Report on the conservation and trade of CITES-listed rosewood tree species [Leguminosae (Fabaceae)]

EXECUTIVE SUMMARY

'Rosewood' is a commercial/trade term used to describe timber from a range of tropical hardwoods in the Leguminosae (Fabaceae) family, which are harvested and traded primarily for the manufacture of traditional furniture in Asia. The over-exploitation of rosewood tree species in Asia has led to a shift in the trade to species with similar characteristics from countries in Latin America and Africa. Many of these species are now listed in CITES Appendix II due to concerns about the impact of trade on their survival, with the most recent listings including all *Dalbergia* species at CoP17 in 2017 and all African populations of *Afzelia, Khaya* and *Pterocarpus* species at CoP19 in 2022, with certain exemptions as allowed by the Convention or in the annotations associated to the genus or species-specific listings.

At its 19th meeting (CoP19; Panama City, 2022), the Conference of the Parties adopted Decisions 19.243 to 19.245 on *Rosewood tree species [Leguminosae (Fabaceae)].* Decision 19.243 directed the Secretariat to commission a study on the conservation and trade of rosewood tree species and stated that the terms of reference should be developed with consideration to discussions referenced in several Plant Committee meeting documents relating to rosewood tree species[1]. Decision 19.244 directed the Plants Committee to collaborate with the Secretariat to consider any findings from this study before making recommendations aimed at improving the implementation of the Convention for rosewood tree species. In August 2023, the CITES Secretariat commissioned TRAFFIC to undertake the study on the conservation and trade of rosewood tree species [*Leguminosae* (*Fabaceae*)], with the findings to be presented at the International Expert Workshop on Non-Detriment Findings between 4 to 8 December 2023 (Nairobi, Kenya) as recommended by the Plants Committee at its 26th meeting (PC26, Geneva, 2023). The terms of reference for the study included three main output which are outlined below.

The first output was to produce an updated list of CITES-listed rosewood tree species and to assign these species categories of high, medium, and low priority for the purposes of prioritising information gathering in this study. Two CITES notifications on rosewood tree species (Notification to the Parties No. 2020/023 and Notification to the Parties No. 2023/107) invited Parties to provide information on any CITES-listed tree species that are traded under the commercial term rosewood and to specify if any of the species identified were 'highly to moderately' affected by trade. An updated list of CITES-listed rosewood tree species was generated from these responses, with two additional species identified during the literature review. Party responses on whether species were affected by trade, alongside CITES Trade Data on wild trade volumes between 2017-2021, information on species undergoing compliance procedures in CITES (e.g., the Review of Significant Trade [RST]), and recent International Union for Conservation of Nature (IUCN) Red List Assessments, were used to assign priority categories to species.

The second output consists of a study on the conservation and trade of CITES-listed rosewood tree species with a focus on those prioritized as 'high' and 'medium' priority. Results included:

- factsheets for high and medium priority species to assist Parties in developing NDFs;
- a summary of source and production systems for CITES-listed rosewood tree species;
- an assessment of challenges and opportunities to improve conservation and trade for rosewood species currently undergoing CITES compliance procedures (with a focus on *Pterocarpus erinaceus*); and,
- the development of case studies to illustrate different approaches to implementing the Convention for CITES-listed rosewood tree species, with a focus on NDF development.

A literature review encompassing academic and grey literature was carried out to generate relevant information for the factsheets, with a focus on gathering information relevant to categories A-H as outlined in paragraph 1 a) ix) of Resolution Conf. 16.7 (Rev. CoP17) on *Non-detriment findings.* CITES trade data were analysed to summarise sources reported in imports of CITES-listed rosewood tree species, with any additional relevant information gathered for high priority species during the literature review. Documents for all CITES-listed rosewood tree species currently in compliance procedures were reviewed to identify common challenges and

[1] *PC25 Doc. 26.1, PC25 Doc. 26.2 and PC25 Doc. 26.3*

reflect on possible future recommendations for the implementation of the Convention. This was done with a particular focus on *Pterocarpus erinaceus* and the range States of this species, for which publicly available NDFs were reviewed and assessed against information in categories A-H of Resolution Conf. 16.7 (Rev. CoP17). In addition, a number of case studies were prepared based on this information to illustrate the current approaches used by Parties when collecting data and information for the development of NDFs for CITES-listed rosewood tree species.

The third output was a report summarising the above, with incorporation of any feedback generated after presenting preliminary findings from the study at the CITES International Expert Workshop on NDFs (4 -8 December 2023; Nariobi, Kenya).

The present study identified 57 CITES-listed tree species that are commercially traded under the name rosewood, and a further 20 species from African populations of species in genera likely to be traded as rosewoods (*Pterocarpus, Afzelia,* and *Khaya*) that had not previously been identified as being traded under this term in Party responses to the aforementioned notifications. Of these 77 species, 13 were assigned the category of 'high' priority, 14 'medium' and 50 'low'.

Detailed factsheets were produced for each high priority species with a focus on information in categories A-H para. 1 a) ix) of Resolution Conf. 16.7 (Rev. CoP17) that would be most relevant as background information for use by all Parties when developing NDFs (e.g. known international uses, or resilience to threats such as fire or drought). An analysis of sources for all CITES-listed rosewood tree species using CITES trade data between 2017 and 2021 showed that most imports of specimens of CITES-listed rosewood tree species from Asia were reported to be from artificially propagated, or previously seized and confiscated sources, whilst most from Africa, North America, and Central and South America and the Caribbean were reported to be wild sourced. A more detailed review of source and production systems for each high priority species found that overall, there is little evidence of large scale/commercial plantations for CITES-listed rosewood tree species, with only one high priority species (*Dalbergia latifolia*) reported to be imported in substantial quantities from artificially propagated specimens in CITES trade data.

The review of CITES documents for species undergoing compliance procedures identified 29 species subject to these procedures (prior to the 77th meeting of the Standing Committee [SC77, November 2023]), and five publicly available NDFs for *Pterocarpus erinaceus* were reviewed and assessed to identify common gaps and strengths. These reviews led to several reflections toward possible future recommendations for improving the implementation of the Convention, which are detailed in Sections 2.3.1 and 2.3.2 of this study. Thirteen publicly available NDFs for all CITES-listed rosewood tree species were identified and reviewed to generate case studies of approaches taken by Parties to develop NDFs under five broad themes of forest inventory, collection of current and historical harvest levels, calculation of recovery rates and the formulation of harvest quotas, forest management plans and collection of other data relevant to NDFs.

The findings from the study were presented to the Module 10 working group on NDFs for tree species at the 2023 International Expert Workshop on CITES NDFs and were well received. Constructive feedback focused on clarity in the use of language and terminology and alignment with Module 10, further detail on some aspects of the methodology used in the prioritization exercise, and adaptation of some reflections for possible future recommendations. These changes were incorporated into the final version of the study. The reflections generated in this study may be considered by the Plants Committee when formulating recommendations to improve the implementation of the Convention for rosewood tree species, and the resources such as factsheets and case studies can be of use to Parties developing NDFs for CITES-listed rosewood tree species.

Report on the conservation and trade of CITES-listed rosewood tree species [Leguminosae (Fabaceae)]

EXAMPLE OF A FACT SHEET[2]

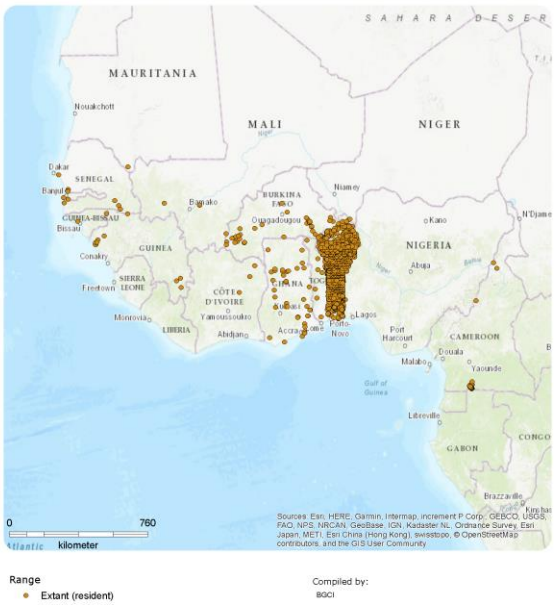
Factsheet 1: *Pterocarpus erinaceus*

Refer to 'factsheet overview' in the introduction to section 2.1.1 of the report for more information on how to use this factsheet when developing NDFs

Pterocarpus erinaceus	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g soil, climate)	The species is native to woody savanna and dry forests in West Africa but can also be found in humid coastal savanna in Togo, Benin, Guinea and Nigeria. (Barstow, 2018). The average rainfall in these areas is between 600–1,200 (–1600) mm, with a dry season that lasts around 8-9 months (Duvall, 2008). Annual temperatures vary between 15-35º C but the species can tolerate temperatures over 40 ºC (CITES, 2016). The tree grows at low altitudes of up to 600 (–1200) m and is found in all soil types but prefers acidic (instead of neutral), light (instead of medium), and free-draining soils (Duvall, 2008). It can be found to thrive even in shallow soils (CITES,2016).
Tree characteristics (e.g maximum height and diameter)	Estimates for the maximum height of *P. erinaceu*s range from 12-15 m in height (Segla et al., 2015) to up to 15(–25) m tall (Duvall, 2008). The species has a trunk size of up to 10 metres in good conditions, although in poor conditions it may be twisted, fluted and low-branched (Duvall, 2008). Estimates of maximum diameter vary according to source. Duvall (2008) states diameters (assumedly DBH, although not stated by the author) can reach up to 75(–100) cm, whilst Segla et al (2015) give larger estimates, stating the diameter (again assumedly DBH, although not stated by the author) range from 1.2-1.8 m.
Growth rates*	*Pterocarpus erinaceus* is classified as slow-growing (Duvall, 2008, CITES, 2016). The species is estimated to take around 100 years to reach its adult size (e.g., a height of 15 metres), based on growth rates of 15 cm a year (Barstow, 2018). In trials, strong growth differences for *P. erinaceus* have been observed between different geographical areas (Duvall, 2008). For example, Duvall (2008) states seedlings in Mali were found to grow to heights of 42cm after two years, whilst seedlings planted under better conditions were found to grow over twice as fast, reaching 100cm in two years. Duvall (2008) also states seedlings in Côte d'Ivoire grew to an average height of 2.8 metres within 2.5 years, whilst the fastest growing tree documented grew to 10 metres within 5.5 years (compared to 5.5 metres -almost half the height- in 5.5 years for the seedlings in Côte d'Ivoire). Barstow (2018) uses data from Duvall (2008) to estimate diameter growth rates *P. erinaceus* ranging from 1-1.3 cm a year (assumedly for DBH, but not explicitly stated). A study of mean average annual increments in the diameter of trees from *P. erinaceus* in South Senegal identified average increments of 0.40 cm a year from ages 1-10 combined, and faster growth rates of 0.58 cm a year from ages 1-20 combined (Mbow et al., 2013).

[2] *Characteristics with a * indicate those for which known global/generic data may be of use to Parties as proxy values where these are missing, but for which it is recommended that forest management unit level data are collected to best inform NDFs, e.g., by ensuring harvest quotas are accurately calculated according to harvest site characteristics.*

	An NDF for the species in Côte d'Ivoire used annual increases in diameter (assumedly DBH but not explicitly mentioned) of 0.4 cm when working out recovery rates for populations, although they do not refer to a source for this data (Zon et al., 2022).
Role of species in Ecosystem*	*P. erinaceus* is a keystone species within landscapes it inhabits due to its nitrogen-fixing abilities, which improve soil fertility (PC22 Inf. 13 2015). This also makes the species a pioneer species, as it can colonise fallow land (IUCN and TRAFFIC, 2017). The species provides an important food source for many animals including deer, particularly in the dry season, with this grazing thought to prevent the species from becoming a dominant tree species in wooded savannah habitats (Barstow, 2018).
Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)	*Pterocarpus erinaceus* is known to be both drought tolerant (e.g., able to survive the 6-9 month dry seasons), and fire resistant (Barstow, 2018). The tree is deciduous, and the trees usually flower at the end of the dry season (usually December-January, or as late as April), after losing their leaves (Duvall, 2008). A paper that modelled varying potential impacts of climate change predicted the climatic niche of the species would expand by around 23-29% by 2050, and 45-56% by 2070, although this expansion is predicted to occur with the loss of some niches across parts of its range (likely the southern of western parts of the range dependent on models used), with the expansion dependent upon extension of populations into (likely northwards) areas (Adjonou et al., 2020). Threats for *Pterocarpus erinaceus* documented in Winfield et al (2016) include an air dispersed fungus *Phyllachora pterocarpi* which can produce brown spots on leaves, and a risk of seedlings being attacked by rodents and crickets.
B. Species range	
Global/geographic distribution	The CITES Checklist of species states the species is native to Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo (UNEP-WCMC, 2023) The IUCN Red List assessment conflicts slightly with this native range; the author states the species is also native to Gabon, and that the presence of the species in uncertain in Chad and Liberia (Barstow, 2018). See below for a distribution map from known occurrences compiled by Botanic Gardens Conservation International (BGCI) and included in the IUCN Red List assessment (Barstow, 2018). The species is generally widespread and adaptable (IUCN and TRAFFIC, 2016). Its distribution includes mostly the Guinean Forest Savanna Mosaic ecoregion of West Africa. Further South its range extends into humid forests in Cote d'Ivoire and humid coastal savannas in Guinea, Togo, and Benin (CITES, 2017). The climatical zones across the range comprise the Guinean in the South of the range, followed by the Sudanian, and then the Sahelian in its northernmost part. These climatic zones are largely classified according to annual total rainfall, with rainfall highest in the South (Guinean) and lowest in the North (Sahelian) (Adjonou et al., 2020). The species has an estimated extent of occurrence (EOO) that exceeds 2 million km^2, but the state of the population across its distribution is not known (Barstow, 2018).

	
C. Population structure, status and trends – information was not included for this category as this needs to be collected at a national level in forest management units/harvest areas. Please refer to the 'Useful Resources for other information related to NDFs section' at the end of the factsheet for any example approaches toward collecting such data for this species.	
D. Threats	
Global	The species population is in decline due to threats including illegal logging, habitat conversion, fuel wood collection and low regenerative capacity. It is found in areas with high population growth, which puts it at risk of deforestation for conversion to new infrastructures such as roads (Barstow, 2018). The Guinean Forest-Savanna Mosaic ecoregion which accounts for large parts of the species range (see Barstow, 2018) was classified as having a critical/endangered status in 2015 (WWF, 2015). Although previously overharvesting of the branches for animal fodder was the main threat, the principal threat more recently is uncontrolled and illegal harvesting and trade of the species for it's valuable timber (CITES, 2017). Where population status assessments have been conducted, recruitment is said to be low, and in some cases even worse in protected areas, which is thought likely due to over-browsing and trampling by ungulate populations in these areas (Winfield et al., 2016).
E. Historical and current species-specific levels and patterns of harvest and mortality	
Global legal/illegal trade	In 2008, Duvall stated there was so significant international trade in timber from *P. erinaceus*. Between 2009-2014, there was a 15,000-fold growth in imports of rosewood into China from West Africa, from imports worth USD 12,000 in 2009 to imports worth over USD 180 million in 2014 (PC22 Inf. 13 2015). China is the biggest consumer of timber from this species. Most of the trade in *P. erinaceus* is now thought to be illegal (Barstow, 2018).
Known uses	The wood from this species is moderately heavy to heavy, with a density of (560–) 800 to 890(–940) kg/m³ at 12% moisture content. The heartwood is yellowish brown to reddish brown, often with purplish brown streaks, and is separate to the 2-5 cm sapwood. The grain is straight to interlocked, and the texture fine to moderately coarse. The fresh timber has an unpleasant smell (Duvall, 2008). The colour of the wood has been shown to vary according to climatic zones, for example those from the Sahelian climatic zone were darker and redder than those from the Guinean climatic zone (Segla et al. 2020) Nationally, leaves from the species are used as fodder for animals. The species has also been documented in use for fuelwood, and for a variety of medicinal purposes (Duvall, 2008, Barstow, 2018). Research is currently being conducted

	into use of the species for the treatment of Alzheimers and dementia (Barstow, 2018). Internationally, the species is used for its' timber, which is used for furniture, decorative panels, flooring and household utensils (Barstow, 2018). The timber from the species is durable and does not require preservatives to treat against attacks from insects (CIRAD, 2003 in Segla et al., 2020). As the wood is hard-wearing, it is suitable for construction. It was used to make high quality (Ming and Qing) furniture in China but is now often used in cheaper mass-produced furniture as it can be an affordable substitute to other rare, protected rosewoods (D. Brown and R. Latchford pers. comm. 2017 in Barstow, 2018). The species is recognised as a Hongmu species in China's National Hongmu Standard (last revised in 2017) (Zhang and Kin Keong, 2022a). The price of the species was reported to be relatively low, with it mostly sold in planks, in a TRAFFIC rosewood market survey in China (Zhang and Hin Keong, 2022a). Interviews conducted for the rosewood market survey indicated there were relatively high stocks available for timber from *P. erinaceus* in China (Zhang and Hin Keong, 2022b). The species was also classified as an ordinary/low end class species based on rosewood market surveys in 2013 (Forest Trends, 2013).
F. Management measures	
Capacity for regeneration*	Natural regeneration is often abundant, and the species may be quite invasive if protected from grazing for some years. Cutting at heights over 1.5 m is recommended, as trees do not resprout well when coppiced at ground level. It regenerates relatively quickly after pollarding and coppicing (Duvall, 2008).
Minimum felling diameter/rotation cycle*	*Pterocarpus erinaceus* is classified as mature at 5 cm in diameter according to one source (van der Burgt, 2016 In litt., in IUCN and TRAFFIC, 2016). Using varying growth rate estimates, the IUCN Red List assessment estimates the time taken for *P. erinaceus* to reach maturity ranges from 5-10 years, with estimates of 30-100 years to reach an exploitable diameter of roughly 40 cm DBH (X. van der Burgt pers. comm., 2017 in Barstow, 2018). Recommended average minimum felling diameters for *P. erinaceus* reportedly range from 26-65 cm (IUCN and TRAFFIC, 2016). However, some countries have smaller limits, with minimum felling limits of 20 cm previously documented in Ghana (Dumenu and Bandoh, 2008). This minimum felling diameter remains in place in Ghana, with a 2023 NDF for the species formulating annual felling quotas on this basis, with 50 year felling cycles as a conservative measure (SC77 Inf. 6, 2023) An NDF in Côte d'Ivoire produced under the CTSP set minimum felling diameters at between 30- 40 cm, as a precautionary measure based on minimum fruiting diameters of between 15-25cm (both assumedly DBH, but not explicitly stated) (Zon et al., 2022). The NDF states rotation periods are generally 30 years for permanent domain forests and 25 years for community forests in Côte d'Ivoire but do not state of that is explicitly for this species or for all species within these forest types. Another NDF in Mali states that previously, minimum felling diamters for the species were 25 cm, based on regular fruiting diameters of this size, with roatation periods of six to ten years. The NDF notes that these does not allow for regeneration of the species after exploitation, so state the proposed export quotas in the current NDF will be calculated based on rotation times of 12.5 years and minimum felling diameters of above 50 cm, and only in forest areas where recovery rates are above 50% in this time frame (PC26 Doc. 16.4 , Annex 3, 2023). A draft NDF for Sierra Leone states minimum felling diameters of 30 cm DBH, but does not elaborate on the scientific basis for these (PC26 Doc. 16.4 , Annex 4, 2023). A study in 2016 identified minimum felling diameters that allowed for optimal restoration of populations for *P. erinaceus* were 35 cm DBH in the Guinean and Sudanian climatic zones, and 65 cm DBH in the Sahelian zone, with rotation periods of 20 years in both cases. The study surveyed habitats within Burkina Faso, Niger and Togo and classified each habitat studied according to total

	annual rainfall: Guinean zone annual rainfall higher than 1,200 mm (areas in Togo), Sudanian annual rainfall between 900 and 1,200 mm (areas in Burkina Faso and Niger) and Sahelian annual rainfall lower than 700 mm (areas in Niger) (Segla et al., 2016).
Conversion factors*	A typical yield is 0.8 m^3 of timber and 1.2 m^3 of firewood for a relatively large (50 cm DBH) tree, and 1.7 m^3 of timber and 2.1 m^3 of firewood for a 70cm DBH tree (Duvall, 2008). For trees aged 22-60 years, the percentage of heartwood averages 64.5±9.0% (Segla, 2012 in Segla et al., 2020). Estimated conversion rates for various units (e.g., container, cubic meter, kilogram) to live tree equivalents for *P. erinaceus* are presented in the methodology for the 2020 UNODC World Wildlife Crime report (see p. 12 in https://www.unodc.org/documents/data-and-analysis/wildlife/2020/WWCR2_Methods_Annext.pdf) A 2023 NDF for the species in Ghana uses a formula to work out volume of trees with the use of data on diameter at breast height ($V= 0.0004634(d^{2.201})$ Where: V= tree volume, d= diameter at breast height but does not provide a source for the formula (SC77 Inf. 6, 2023)
G. Population monitoring Information for this category was not included in the factsheets as it needs to be collected at a national level in harvest areas/forest management units	
H. Conservation status	
Global Red List assessment	*Pterocarpus erinaceus* has most recently been assessed for The IUCN Red List of Threatened Species in 2017 and is listed as globally Endangered under criteria A3d. (Barstow, 2018)

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Useful resources for other information related to NDFs for *Pterocarpus erinaceus*

This section provides national/country specific information (where available) related to information categories A-H outlined in Resolution Conf. 16.7 (Rev. CoP17) that Parties may be able to use when developing their NDFs.

Species range (Category B) and Population structure, status, and trends (Category C)

A 2020 paper details the estimated potential range of the species under current and future climatic niches for each range state under varying climate change models (Adjonou et al., 2020) (see https://www.cell.com/heliyon/pdf/S2405-8440(20)30875-6.pdf). Another paper (Dimobe, 2022) details potential changes to the distribution resulting from climate change for the species specifically in Burkina Faso) (see https://www.sciencedirect.com/science/article/abs/pii/S1617138122001728?via%3Dihub)

See p.129- 166 in Winfield et al., 2016 (https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Global-Status-of-Dalbergia-and-Pterocarpus-Rosewood-CITES-2017-.pdf) for references to population structure and status assessments of *P. erinaceus* in Benin (2008), Burkina Faso (2016), Ghana (2013-2014), Niger (2012), Nigeria (2016), Senegal and the Gambia (1992), and Togo (2015). These highlight varying approaches that can be taken when collecting and presenting data.

See also recent NDFs for *P. erinaceus* produced under the CITES Tree Species Programme in Benin (https://cites-tsp.org/regions/benin) and Cote D'Ivoire (https://cites-tsp.org/regions/cote-divoire), and additionally NDFs produced by Mail and Sierra Leone (see Annexes to https://cites.org/sites/default/files/documents/E-PC26-16-04_0.pdf) and Ghana (see https://cites.org/sites/default/files/documents/E-SC77-Inf-06.pdf) which show example approaches to data collection and presentation of data on population abundance and structure

An approach to inventory and classification of population structure for the species is detailed in Segla et al. (2016) (see https://www.sciencedirect.com/science/article/pii/S0254629915003932?via%3Dihub)

Historical and current species-specific levels and patterns of harvest and mortality (Category E)

See Dumenu and Bandoh (2016) (https://www.academia.edu/33712147/Exploitation_of_African_rosewood_Pterocarpus_erinaceus_in_Ghana) for an example approach to estimating exploitation levels of the species in Ghana, inclusive of example conversion rates used to convert export volumes into (harvested) roundwood equivalent volumes, and use of forest inventory data to assess sustainability of exploitation against a reverse J shape expected in a forest under sustainable management

See p.146 in Winfield et al., 2016 (https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Global-Status-of-Dalbergia-and-Pterocarpus-Rosewood-CITES-2017-.pdf) and the IUCN Red List assessment https://www.iucnredlist.org/species/62027797/62027800 (Barstow, 2018) for references to varying uses of the species.

Duvall (2008) lists detailed uses of the species domestically, including some specific to Mali and Gambia (see 'uses' and 'production and international trade' in **https://uses.plantnet-project.org/en/Pterocarpus_erinaceus_(PROTA)**)

The IUCN Red List assessments details some examples of illegal trade volumes and modes of operation for Togo, Senegal, Gambia, Sierre Leone, Ghana and Guinea-Bissau (see p. 7 in pdf from **https://www.iucnredlist.org/species/62027797/62027800#bibliography**). Further details on illegal trade dynamics between Gambia and Senegal are provided in a 2015 report on China's Hongmu consumption boom (Treanor, 2015) (see 0.26 https://www.forest-trends.org/wp-content/uploads/imported/for173-china-rosewood-report-letter-16-0329-hr-no-crops-pdf.pdf).

The 2020 UNODC World Wildlife Crime report details imports of the species into Asian countries from various West African countries in 2017 using UN Comtrade data, and also summarises some recent illegal trade in Nigeria and Guinea-Bissau (see p. 39-40 in https://www.unodc.org/documents/data-and-analysis/wildlife/2020/WWLC20_Chapter_2_Rosewood.pdf)

Some recent trade dynamics for the species are referred to in a recent TRAFFIC rosewood market survey in China (Zhang and Hin Keong, 2017) (see https://www.traffic.org/site/assets/files/19229/rosewood_market_full_report_final.pdf)

Management measures currently in place and proposed, including adaptive management strategies and consideration of levels of compliance (Category F)

See https://cites-tsp.org/regions/benin and https://cites-tsp.org/regions/cote-divoire for detailed management plans produced under the CITES Tree Species Programme. See also the NDFs produced for each country for additional example approaches to species management, with the Cote D'Ivoire example also demonstrating an approach to establishing harvest quotas for the species in specific areas based on data such as minimum felling diameters and recovery rates. See also NDFs produced by Mail and Sierra Leone (in annexes to https://cites.org/sites/default/files/documents/E-PC26-16-04_0.pdf) and Ghana (see https://cites.org/sites/default/files/documents/E-SC77-Inf-06.pdf) for example approaches to management.

Consideration of the potential impacts of climate change on future management of the species are outlined in Adjonou et al. (2020) (see https://www.cell.com/heliyon/pdf/S2405-8440(20)30875-6.pdf).

An approach to formulation of sustainable felling diameters for the species is detailed in Segla et al. (2016) (see https://www.sciencedirect.com/science/article/pii/S0254629915003932?via%3Dihub)