8.2 Population monitoring

It is necessary to draw up inventories of the species so that the remaining populations of the Brazilian rosewood can be monitored. Ongoing monitoring of areas subjected to harvest and areas formerly harvested is also essential.

8.2.1 Botanical identification of the three varieties of the Brazilian rosewood

In parallel to the forest inventory, it is necessary to collect biological material for a chemical and molecular analysis of the Brazilian rosewood from different places of origin. The 'mulatinho' variety is known to yield a greater amount of oil.

8.2.2 Collection of seeds for genetic tests and seed bank

When drawing up the forest inventory, it is necessary to select a minimum of 10 matrices/population (origins) for seed collection and the production of seedlings to perform genetic tests and deposit material from the remaining populations in seed banks.

8.3. Control measures

8.3.1 International

The Brazilian rosewood is not subjected to any international control measures, since it is not included in any international agreements.

8.3.2 National

See 7.1.

8.4 Artificial propagation

Seedlings can be obtained from seeds or cuttings, or through natural regeneration (Souza *et al.,* 1999). Fruits should be collected on the ground or from the tree once they have started to fall off naturally. After this, they should be stored in bags until the pulp starts to decompose, so that the seeds can be collected more easily (Lorenzi, 1998). Seeds of the Brazilian rosewood are extremely recalcitrant and therefore should be prevented from drying out. The recommendation is to remove the tegument in low vigour seeds or slightly dried seeds to promote emergence of the radicle (Sampaio *et al.,* 2003). After collection, seeds should be put to germinate in semi-shaded beds or directly in individual containers. Seedlings should be transplanted from the beds once they have reached 5-7 cm in size (Lorenzi, 1998).

Seed germination takes 5 to 8 weeks; germination rate is usually low (Lorenzi, 1998). The main factors limiting germination are related to seed collection and the delay between collection and sowing (Araújo, 1967).

The species can be propagated well by cuttings, especially when the cuttings come from the forest and are transplanted on rainy days (Espinel, 1982). Cuttings should have leaves and come from juvenile material (Barbosa *et al.,* 2000; Sampaio *et al.,* 1989. Rosa *et al.,* 1993). Sampaio (1988) and Sampaio *et al.* (1989) concluded that cuttings from lateral branches root better and that rooting is unlikely to depend on the use of indole butyric acid. This technique offers great possibilities to select quality material for experimental and commercial plantations. Sampaio *et al.* (2000) obtained good results with natural regeneration seedlings obtained from the understory. Seedlings can be used as a source of propagules for replanting the species in the forest.

In the field, the Brazilian rosewood is considered to be a slow-growing species (Lorenzi, 1998). It should be planted in the wet season, with a separation of 10 m x 5 m between trees. Crop association is another possibility (Revilla, 2001). In its juvenile stage, the Brazilian rosewood does not tolerate full sun and prefers shaded environments (Rosa *et al.,* 1997b). However, Alencar & Fernandez (1978) suggested that a greater quantitative development of the species can be obtained by exposing plantations to greater light. They recommended planting seedlings in the shade of formerly exploited native forests. Yet, a good survival rate (80 %) was described by Sampaio (2000) in full sun, with mean annual increases of 0.83 m in height, 0.79 cm in diameter, and 9.1 m^3/ha/year in volume. Plantation of leafless seedlings under partial shade in primary forests (30 % light) in clay soil and at a distance of 10 m x 5 m between plants yielded a mean annual increase of 0.75 m in height on the seventh year after planting (Alencar & Fernandez, 1978). Regular irrigation, fertilization and care of seedlings are recommended while the plants are still small.

On the basis of an experiment, a high number of shoots per stem was observed in Brazilian rosewood stems after crown pruning; this suggests the feasibility of managing the species through crown pruning in adult individuals. Regular pruning performed on the same individuals did not decrease their sprouting ability. It is necessary to perform tests at time intervals greater than 24 months between each pruning to increase the biomass of thin shoots and leaves (Santos, 2003). Given the resprouting ability of the species and the greater oil yield of shoots and leaves compared to the timber of the trunk, studies suggest that *ex situ* plantations can be managed through pruning (Barata, 2004). Pruning stimulated the production of aerial biomass in Brazilian rosewood trees, assessed 13 years after pruning (Sampaio *et al.,* 2003).

8.5 Habitat conservation

One of the main challenges of sustainable development in the Amazon, a region with a current human population close to 23 million, is to develop mechanisms that promote and accelerate the transformation processes of the region's productive bases. This should ultimately lead to an efficient and sustainable use of natural resources, stimulating the economy in the medium and long term and reducing social and regional inequalities (Brazilian Ministry of the Environment, 2004).

According to Bensusan (2009), one of the mechanisms most widely used to protect biodiversity is the creation of protected areas. In Brazil as well as in other parts of the world, this tool is even used to express the degree of environmental conservation. Countries with many protected areas are considered to better protect their biological diversity. Currently, 19.87 % of the Amazon is officially protected, although such protected areas do not always effectively reduce deforestation and biodiversity loss. The State of Amazonas has 65 Conservation Units and Pará has 63. These include national and State reserves, although the Brazilian rosewood does not occur in all of them.

8.6 Safeguards

In 2006, IBAMA created the electronic 'DOF system' (*Documento de Origem Florestal*), which regulates the transport of timber species and products and by-products of plant species threatened with extinction. This document is required for domestic legal transport of rosewood essential oil. The DOF system has led to a much more efficient monitoring of the chain of custody of the species at the domestic level.

However, it is necessary to train inspectors to identify the species correctly, since timber of *A. rosaeodora* is very similar to that of related species of the family Lauraceae.

9. Information on similar species

The species *A. fragans and A. parviflora*, also aromatic, are occasionally confused with *A. rosaeodora*. It is not certain yet whether they are traded or not (Sampaio, 2008, personal communication).

10. Consultations

The Bolivarian Republic of Venezuela, Colombia, Ecuador, France, Guiana, Peru and Suriname – Amazonian countries where the species also occurs – were consulted with regard to the Brazilian proposal. Colombia, Ecuador and Peru expressed a favourable initial reaction, but the other countries have not responded yet.

11. Additional remarks

11.1. Scattered plantations of the species exist in the Brazilian Amazon, as well as an incipient trade in essential oil obtained from leaves and young shoots pruned from trees, which does not require cutting the trees. Although this trade has good prospects, rosewood leaf oil cannot be considered to be a direct substitute for oil obtained from timber, since it has different olfactory characteristics (Barata, 2008).

11.2. In the understanding that, to be effective, biodiversity protection must be associated to broader sustainable development policies, Brazil supports the study and adoption of strategies to mitigate the possible impacts of the implementation of CITES listings on the livelihood of local communities. With regard to the harvest of the Brazilian rosewood in Brazil, preliminary observations indicate that workers hired to harvest the species also harvest other timber species; therefore, the impact on people's livelihoods that an inclusion in CITES Appendix II would have should not be significant. In any case, the Brazilian authorities have increasingly shown a greater interest in gaining knowledge on, avoiding and mitigating negative impacts of CITES listings on people's livelihoods.

12. References

ALENCAR, J.C.; FERNANDES, N.P. Desenvolvimento de árvores nativas em ensaios de espécies. 1. Pau rosa (*Aniba duckei* Kostermans). **Acta Amazônica,** Manaus, v.8, n.4, p.523-541, 1978.

ARAÚJO, V.C. de. **Sobre a germinação de Aniba (Lauraceae) I**. *Aniba duckei* kostermans (Pau-rosa Itauba). Manaus: INPA, 1967. (Botânica, 23).

BARATA, L.E.S & MAY, P. Rosewood Exploitation in the Brazilian Amazon: Options for sustainable production. **Economic Botany**, n 58, p. 257-265, 2004.

BARBOSA, A.P. Comunicação pessoal. **Workshop sobre o pau-rosa**, realizado nos dias 24 e 25 de novembro de 2008, na sede do IBAMA.

BENCHIMOL, S. **Production of Brazilian Rosewood Oil, Copaiba Balsam and Tonka Beans.** Paper presented to the International Conference on Essential Oils and Aromas, Buenos Aires, Argentina, 11 to 15 November 2001.

BRAGA, H.C. **Os óleos essenciais do Brasil**: estudo econômico. Rio de Janeiro: Ministério da agricultura, 1971. 86 p.

CARVALHO, J.O.P. de. **Abundância, freqüência e grau de agregação do pau-rosa (*Aniba duckei* Kortermans) na Floresta Nacional do Tapajós.** Belém: EMBRAPA – CPATU, 1983. 17p.

COSTA, L.G.S.; OHASHI, S.T.; DANIEL, O. **O pau-rosa** – *Aniba rosaeodora*, Ducke. Belém: FCAP, 1995.

ESPINEL, M.A.P. Agrosilvicultura para la Amazonia colombiana. **Colômbia Amazônica,** v.1, n.1, p.31-52, 1982.

FOOD AND AGRICULTURE ORGANIZATION – FAO. **Flavours and fragances of plant origin.** Roma: FAO, 1995.

HOMMA, A.K.O. **História da agricultura na Amazônia:** da era pré-colombiana ao terceiro milênio. Brasília: Embrapa Informação Tecnológica, 2003. 274p.

HOMMA, A.K.O. O Extrativismo do óleo essencial de pau-rosa na Amazônia. XLIII Congresso da Sociedade Brasileira de Economia, Administração e Sociologia Rural: **"Instituições, Eficiência, Gestão e Contratos no Sistema Agroindustrial".** Ribeirão Preto, 24 a 27 de Julho de 2005, Palestra.

INPE (Instituto Nacional de Pesquisas Espaciais). 2004. **Monitoramento da floresta amazônica brasileira por satélite:** Projeto PRODES. INPE, São José dos Campos, São Paulo. Disponível em: <http://www.obt.inpe.br/prodes/index.html>. Acesso: 06/01/2009.

INSTITUTO DE ESTUDOS AMAZONICOS E AMBIENTAIS – IEA. **Manual de Plantas Amazônicas.** Curitiba: IEA, 1993. 179p.

LAURANCE, W. & C.A. Peres, (eds). **Emerging threats to tropical forests.** University if Chicago Press, Chicago, EUA. 2005.

LEITE, A.M.C.; LLERAS, E. Áreas prioritárias na Amazônia para conservação dos recursos genéticos de espécies florestais nativas: fase preliminar. **Acta Botânica Brasílica,** v.7, n.1, p.61-93, jul. 1993.

LOPES, D.; BIZZON, H. R.; SA SOBRINHO, A. F.; PEREIRA, M. V. G.; ABREU, L. F. Alternative sources for essential oils obtained by extractivism: linalool-rich oil from leaves of *Croton cajucara* Benth. In: INTERNATIONAL SYMPOSIUM ON ESSENTIAL OILS, 30. Leipzig. **Proceedings...** [s.l.: s.n.], 1999. p.B-26.

LORENZI, H. **Árvores brasileiras**: manual de identificação e cultivo de plantas arbóreas do Brasil. Nova Odessa: Instituto Plantarum de Estudos da Flora, 1998. 2v.

MAGALHÃES, L.M.S.; ALENCAR, J.C. fenologia do pau-rosa (*Aniba duckei* Kostermans), Lauraceae, em floresta primária na Amazônia Central. **Acta Amazonica**, Manaus, v.9, n.2, p.227-232, 1979.

PAGÁN, T.C. **Características del aceite esencial de Palo rosa (*Aniba rosaeodora* Ducke) obtenido por dos métodos de destilacíon**. Lima: Universidade Federal de Molina. Dissertação para o grau de Engenheiro Florestal, 2003. 86 folhas.

REVILLA, J. **Plantas da Amazônia**: oportunidades econômicas e sustentáveis. Manaus: SEBRAE-AM/INPA, 2001. 405p. il.

ROSA, L. dos S.; OHASHI, S.T.; SANTANA, J.A.S.; OLIVEIRA, F. de A. Estágio atual de conhecimento sobre formação de mudas de pau-rosa (*Aniba rosaeodora* Ducke). In: CONGRESSO FLORESTAL PANAMERICANO, 1, 1993, Curitiba. Floresta para o desenvolvimento: política, ambiente, tecnologia e mercado. **Anais**... Curitiba: Sociedade Brasileira de Silvicultura/Sociedade Brasileira de Engenheiros Florestais, 1993. v.2. p.761.

ROSA, L. dos S.; SÁ, T.D.A.; OHASHI, S.T.; BARROS, P.L.C.; SILVA, A.J.V. Crescimento e sobrevivência de mudas de pau-rosa (*Aniba rosaeodora* Ducke) oriundas de três procedências, em função de diferentes níveis de sombreamento, em condições de viveiro. **Boletim FCAP**, n.28, p.37-62, 1997b.

SÁ, S. Pau-rosa (*Aniba rosaeodora* Ducke – Lauraceae). In: PRANCE, G.T. (ed). **Botânica econômica de algumas espécies amazônicas:** buriti, araçá-boi, camu-camu, abiu, cubiu, copaíba, piassaba, pataua, pupunha, pau-rosa, sorva e tucumã. Manaus: INPA/FUA, 1987. 143p. (Relatório dos alunos de pós-graduação em Botânica (INPA/FUA), disciplina de Botânica Econômica).

SAMPAIO, P. de T.B. **Propagação vegetativa do pau-rosa (*Aniba rosaeodora* Ducke) pelo método de estaquia**. 1988. 109f. Dissertação de Mestrado – Curso de pós-graduação em Silvicultura, INPA/Fundação Universitária do Amazonas, Manaus, 1988.

SAMPAIO, P. de T.B.; PARENTE, R.C.P.; NODA, H. Enraizamento de estacas de material juvenil de pau-rosa (*Aniba rosaeodora* Ducke – Lauraceae). **Acta amazônica,** v.19, p.391-400, 1989.

SAMPAIO, P. de T.B. Pau-rosa (*Aniba rosaeodora* Ducke). In: CLAY, J.W.; SAMPAIO, P.T.B.; CLEMENT, C.R. **Biodiversidade amazônica**: exemplos e estratégias de utilização. Manaus: Programa de Desenvolvimento Empresarial e tecnológico, 2000. p.291-297.

SAMPAIO, P. de T.B.; BARBOSA, A.P.; VIEIRA, G.; SPIRONELLO, W.R.; FERRAZ, I.D.K.; CAMARGO, J.L.C.; QUINSEN, R.C. Silvicultura do pau-rosa (*Aniba rosaeodora* Ducke). In: HIGUCHI, N.; SANTOS, J. dos; SAMPAIO, P.T.B.; MARENCO, R.A.; FERRAZ, J.; SALES, P.C. de; SAITO, M.; MATSUMOTO, S. (org.). **Projeto Jacarandá - fase II**: pesquisas florestais na Amazônia Central. Manaus: CPST/INPA, 2003. p.179-189.

SAMPAIO, P.T.B.; FERRAZ, T.D.K.; CAMARGO, J.L.C. 2003. Manual de sementes da Amazônia. Disponível em: <ftp://ftp.inpa.gov.br/pub/documentos/sementes/manuais/fasciculo3_aniba.pdf>

SANTANA, J.A. da S. Distribuição espacial da regeneração natural de *Aniba rosaeodora* Ducke (pau-rosa). **Revista Ciências Agrárias**, n.33, p.37-42, jan./jun. 2000.

SANTOS, M.C. dos**. Avaliação do crescimento da rebrota da copa de árvores de pau-rosa (*Aniba rosaeodora* Ducke) em sistema de plantio**. 2003. 42f. Dissertação (Mestrado em Ciências de Florestas Tropicais) – Instituto Nacional de Pesquisa da Amazônia/ Universidade do Amazonas, Manaus, 2003

SOUZA, K.S. de; NUNES, H. da C.B.; SILVA, S.P.G. da; VIEIRA, I.M.S.; MOTA, M.G. da C. Produção *in vitro* de plântulas de pau-rosa (*Aniba rosaeodora*). In: SEMINÁRIO DE INICIAÇÃO CIENTÍFICA DA FCAP, 9., SEMINÁRIO DE INICIAÇÃO CIENTÍFICA DA EMBRAPA AMAZÔNIA ORIENTAL, 3., 1999, Belém. **Resumos...** Belém: FCAP-Unidade de Apoio à Pesquisa e Pós-Graduação, 1999. p.371.

UNITED STATES DEPARTMENT OF AGRICULTURE - USDA. **Agricultural Research Service** – ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Base de Dados Disponível na Internet]. National Germplasm Resources Laboratory, Beltsville, Maryland. Disponível em: http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl. Acesso em: 03/12/2008.