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

Twenty-seventh meeting of the Plants Committee
Geneva (Switzerland), 8 – 13 July 2024

Species conservation and trade

ROSEWOOD TREE SPECIES [LEGUMINOSAE (FABACEAE)]

1. This document has been prepared by the Secretariat.

2. At its 19th meeting (CoP19, Panama City, 2022) the Conference of the Parties adopted Decisions 19.234 to 19.245 on *Rosewood tree species [Leguminosae (Fabaceae)]* as follows:

Directed to the Secretariat

19.243 *Subject to external resources, the Secretariat shall:*

a) compile and submit for consideration of the Plants Committee an overview and status of work completed, underway, or to be undertaken as a result of CoP19 to improve CITES implementation for rosewood tree species;

b) in consultation with the Plants Committee, develop the terms of reference for a study of rosewood tree species, taking into account findings and recommendations contained in documents PC25 Doc. 26.1, PC25 Doc. 26.2 and PC25 Doc. 26.3 and any planned CITES workshops on non-detriment findings;

c) commission the study on the conservation and trade rosewood-tree species;

d) organize an international workshop, inviting relevant range States, trading countries, relevant organizations, industry representatives and other experts to present the results of the study and develop recommendations aimed at improving the implementation of the Convention for rosewood tree species; and

e) submit the final study for consideration by the Plants Committee, as well as the outcomes of the workshop.

Directed to the Plants Committee

19.244 *The Plants Committee shall collaborate with the Secretariat in the implementation of Decision 19.243 and make recommendations aimed at improving the implementation of the Convention for rosewood tree species to the Standing Committee and/or the Conference of the Parties, as appropriate.*

Directed to the Standing Committee

19.245 *The Standing Committee shall consider any report from the Plants Committee under Decision 19.244 and make recommendations aimed at improving the implementation, interpretation, and enforcement of the Convention for rosewood tree species to the Conference of the Parties, as appropriate.*

3. At the 26th meeting of the Plants Committee (PC26; Geneva, June 2023), the Secretariat presented draft terms of reference for a study on the conservation and trade in rosewood tree species in Annex 1 to document PC26 Doc. 29. The Secretariat noted that the draft terms of reference anticipated reporting preliminary findings and recommendations at the international expert workshop on non-detriment findings (NDF), and specifically to the workstream on tree species.

4. The Plants Committee invited the Secretariat to consider a set of comments as it finalized the terms of reference of the study (see summary record PC26 SR).

Progress since PC26

5. The Secretariat finalized the terms of reference taking into consideration the comments made by PC26 and is working with TRAFFIC International (TRAFFIC) to undertake the study on the conservation and trade of CITES-listed rosewood tree species [Leguminosae (Fabaceae)]. The study was made possible thanks to the financial contribution of Switzerland. The Secretariat appreciates the support provided in this regard.

6. In line with the recommendations of PC26, the rosewood study was concluded ahead of initiating the study called for in Decision 18.321 (Rev. CoP19) on *Annotation #15*. Progress on the latter is reported at the present meeting in document PC27 Doc. 35.

7. Furthermore, as also recommended by PC26, the rosewood study included consultations with range States, and the preliminary outputs of the study were presented to the working group on Non-Detriment Findings (NDFs) on tree species at the international expert workshop on NDFs that took place from 4 to 8 December 2023 in Nairobi, Kenya. The working group welcomed the preliminary findings of the study, and provided feedback focused on clarifying the use of language and terminology and alignment with Module 10: NDFs for tree species; including further detail on some aspects of the methodology used in the prioritization exercise; and reflections for possible future recommendations. A Notification to the Parties on rosewood tree species were also issued to obtain further inputs from range States (see Notification to the Parties No. 2023/107 of 25 August 2023. The responses received informed the study.

8. The study was structured around the following three outputs:

   a) An updated list of CITES-listed rosewood tree species assigned to categories of high, medium and low priority for the purposes of information gathering for the study. The resulting list is comprised of the following:

      i) thirteen high priority CITES-listed rosewood tree species, of which five are native to Africa, four to Central and South America and the Caribbean, three to North America and four to Asia;

      ii) fourteen medium priority CITES-listed rosewood tree species (5 of these listed in Appendix II at CoP19);

      iii) fifty low priority CITES-listed rosewood tree species (20 of these listed in Appendix II at CoP19);

   b) An assessment of the conservation of and trade in CITES-listed rosewood tree species with a focus on those prioritized as “high” and “medium”. This resulted in a set of factsheets, a summary of source and production systems for CITES-listed rosewood tree species, an assessment of challenges and opportunities for rosewood tree species undergoing compliance processes (e.g., *Pterocarpus erinaceus*), and the development of regionally representative and illustrative case studies on the implementation of the Convention for rosewood tree species; and,

   c) A consolidated report incorporating feedback from Parties, the Plants Committee and the international expert workshop on NDFs (4 to 8 December 2023, Nairobi, Kenya), including reflections towards future recommendations for CITES-listed rosewood tree species.

9. The final outputs are attached as Annexes to the present document, as follows:

   a) Annex 1A: The executive summary of the report and Annex 1B: an example of one fact sheet, available in English, French and Spanish.

   b) Annex 2: The consolidated report entitled: *Report on the conservation and trade of CITES-listed rosewood tree species [Leguminosae (Fabaceae)*, available only in English.

c) Annex 3: The “high”, “medium”, and “low” priority list of CITES-listed rosewoods (as taken from Tables 2 to 4 of the report), and with a breakdown of the criteria met for prioritization.

Reflection on the implementation of Decisions 19.243 to 19.245

10. The Secretariat considers that, pending feedback from the Plants Committee at the present meeting, with the consolidated rosewood study now finalized, Decisions 19.243 and 19.244 can be considered completed.

11. The Secretariat notes that Parties could benefit from a new set of decisions on CITES-listed rosewood-tree species, to follow up on the outcomes and findings of the report, particularly for the CITES-listed rosewood tree species identified as of “high” and “medium” priority. Further work would focus on addressing the capacity-building needs of Parties trading in “high” and “medium” priority rosewood tree species, notably in the making of non-detriment findings, and on updating the report *inter alia* by preparing new factsheets for any rosewood tree species that may be included in the Appendices at the next meeting of the Conference of the Parties.

12. For this purpose, the Plants Committee could consider proposing the following draft decisions on CITES-listed rosewood tree species for submission to the 20th meeting of the Conference of the Parties:

Directed to the Secretariat

20.AA *The Secretariat shall:*

a) focus its capacity-building efforts for CITES-listed rosewood tree species on the 13 high priority and 14 medium priority species identified in the “Report on the conservation and trade of CITES-listed rosewood tree species [Leguminosae (Fabaceae)]” (see document PC27 Doc. 27, Annex 3), particularly as they relate to the implementation of Article IV of the Convention;

b) issue a Notification to the Parties inviting feedback on the “Report on the conservation and trade of CITES-listed rosewood tree species [Leguminosae (Fabaceae)]” to assess which additional information or CITES-listed species could be added in a future revision of the report;

c) subject to the availability of external funds and internal resources, and in close consultation with the Plants Committee, revise the “Report on the conservation and trade of CITES-listed rosewood tree species [Leguminosae (Fabaceae)]” by:

i) reviewing or updating the prioritization exercise taking into account any new rosewood-tree species that may be included in the Appendices at the 20th meeting of the Conference of the Parties (CoP20);

ii) reviewing, updating and, if appropriate, expanding the set of factsheets;

iii) strengthening linkages with the Module on NDFs for tree species of the CITES Non-Detriment Findings Guidance *(CITES Secretariat, 2024).*

d) report on progress on the above to the Plants Committee.

Directed to Parties

20.BB *Parties are invited to:*

a) when developing non-detriment findings for CITES-listed rosewood tree species, consider using as a baseline reference the “Report on the conservation and trade of CITES-listed rosewood tree species [Leguminosae (Fabaceae)]” and its factsheets, in conjunction with the Module on NDFs for tree species of the CITES Non-Detriment Findings Guidance *(CITES Secretariat, 2024);*

b) provide feedback and information to the Secretariat in support of its implementation of Decision 20.AA.

Directed to the Plants Committee

20.CC *The Plants Committee shall:*

a) consider and provide input on any report prepared by the Secretariat under Decision 20.AA; and

b) report on the implementation of these Decisions to the Conference of the Parties.

Recommendations

13. The Plants Committee is invited to:

a) consider and provide feedback on the report on rosewood tree species contained in Annexes 1 to 3 to the present document;

b) request the Secretariat to bring to the attention of the Standing Committee any relevant aspect of the report to support the Standing Committee in its review of the expedited application of Article XIII for West African rosewood (*Pterocarpus erinaceus*) for all range States;

c) agree that Decisions 19.243 and 19.244 have been implemented and recommend the deletion of these Decisions to the 20th meeting of the Conference of the Parties; and

d) submit the draft decisions contained in paragraph 12 of the present document to the 20th meeting of the Conference of the Parties.

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

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

rosewood tree species currently in compliance procedures were reviewed to identify common challenges and 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]

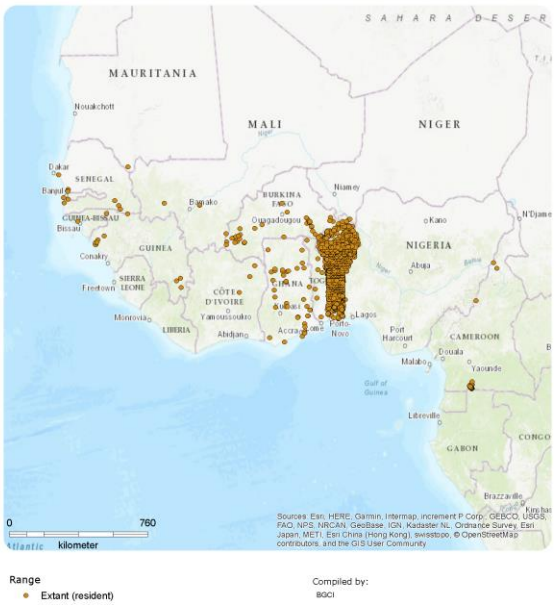
Factsheet 1: *Pterocarpus erinaceus*

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

[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.*

	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). 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)

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

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Disclaimer

The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat (or TRAFFIC) 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 this document rests exclusively with its authors. The geographical distribution of each species is based on the best available knowledge at the time of publication.

Contents

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 prioritised 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.

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

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 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

prioritisation 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.

Glossary of key terms and definitions

This glossary is complementary to Module 15 (Glossary of key terms and definitions introduced in this guidance) of the *CITES Non-Detriment Findings Guidance* [CITES Secretariat (2024)][2], and should be read in conjunction with it.

Conversion factors: These can be used to calculate the raw amount that would have needed to have been harvested to account for the processed products (for which permits are being applied for). Although some standard conversion rates are available, in reality, conversion rates will depend on each species, sawmill or industry and its machinery, the product and other processors. If these individual conversion rates are not provided, the CITES Scientific Authority can request this information (from traders/sawmills/industry) or make use of the most conservative value available from other comparable species and products. Such conversion rates may also be available from other sources or published in the literature. [Source: 9-step process for producing NDFs for timber/tree species, Wolf et al., 2018]

CITES Tree Species Programme (CTSP): A programme that provides direct financial assistance to Parties in taking conservation and management measures to ensure that their trade in timber, bark, extracts and other products from CITES-listed tree species is sustainable, legal and traceable. See also: CITES Tree Species Programme.[Source: CITES].

Export quota: A national quota for exports in specimens from a CITES-listed species resulting from a non detriment finding, usually to cover a calendar year (e.g., 1 January to 31 December) and reviewed annually. These are not mandated by CITES but Parties are encouraged to use them where they are relevant to the management and conservation of the species concerned. [Source: Resolution Conf. 14.7 (Rev. CoP15)].

Growth rate: The incremental increase in a tree's diameter (cm per year) or volume (m^3 per hectare per year) which can be used to estimate recruitment and assess whether regrowth can compensate for harvest in a given **rotation cycle**. This is most relevant when specific estimates for different size classes are generated and is preferably collected from a forest management unit as growth rates are influenced by site conditions. [Source: Adapted from the 9-step process for producing NDFs for timber/tree species, Wolf et al., 2018].

Hongmu: The term 'Hongmu' literally means "red wood" in Chinese and refers to a range of richly hued tropical hardwoods used to produce high-end furniture. [Source: CoP17 Prop 57, 2016].

Habitat specificity: An assessment of whether a species is specific to one or a few habitat types, or highly adaptable to various habitat types across its' range. [Source: adapted from the 9-step process for producing NDFs for timber/tree species, Wolf et al., 2018].

Non detriment finding: A conclusion by a Scientific Authority that the export of specimens of a particular species will not impact negatively on the survival of that species in the wild. The non-detriment finding by a Scientific Authority is required before an export or import permit or a certificate for an introduction from the sea may be granted for a specimen of an Appendix-I species, and before an export permit or a certificate for an introduction from the sea may be granted for a specimen of an Appendix-II species. [Source: CITES Glossary]].

[2] CITES Secretariat (2024), *CITES Non-Detriment Findings Guidance*. Available at: Non-detriment findings | CITES

Introduction

"Rosewood" is a commercial/trade term used for timber from a range of tropical hardwoods, most of which are now harvested to produce traditional 'Hongmu' furniture in Asia (PC25 Doc. 26.2, UNODC 2020). The term 'Hongmu' literally means "red wood" in Chinese and refers to a range of richly hued tropical hardwoods used to produce high-end furniture (CoP17 Prop 57, 2016). Overexploitation of Asia's Hongmu species alongside stricter conservation and enforcement measures has led to a shift towards alternative species with similar characteristics from Latin America and Africa being utilised in trade (PC25 Doc. 26.2, UNODC 2020). Most tree species used to produce Hongmu furniture come from the *Dalbergia* and *Pterocarpus* genera (UNODC,2020, PC25 Doc. 26.2), but a growing number of tree species, with some from other genera, have also started to be traded as rosewood (UNODC, 2020).

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)]* as follows:

Directed to the Secretariat

19.243 *Subject to external resources, the Secretariat shall:*

a) compile and submit for consideration of the Plants Committee an overview and status of work completed, underway, or to be undertaken as a result of CoP19 to improve CITES implementation for rosewood tree species;

b) in consultation with the Plants Committee, develop the terms of reference for a study of rosewood tree species, taking into account findings and recommendations contained in documents PC25 Doc. 26.1, PC25 Doc. 26.2 and PC25 Doc. 26.3 and any planned CITES workshops on non-detriment findings;

c) commission the study on the conservation and trade of rosewood-tree species;

d) organize an international workshop, inviting relevant range States, trading countries, relevant organizations, industry representatives and other experts to present the results of the study and develop recommendations aimed at improving the implementation of the Convention for rosewood tree species; and

e) submit the final study for consideration by the Plants Committee, as well as the outcomes of the workshop.

Directed to the Plants Committee

19.244 *The Plants Committee shall collaborate with the Secretariat in the implementation of Decision 19.243 and make recommendations aimed at improving the implementation of the Convention for rosewood tree species to the Standing Committee and/or the Conference of the Parties, as appropriate.*

Directed to the Standing Committee

19.245 *The Standing Committee shall consider any report from the Plants Committee under Decision 19.244 and make recommendations aimed at improving the implementation, interpretation, and enforcement of the Convention for rosewood tree species to the Conference of the Parties, as appropriate.*

At the 26th meeting of the Plants Committee (PC26, Geneva, 2023), the Plants Committee introduced document PC26 Doc. 29 presenting draft terms of reference for the study called for by paragraph c) of Decision 19.243.

At PC26, the Plants Committee provided feedback to the Secretariat as it finalized the terms of reference, including a recommendation to prioritize the implementation of activities for which the expected outputs would be relevant for consideration at the International Expert Workshop on Non-Detriment Findings to take place from 4 to 8 December 2023 (Nairobi, Kenia).

On 29 August 2023, the CITES Secretariat commissioned TRAFFIC to undertake a study on the conservation and trade of rosewood tree species [Leguminosae (Fabaceae)], in support of the implementation of Decision 19.243.

The present report is structured as per the expected outcomes and activities of the agreement between the CITES Secretariat and TRAFFIC, namely:

1. Outcome 1: An updated and prioritised list of CITES-listed rosewood tree species, the specimens of which are or could be traded under the common name “rosewood”.
2. Outcome 2: A detailed study on the conservation and trade of CITES-listed rosewood tree species as identified from outcome 1, with a focus on those prioritized as “high” and “medium” for this study. To this end, the following activities were undertaken:

   a) a review of literature and data relating to trade, with a focus on information relevant to information on NDFs in Resolution Conf. 16.7 on *Non-detriment findings* and those CITES-listed rosewood tree species prioritised as ‘high’ and ‘medium’ priority. This activity focused on collecting information outlined in Resolution Conf. 16.7 on *Non-detriment findings* (NDFs) and document PC26 Doc. 29 and its Annexes;

   b) an analysis of any updated information from responses to Notification to the Parties No. 2023/107 on the *Questionnaire on rosewood tree species [Leguminosae (Fabaceae)]*;

   c) an assessment of outputs relevant to rosewood tree species available on the CITES website relating to Article IV of the Convention (e.g., NDFs), utilising primarily information sources from the NDF database and CITES Tree Species Project;

   d) characterisation of the range of sources and production systems for CITES-listed rosewood tree species, with a focus on those species prioritised as ‘high’ and ‘medium’ priority for this study;

   e) an assessment of challenges and opportunities to improve the conservation and sustainable trade of rosewood tree species included in the compliance processes due to challenges in the implementation of Article IV of the Convention;

   f) development of case studies illustrating different approaches toward the implementation of the Convention for rosewood tree species; and,

3. Outcome 3: A consolidated report, incorporating feedback from the international NDF workshop (December 2023, Nairobi).

Chapter 1: An updated and prioritized list of CITES-listed rosewood tree species

1.1 Method and data sources

An initial list of CITES-listed tree species traded under the name 'rosewood' was identified from summary lists of responses from Parties to Notification to the Parties No. 2020/023 on rosewood tree species, contained in Annex 2 to PC26 Doc. 29. Any additional CITES-listed species identified as rosewood by Parties in a second Notification to the Parties (No 2023/107) in 2023 were used to supplement this list. As a precautionary measure, all new (CoP19) listings of tree species in the *Fabaceae* family were included in the list regardless of whether a Party identified them as 'rosewood' in the response to the second Notification.

The *CITES Dalbergia Checklist* (Cowell *et al.*, 2022) was used to identify any non-timber producing CITES-listed rosewood species of the genus *Dalbergia*, which were excluded from the list of species that could be found in trade as "rosewood" tree species. On the other hand, two additional CITES-listed species were identified as rosewood tree species from the literature review for high priority species (see chapter 2) and were included in the list: *Platymiscium parviflorum* and *Senna meridionalis* (UNODC, 2020).

Standard nomenclature references were used for all taxa, with this sourced from the CITES *Dalbergia* checklist[3] for all *Dalbergia* species, and from the Checklist of CITES Species[4] ,which follow the CITES standard references adopted by the CoP (see Annex to Resolution Conf. 12.11 (Rev. CoP19) on *Standard Nomenclature*,) for all other genera. Due to the same common names being used for multiple rosewood species referred to in this report, scientific names will be used throughout.

To ensure that the present study focused its review on those species which most urgently require NDFs, the CITES-listed tree species identified as traded under the name 'rosewood' were assigned priority categories of 'high', 'medium' and 'low'. To inform upon these categories, data on compliance measures, trade volumes from wild sources, Party responses to Notifications to the Parties No 2020/023 and 2023/107, and IUCN Red List assessments were gathered. Table 1 outlines the methodology used for each data source, and Figure 1 outlines the decision tree used to assign species risk categories using these data.

[3] See https://www.kew.org/science/our-science/science-services/UK-CITES/cites-resources
[4] https://checklist.cites.org/#/en

Table 1. Methodologies for each data source used to prioritise CITES-listed rosewood tree species for the purpose of this study

Criteria	Method
Ongoing compliance measures for species (e.g., from Article XIII and RST processes). This includes new RST selections from PC26.	The updated information on countries subject to a recommendation to suspend trade[5] was checked to see if any of the identified CITES-listed rosewood species were currently subject to any such recommendation. The CITES Compliance Procedures[6] page was also checked to identify if any Parties were subject to Article XIII due to concerns over trade in rosewood tree species. The Review of Significant Trade Management System[7] was checked for all ongoing cases for species in the RST between January 1st 2012 and October 2023. The summary records from PC26[8] were also reviewed to include any CITES-listed rosewood species that were not yet listed on the RST Management System.
High legal trade volumes from wild sources	CITES trade data were downloaded in September 2023, for the families *Lauraceae, Leguminosae* and *Meliaceae* (e.g., incorporating all CITES-listed timber species identified as traded under 'rosewood') with the following criteria: - All exporters and importers - Sources wild (W), assisted production (Y) and unknown (U) - Commercial purposes (T) - All terms - Years 2017-2021 The analysis used trade data between 2017 and 2021 to allow for reliable trade data comparisons between all species, with close to a third of CITES-listed species identified as rosewood tree species listed for the first time in 2017. Only direct exports (e.g., where the origin country was the same as the exporter) were included. Importer-reported data were used throughout the analysis as Some Parties may report quantities of commodities in export permits issued (e.g not quantities actually exported), so importer-reported data are more likely to reflect the quantities of commodities traded. Terms were categorised as 'raw wood and raw timber' for any specimens which were not substantially processed (logs, plywood, sawn wood, timber, timber pieces, transformed wood, veneer) and 'wood and timber products' for those that were substantially processed (carvings, jewellery, piano keys, wood products) for effective comparison between quantities of commodities per species in direct exports. Non-timber commodities (bark, chips, cosmetics, derivatives, extract, leaves, live, medicine, powder, oil, roots, seeds, specimens, wax) were excluded from the analysis*. Total quantities of raw wood and raw timber, and wood and timber products, for each species reported by importers in mass in kg, volume in m^3 and number of specimens were calculated. Records reported in grams and tonnes were converted into mass in kg and records reported in cm^3 converted into volume in m^3. A relatively small quantity (~ 19,500 m^2) of timber commodities were reported by length and excluded from the analysis. It was beyond the scope of this study to conduct an in-depth assessment of trade volumes relative to population sizes to assess the risk of trade to species, with accurate population size data also lacking for most species. As a precautionary measure, 'high' trade volumes from wild sources were therefore defined as quantities of more than 1,000 units (kg, number of specimens, m^3) for most species, or 500 units or more for Critically Endangered species, for which even small quantities of trade may impact populations. These quantities were selected because they incorporated > 99% of all global

[5] https://cites.org/eng/resources/ref/suspend.php
[6]https://cites.org/eng/prog/compliance
[7] https://rst.cites.org/public/cases
[8] https://cites.org/sites/default/files/documents/E-PC26-SR_0.pdf
*It should be noted when interpreting the data for each unit (number, kg and m^3) that Parties did not always report timber/wood products according to preferred units as outlined in the CITES guidelines for the preparation and submission of CITES annual reports . For example logs were often reported as mass in kg, although the preferred unit recommended for logs in the CITES guidelines is m^3.

Criteria	Method
	exports in CITES-listed rosewood species reported by importers and were therefore a conservative measure to ensure all CITES-listed rosewood species traded in notable quantities (and also assessed as globally threatened on the IUCN Red List) would be selected as either 'high' or 'medium' priority species for the purposes of this study (see Decision tree in Figure 1).
Sharp increases in recent years of reported legal trade from wild sources	The analysis of sharp increase in recent years of trade used the same dataset as outlined above for identifying high legal trade volumes from wild sources, and adapted the method used by UNEP-WCMC to identify sharp global increases in trade when identifying candidates for potential inclusion in the RST. UNEP-WCMC states taxa meet this criterion if the volume of direct exports (e.g., where the origin country is the same as the exporter) in the most recent year of reported trade (e.g., 2021) is more than three times the volume in the preceding five years from 2016-2020, with taxa traded in small quantities excluded (CITES Secretariat and UNEP-WCMC, 2023). Over half of CITES-listed species identified as rosewoods were either first listed in 2017, or had listings amended from certain countries only (e.g., Guatemala, Nicaragua, and Madagascar for various *Dalbergia* species, and Senegal for *Pterocarpus erinaceus*) to global listings in 2017. To enable consistent comparison between species, species were defined as having a sharp increase in trade if the volume of direct exports in 2021 was more than three times the average volume in the preceding four years from 2017-2020. One species, *Pterocarpus tinctorius*, was listed in 2019 so the volume of direct exports in 2021 was compared to the average between 2019-2020. A species could meet the criteria for a sharp increase through any commodity type/reported unit combination (e.g., an increase in raw wood and raw timber' reported by mass in kg, or wood and timber products reported by number of specimens). If only small quantities of direct exports in a species (e.g., 500 units or less) were reported between 2017-2021, they were excluded from the analysis. Although relatively few Parties have reported trade data in 2022, CITES trade data from 2022 were downloaded to check for any marked increases in exports for any species since 2021, but negligible quantities (~ 550kg from carvings and 200 m^3 from sawn wood/timber) from two species were reported imported, with both in lower quantities than were reported for these species in 2021.
IUCN Red List conservation categories	These were retrieved from the IUCN Red List in September 2023 (IUCN, 2022).
Inputs from Parties	Summaries from the 2020 Notification to the Parties No. 2020/023 on rosewood tree species provided in PC26 Doc.29 Annex 2 (page 9) were used to identify if any Party had stated a CITES-listed rosewood tree species was of moderate to high risk from trade. This was supplemented with additional responses from the 2023 Notification to the Parties No. 2023/107, and other relevant comments in reports from the intersessional working group on rosewood tree species using records provided in Annexes 2 and 4 to PC26 Doc.29. In line with the precautionary approach a species was assigned the category of 'moderate to high' risk from trade if at least one Party response assigned that category to that species.

1.2 Decision tree for assigning priority categories to CITES-listed rosewood tree species

A total of 55 tree species from the *Fabaceae* family and listed in the CITES Appendices were identified as traded under the commercial term rosewood by Parties in their responses to No 2020/023 and 2023/107 and two species (*Platymiscium parviflorum* and *Senna meridionalis*) by UNODC (2020). A further 20 species in the *Fabaceae* family listed at CoP19 in 2022 (African populations from the genera *Afzelia, Pterocarpus*, and *Khaya*) are yet to be identified as commercially traded as rosewoods

The 20 species from African populations from the genera *Afzelia, Pterocarpus*, and *Khaya* listed at CoP19 in 2022 do not have any reported CITES rade data between 2017 and 2021. Any of these species identified as rosewoods in Party responses to the most recent Notification (No. 2023/107) were automatically assigned the category of 'medium' as a precautionary measure, with any not yet identified as traded under the term rosewood by Parties assigned the category of 'low'.

For all other species, the decision tree in Figure 1 was used to categorise species into 'low', 'medium', and 'high' priority. These categories of low, medium and high priority are used only to prioritise species which would most benefit from information gathering in this study and are not intended for use in the context of any compliance procedures or other CITES processes. This resulted in:

a) 13 high priority rosewood tree species, of which five are native to Africa, four to Central and South America and the Caribbean, three to North America and four to Asia (Table 2).

b) 14 medium priority rosewood tree species (5 of these listed in Appendix II at CoP19) (Table 3); and,

c) 50 low priority rosewood species (20 of these listed in Appendix II at CoP19) (Table 4).

During the International Expert Workshop on CITES NDFs in Nairobi, Kenya (December 4-8), participants of Module 10 on NDFs for tree species raised the concern that due to similarities between many CITES-listed rosewoods species, there may be cases in which the species in trade is not actually the species reported in the CITES Trade Database. This is a limitation to the prioritisation exercise, as it means that some species may be traded in lower/higher volumes than is reported; an example of this issue is provided in the IUCN Red List assessment for *Guiboroutia pellegriniana* , which states that it is not possible to separate trade data for this species and *Guibourtia tessmannii* given their morphological similarity (Barstow et al., 2021a).

Annotations included with listings for each CITES-listed rosewood species are included in Tables 2, 3 and 4. Full definitions for all annotations are provided in the CITES Appendices. The most common of these for CITES-listed rosewood tree species are annotation number 15 for *Dalbergia* and *Guibourtia* species, which excludes musical instruments and wood shipments of up to 10 kg from CITES controls. There are two exemptions to this: in Mexico, annotation number six applies to all *Dalbergia* species, and for all Parties annotation number four applies to parts and derivatives of *Dalbergia cochinchinensis*. For most other CITES-listed rosewood species (African populations of *Pterocarpus, Afezlia* and

Khaya spp.) annotation number 17 applies, which excludes specimens other than logs, sawn wood, veneer sheets, plywood and transformed wood from CITES controls.

In addition, artificially propagated specimens (i.e., those meeting the definition of *artificially propagated* according to Resolution Conf. 11.11 (Rev. CoP18), determined as such by Management Authorities with the advice of Scientific Authorities, are subject to exemptions and other special provisions to trade according to Article VII of the text of the Convention, although an NDF is required for the establishment of the parental stock and in cases where wild specimens are added to the artificially propagated population. Further guidance on this is provided in the CITES Preliminary guidance on terms related to the artificial propagation of CITES regulated plants.

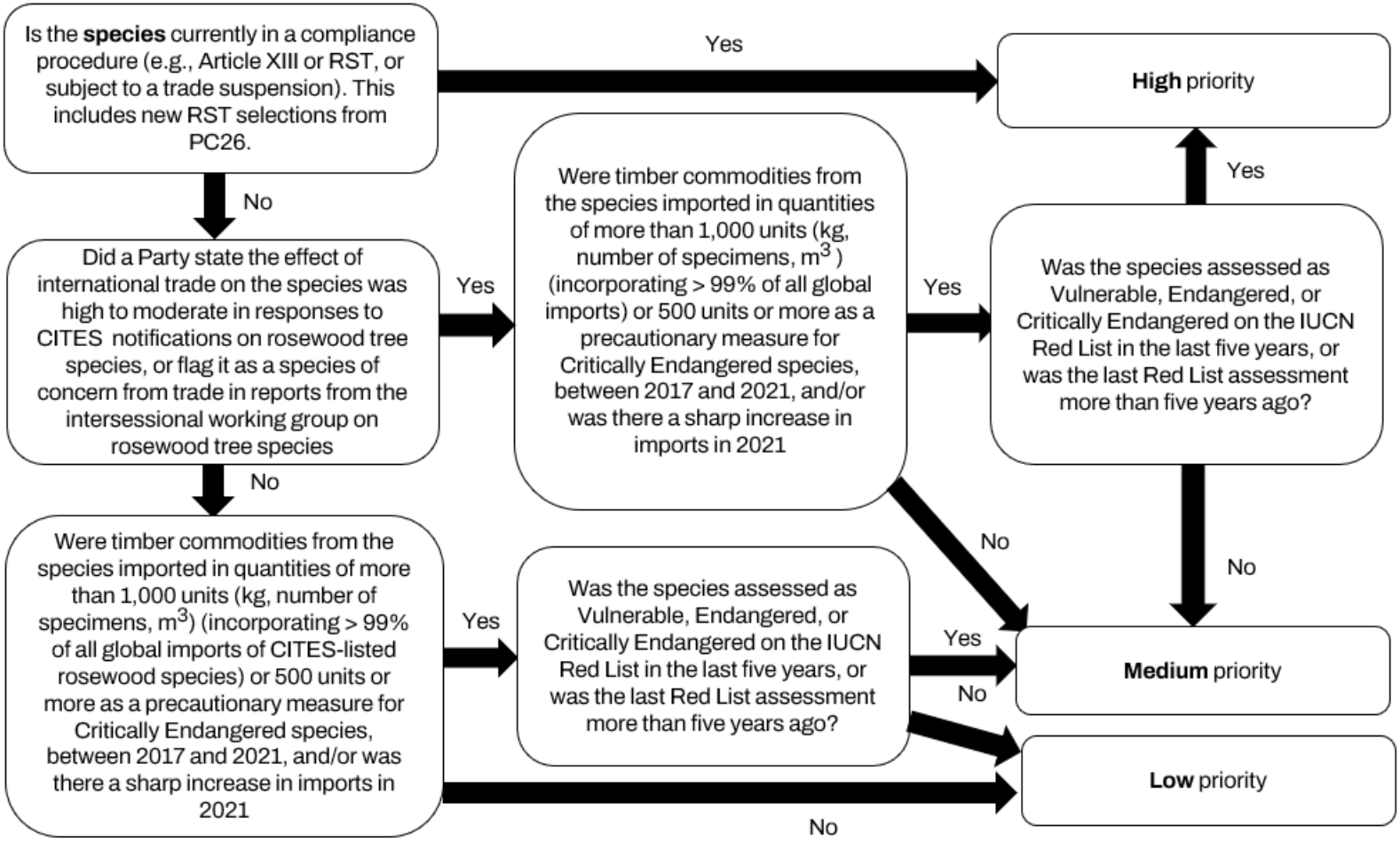


Figure 1. Decision tree used to classify CITES-listed species identified as rosewood into categories of 'low', 'medium', or 'high' priority for the purposes of this study, using data gathered as outlined in Table 1.

Table 2. CITES-listed species identified as traded under the commercial term 'rosewood', and assigned as high priority for the purposes of this study, with data used to assign priority categories using the decision tree in Figure 1 and a summary of high priority criteria met. The list is arranged in an ascending alphabetical order from the first column.

High priority CITES-listed rosewood tree species	Appendix	Annotation	CITES Region
1) *Dalbergia cochinchinensis*	II	15	Asia
2) *Dalbergia granadillo*	II	15	North America and Central and South America and the Caribbean
3) *Dalbergia latifolia*	II	15	Asia
4) *Dalbergia melanoxylon*	II	15	Africa
5) *Dalbergia oliveri*	II	15	Asia
6) *Dalbergia retusa*	II	15	Central and South America and the Caribbean
7) *Dalbergia stevensonii*	II	15	North America and Central and South America and the Caribbean
8) *Dalbergia tucurensis*	II	15	North America and Central and South America and the Caribbean
9) *Guibourtia pellegriniana*	II	15	Africa
10) *Guibourtia tessmannii*	II	15	Africa
11) *Pterocarpus erinaceus*	II	17	Africa
12) *Pterocarpus santalinus*	II	17	Asia
13) *Pterocarpus tinctorius*	II	17	Africa

Table 3. CITES-listed species identified as traded under the commercial term 'rosewood', and assigned as medium priority for the purposes of this study, with data used to assign priority categories using the decision tree in Figure 1 and a summary of medium priority criteria met. The list is arranged in an ascending alphabetical order from the first column.

Medium priority CITES-listed rosewood tree species	Appendix	Annotation	CITES Region
1) *Afzelia africana*	II	17	Africa
2) *Dalbergia baronii*	II	15	Africa
3) *Dalbergia calderonii*	II	15	Africa
4) *Dalbergia congestiflora*	II	15	North America and Central and South America and the Caribbean
5) *Dalbergia glomerata*	II	15	North America and Central and South America and the Caribbean
6) *Dalbergia maritima*	II	15	Africa
7) *Dalbergia sericea*	II	15	Asia
8) *Dalbergia spruceana*	II	15	Central and South America and the Caribbean
9) *Guibourtia demeusei*	II	15	Africa
10) *Khaya ivorensis*	II	17	Africa
11) *Khaya senegalensis*	II	17	Africa
12) *Paubrasilia echinata*	II	10	Central and South America and the Caribbean
13) *Pterocarpus angolensis*	II	17	Africa
14) *Pterocarpus soyauxi*i	II	17	Africa

Table 4. CITES-listed species identified as traded under the commercial term 'rosewood', and assigned as low priority for the purposes of this study, with data used to assign priority categories using the decision tree in Figure 1 and a summary of low priority criteria met. The list is arranged in an ascending alphabetical order from the first column.

Low priority CITES-listed rosewood tree species	Appendix	Annotation	CITES Region
1) *Afzelia bella*	II	17	Africa
2) *Afzelia bipindensis*	II	17	Africa
3) *Afzelia pachyloba*	II	17	Africa
4) *Afzelia parviflora*	II	17	Africa
5) *Afzelia peturei*	II	17	Africa
6) *Afzelia quanzensis*	II	17	Africa
7) *Aniba rosaeodora*	II	12	Central and South America and the Caribbean
8) *Dalbergia abrahamii*	II	15	Africa
9) *Dalbergia arbutifolia*	II	15	Africa
10) *Dalbergia assamica*	II	15	Asia
11) *Dalbergia boehmii*	II	15	Africa
12) *Dalbergia brownei*	II	15	North America and Central and South America and the Caribbean
13) *Dalbergia calycina*	II	15	North America and Central and South America and the Caribbean
14) *Dalbergia cearensis*	II	15	Central and South America and the Caribbean
15) *Dalbergia cubilquitzensis*	II	15	North America and Central and South America and the Caribbean
16) *Dalbergia decipularis*	II	15	Central and South America and the Caribbean
17) *Dalbergia frutescens*	II	15	Central and South America and the Caribbean
18) *Dalbergia glabra*	II	15	North America and Central and South America and the Caribbean
19) *Dalbergia greveana*	II	15	Africa
20) *Dalbergia longepedunculata*	II	15	North America and Central and South America and the Caribbean
21) *Dalbergia louvelii*	II	15	Africa
22) *Dalbergia luteola*	II	15	North America and Central and South America and the Caribbean
23) *Dalbergia madagascariensis*	II	15	Africa
24) *Dalbergia melanocardium*	II	15	North America and Central and South America and the Caribbean
25) *Dalbergia modesta*	II	15	North America and Central and South America and the Caribbean
26) *Dalbergia monetaria*	II	15	North America and Central and South America and the Caribbean
27) *Dalbergia nigra*	I	N/A	Central and South America and the Caribbean
28) *Dalbergia obtusa*	II	15	Africa
29) *Dalbergia odorifera*	II	15	Asia
30) *Dalbergia palo-escrito*	II	15	North America and Central and South America and the Caribbean
31) *Dalbergia pinnata*	II	15	Asia

32) *Dalbergia rhachiflexa*	II	15	North America and Central and South America and the Caribbean
33) *Dalbergia ruddiae*	II	15	North America and Central and South America and the Caribbean
34) *Dalbergia sissoo*	II	15	Asia
35) *Khaya agboensis*	II	17	Africa
36) *Khaya anthotheca*	II	17	Africa
37) *Khaya euryphylla*	II	17	Africa
38) *Khaya grandifoliola*	II	17	Africa
39) *Khaya madagascariensis*	II	17	Africa
40) *Khaya nyasica*	II	17	Africa
41) *Platymiscium parviflorum*	II	4	Central and South America and the Caribbean
42) *Pterocarpus brenanii*	II	17	Africa
43) *Pterocarpus lucens*	II	17	Africa
44) *Pterocarpus mildbraedii*	II	17	Africa
45) *Pterocarpus officinalis*	II	17	Africa
46) *Pterocarpus osun*	II	17	Africa
47) *Pterocarpus rotundifolius*	II	17	Africa
48) *Pterocarpus santalinoides*	II	17	Africa
49) *Pterocarpus tessmannii*	II	17	Africa
50) *Senna meridionalis*	II	N/A	Africa

Chapter 2: Study on the conservation and trade of CITES-listed rosewood species

2.1 Methodology for the review of information relevant to non-detriment findings for priority rosewood tree species

Data relevant to the formulation of NDFs were taken from Resolution Conf. 16.7 (Rev. CoP17) on *Non-detriment findings,* in particular from recommended information to be considered for inclusion in NDFs under categories A-H as outlined in paragraph 1 a) ix) of the Resolution. These information categories refer to general principles that are relevant for all taxa, so to focus the literature review on information most relevant to timber, relevant subheadings for each category A-H were sourced from guidance on the working group for Module 10 on NDFs for tree species formed under the NDF project (Decisions 19.132-19.134) (under review). These were supplemented with any subheadings for each category identified from information requirements outlined in the 9-step process for producing NDFs for timber/tree species (Wolf et al., 2018). For data under information category F (management measures), subheadings sourced from Chapter 3 of the Guidelines for the Management of Tropical forests (FAO, 1998), (which are recommended as a useful source for management approaches in Module 10 on NDFs for tree species) were used (see Figure 2).

To focus the literature review on data which would be of most use to Parties when developing NDFs, the subheadings under information categories A-H were split into two types:

1) **Global/generic**: those which Parties could use regardless of local context (e.g., habitat characteristics under information category A. Species biology and life-history characteristics). Global and generic characteristics are outlined in bold in Figure 2. For some characteristics included as 'global/generic', such as growth rates, or minimum felling diameters, Parties would still benefit from collecting data specific to their areas, but a range of data from other studies is provided, when available, which could be used as proxy values if needed until these data are collected. These characteristics are indicated with an asterisk in Figure 2
2) **National/specific:** those characteristics for which Parties would need to collect/use their own forest management unit level data (e.g., population structure, current levels of harvest, national/local threats, and management plans in place). National and specific characteristics are in italics in Figure 2.

For each high priority species, a factsheet with all relevant information available on global and generic characteristics that can be used when making NDFs was produced. Any sources with national/specific data that Parties could use for the species, or example approaches to collecting national/specific data, were also collated, and included in each high priority species factsheet under a subheading of 'other useful resources for NDFs'.

The working group for Module 10 on NDFs for tree species recommends that for widespread species (such as rosewood tree species) information in NDFs is focused on discrete forest management units where the species is known to exist and where exploitation is usually already occurring (Johnson S., in litt., 2023). The factsheets are intended to provide relevant background data for NDFs of high priority rosewood species, before a more detailed assessment of forest management units is conducted.

A. Species biology and life-history characteristics
(i) Habitat characteristics
(ii) Growth rate*
(iii) Characteristics of tree species e.g., maximum diameter size and height)
(iv) Role of species in the ecosystem*
(v) Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)

B. Species range (historical and current)
(i) Global/geographic distribution
(ii) National/subnational

C. Population structure, status, and trends
(i) Abundance e.g., number of trees per hectare
(ii) Trends in population size

D. Threats
(i) Global
(ii) *National/local e.g., habitat vulnerability*

E. Historical and current species-specific levels and patterns of harvest and mortality (e.g. age, sex) from all sources combined
(i) Mortality rate both naturally and in the harvesting area
(ii) Volume of trade (legal and illegal, in all commodities including those not covered by CITES)
(iii) Domestic uses
(iv) International uses

F. Management measures currently in place and proposed, including adaptive management strategies and consideration of levels of compliance
(i) Forest management plan (FMP)
(ii) Forest Inventory Protocols
(iii) Size class distribution of trees
(iv) Capacity for regeneration*
(v) Minimum felling diameter*
(vi) Rotation cycle*
(vii) Annual allowable cut
(viii) Silviculture
(ix) Harvest techniques
(x) Conversion rates*
(xi) Establishment of suitable harvest and export quotas

G. Population monitoring

H. Conservation status
(i) Globally
(ii) Nationally
(iii) Sub-nationally

Figure 2. Data relevant to the formulation of NDFs under recommended information to be considered for inclusion in NDFs as outlined under categories A-H from paragraph 1 ix) of Resolution Conf. 16.7 (Rev. CoP17), with global/generic data types highlighted in bold, and national/specific in italics.

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.

For each high priority species identified in Table 2, the following steps were taken to identify relevant data or sources for information categories A-H above:

1. Responses to notifications to Parties No 2020/023 and 2023/107 were checked to make a list of all relevant sources mentioned by Parties
2. Each source was reviewed, with any relevant global/generic information for the species as outlined in subheadings in bold in Figure 2 extracted with references, and any relevant approaches for collecting national/specific information for the species (e.g those subheadings in italics in Figure 2) collated under their relevant headings with links to sources
3. Step 2 was repeated for any NDFs (from the CITES NDF database[9], the CITES Tree Species Programme – CTSP- Website[10]) and other projects/reports from the CTSP under categories 'marking and traceability', 'capacity building and governance', and 'identification'
4. Whenever gaps remained for any information category A-H, sources outlined in Annex 4 to the document from the working group for NDFs in high-value timber species were reviewed for relevant data
5. Google scholar was searched for any additional data for each high priority species, limited to the most relevant findings from the first four pages of search results for the species name

Range states for all *Dalbergia* species were sourced directly from the CITES *Dalbergia* Checklist (Cowell et al., 2022), and for all other species from the Checklist Database of CITES species.

Any reference to sources or production species for each high priority species was noted and included in section 2.2.2 (a regional analysis of sources and production systems for high priority species).

For all medium-priority species, a collection of useful sources identified in the review were collated under each subheading for Parties to refer to when formulating NDFs.

[9] https://cites.org/eng/virtual-college/ndf
[10] https://cites-tsp.org/

2.1.1 Factsheets for high-priority CITES-listed rosewood tree species

These factsheets provide background information that can be used and assessed when developing NDFs as outlined in Resolution Conf. 16.7 (Rev. CoP17) para. 1. a) ix) A-H, with a focus on global/generic information that can be of most use to all Parties regardless of local context. Subheadings most relevant to timber species for each information category A-H recommended for inclusion in Resolution Conf 16.7 were sourced from Module 10 on NDFs for tree species formed under the NDF project and the 9-step process for producing NDFs for timber/tree species. Some subheadings (such as growth rates under information category A species biology/life-history characteristics), have an asterix. This indicates that Parties are encouraged to use their own data from forest management units for characteristics in these subheadings, although any known estimates are provided and may be useful as proxy values until such data can be collected. Information from some subheadings and subheadings in categories A-H were not included in the main factsheet as these data need to be collected by Parties in forest management units (see those in italics in Figure 2). Any example approaches to collecting these data at a national level, or reports with information specific to Parties containing such data, were however provided in the section entitled 'Useful resources for other information related to NDFs'. It is recommended Parties supplement the information provided in the factsheets with a shorter literature to fill gaps where needed, or to collate more up to data on information such as legal and illegal trade and conservation status.

a) Africa

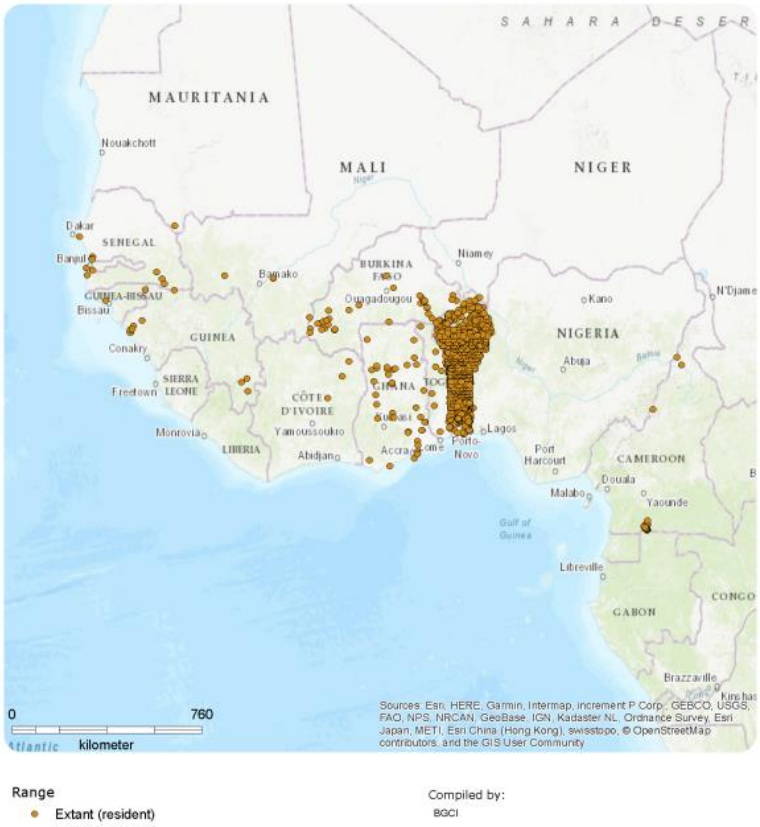
Factsheet 1: *Pterocarpus erinaceus*

Refer to 'factsheet overview' in the introduction to section 2.1.1 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. erinaceus* 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). 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.

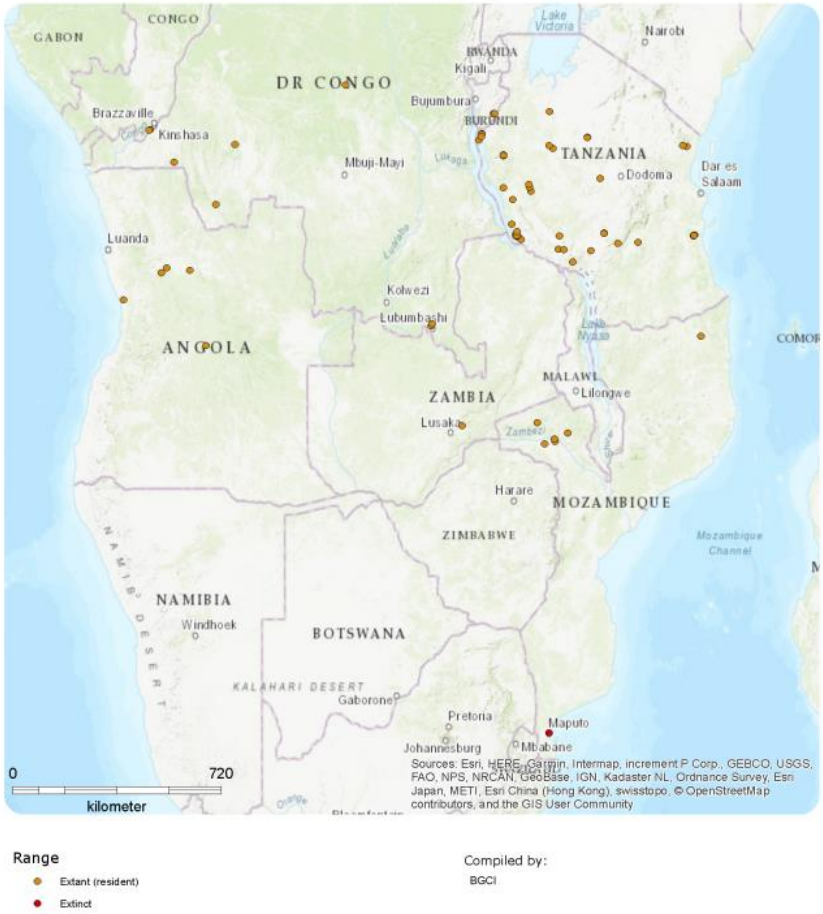
Consideration of the potential impacts of climate change on future management of the species are outlined in Adjonou et al. (2020) (see https://www.cell.com/heliyon/pdf/S2405-8440(20)30875-6.pdf).

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)

Factsheet 2: *Pterocarpus tinctorius*

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

Pterocarpus tinctorius	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g soil, climate)	*Pterocarpus tinctorius* can grow in a variety of habitats including evergreen rainforest, riverine forest, and wooded savanna. It often occurs on rocky hills (Lemmens, 2008) and on stony soils and termite mounds (Oliver et al., 1871 in African Plant Database, 2023). The species grows at altitudes of 450-1,750 m according to Phiri et al., (2015), or a wider range of 50-1,800 m reported by another source (Oliver et al., 1871 in African Plant Database, 2023). *Pterocarpus tinctorius* is heliophilous (e.g. adapted to, or tolerant of, a high level sunlight).
Tree characteristics (e.g maximum height and diameter)	The morphology of the species varies across its range (CoP18 Proposal 54, 2019). *Pterocarpus tinctorius* is small to medium in size and can grow up to 25 m in height according to Lemmens (2008), or in some instances up to 30 m (Oliver et al., 1871 in African Plant Database, 2023). The trunk can be branchless for up to 15 metres and can reach up to 75 cm in diameter (assumedly DBH, but this is not explicitly stated by the author) (Lemmens, 2008).
Growth rates *	The species is classified as slow-growing (Phiri et al., 2015) and can take up to 90 years to reach maturity (Burkill, 1995 in Phiri et al., 2015).
Role of species in Ecosystem*	The leaves of the tree are commonly eaten by colobus monkeys and chimpanzees, and the foliage can be browsed by goats (Lemmens, 2008), as well as other livestock such as cattle and sheep (Phiri et al., 2015). Forest elephants eat the tree sprouts, and baboons and squirrels the seed pods (CoP18 Proposal 54, 2019). The species can form symbiotic associations with soil bacteria to fix atmospheric nitrogen (CoP18 Proposal 54, 2019). One study sampled roots from the species to identify mycorrhizal fungi inhabiting the plant and found around 30 unique taxa from five genera: *Rhizophagus, Dominikia, Glomus, Sclerocystis and Scutellospora*, with higher diversity of species identified in acidic soils with high levels of aluminium and iron (Kaumbu et al., 2023). *Pterocarpus tinctorius* is classified as a pioneer species and could be a good potential candidate for restoration of degraded woodland (Kaumbu et al., 2021).

Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)	In Zambia, the tree has been reported to be resistant to seasonal fires (Phiri et al., 2015). The tree can be evergreen or deciduous. Flowers are thought to be pollinated by bees and based on data from Democratic Republic of the Congo (DRC), the trees flower between March and May (Lemmens, 2008).
B. Species range	
Global/geographic distribution	The species is widely distributed (Barstow, 2018). The CITES Checklist of species states the species is native to Angola, Congo, Democratic Republic of the Congo, Malawi, Mozambique, United Republic of Tanzania, Zambia (UNEP-WCMC, 2023). The IUCN Red List assessment conflicts with this and does not include Congo as part of it's native range, but does include Burundi (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). 

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	Although the species can be locally common, the overall global population is thought to be in decline as a result of harvesting for timber. It's in high demand in local markets but it is predicted that international demand will increase as other *Pterocarpus* timber species become increasingly rare/protected (Barstow, 2018). The species is not recognised as a Hongmu species in China's National Hongmu Standard (last revised in 2017) but is used as a replacement for Hongmu species (Zhang and Kin Keong, 2022). The species is subject to over harvesting and illegal logging due to high international demand (Phiri et al., 2015). Lemmens (2008) stated the species is likely traded internationally in small quantities, and occasionally traded in mixed consignments with other Pterocarpus species as 'African padauk', as well as specifically being traded as an alternative to the threatened *Pterocarpus angloensis.* A TRAFFIC 2017 report also stated the species is a substitute for wood from *Pterocarpus angloensis* (Lukumbuzya and Sianga, 2017) and it was additionally reported thought likely to be used as a substitute for *Pterocarpus santalinus* in a rosewood market survey in China (Zhang and Kin Keong, 2022). Threats to the species documented in Winfield et al., (2016) include selective logging for domestic markets/use, and harvest for export.
E. Historical and current species-specific levels and patterns of harvest and mortality	
Global legal/illegal trade	In 2008, it was reported that the wood was traded internationally only in small quantities, and that locally it was in great demand (e.g., in Burundi and DRC) (Lemmens, 2008). Between 2010-2012 there was reported to have been a 'boom' in a fake rosewood market, with the species exported to China after mixing with *Pterocarpus santalinus* in Viet Nam and the Phillipines. More recently, however, the species has become recognised as a species in demand with traders and importers in markets in China, with less mixing thought to occur and more direct shipments to China (Cerutti et al., 2018). International legal trade volumes reported may be underestimated due to illegal logging of the species (Barstow, 2018, in reference to illegal logging reported in Phiri et al., 2015) A TRAFFIC report on timber trade in East and Southern Africa in 2017 states that the species is more in demand in international markets such as China, and less so in domestic markets (Lukumbuzya and Sianga, 2017). A TRAFFIC rosewood market survey report in China suggested that the relatively lower prices for *P. tinctorius* compared with the three most expensive rosewood species for sale (*Dalbergia odorifera, Pterocarpus santalinus and Dalbergia cochinchinensis*), may make the species a target for customers with a lower purchasing power that wish to purchase rosewood products (Zhang and Kin Keong, 2022).

Known uses	The density of the wood at 12% moisture content ranges from ~ 450 kg/m^3 (for forest trees in Mayombe, DRC) to ~900 kg/m^3 (for savanna trees in Burundi). The heartwood is pale yellow when freshly cut and turns to pinkish red upon exposure to air (Lemmens, 2008), and is elsewhere described as 'golden reddish' (Phiri et al., 2015). The species is popular in furniture making, cabinet making, and decorative parquet floors, packing crates, light construction, and carvings, with the reddish dye also used to decorate the body (Lemmens, 2008). The tree can also be used by local communities for firewood, and manufacture of charcoal (Phiri et al., 2015). The wood is easy to saw and work and is generally not liable to splitting. It is moderately durable to durable, with the lighter wood susceptible to termite attack and slightly liable to *Lyctus* attack but heavier wood more resistant to both (Lemmens, 2008). Feng shui columns, and furniture (e.g tea tables and chair sets) made from *Pterocarpus tinctorius* were observed offered for sale in a TRAFFIC market survey in China (Zhang and Kin Keong, 2022). The species is a priority medicinal plant tree used by local communities around the miombo woodland of Urumwa Forest Reserve in Tanzania (Augustino and Hall, 2008).
F. Management measures	
Capacity for regeneration *	The species has been observed responding well to coppicing in one district within Zambia (Phiri et al., 2015). Field observations in Zambia have shown fruit may be easily attacked by pests before it matures (Phiri et al., 2015).
Minimum felling diameter/rotation cycle*	In Zambia, the legal minimum felling diameter was 40 cm (assumedly DBH but not explicitly stated by the author), but this was reduced to 30 cm in 2013 (Cerutti et al., 2018). Data used to inform this diameter is not described by the authors.
Conversion factors*	No previously used conversion factors could be found for this species. Estimated conversion factors for various units (e.g., container, cubic meter, kilogram) to live tree equivalents for other species in the genus *Pterocarpus* (*Pterocarpus erinaceus* and *Pterocarpus santalinus)* 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)
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 tinctorius* has most recently been assessed for The IUCN Red List of Threatened Species in 2017 and is listed as Least Concern, largely due to its large extent of occurrence which exceeds the threshold for a threatened category (Barstow, 2018)
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Useful resources for other information related to NDFs for *Pterocarpus tinctorius*

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.

Population structure, status and trends (in the harvested area and nationally) (Category C)

A 2008 paper outlines a methodology for inventory and assessment of population structure for populations of the species in Tanzania (Augustino and Hall, 2008) (see https://www.ajol.info/index.php/tjfnc/article/view/51974)

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

The IUCN Red List assessment https://www.iucnredlist.org/species/62027862/62027864 (Barstow, 2018b) references various uses of the species. Uses specific to DRC and Tanzania are also outlined by Lemmens (2008) (see http://www.prota4u.org/search.asp), 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 under 'National utilisation' in CoP18 Prop. 54 (see https://speciesplus.net/api/v1/documents/10709).

The CoP19 Prop. 50 (to list all *Pterocarpus* species) also outlines illegal trade dynamics in the species (see 'national' in https://speciesplus.net/api/v1/documents/15663).

A 2022 study used publicly available Landsat type images to assess changes to landscapes in an area exploited for *P. tinctorius,* and were able to use this data to assess loss of forest cover (see Mukenza at al., 2022 **https://doi.org/10.3390/land11091541**)

A 2017 joint TRAFFIC WWF report on timber trade in East and Southern Africa references legal and illegal trade of the species in Tanzania, although this refers largely to trade between 2007 and 2014 (see p.15 of https://www.trafficj.org/publication/17_Timber-trade-East-Southern-Africa.pdf). The same report (p. 46) refers more generally to *P. tinctorius* being more in demand for international markets such as China, and less so for domestic markets.

A 2015 paper reports on threats and reports of illegal harvest in Zambia(Phiri et al., 2015) (see http://www.openscienceonline.com/journal/archive2?journalId=706&paperId=2442)

A 2022 TRAFFIC report on rosewood trade in China used trade statistics, online trade data, and physical market surveys to identify proportions/commodities from taxa for sale in different areas, and includes data on *P. tinctorius* (see https://www.traffic.org/site/assets/files/19229/rosewood_market_full_report_final.pdf)

The Rosewood chapter in the 2020 UNODC World Wildlife Crime Report makes some reference to P. tinctorius being traded as Kosso (see https://www.unodc.org/documents/data-and-analysis/wildlife/2020/WWLC20_Chapter_2_Rosewood.pdf), and other illegal trade dynamics for the species – including reference to reports in specific countries - are referred to under 'Illegal trade' in in CoP18 Prop. 54 (see https://speciesplus.net/api/v1/documents/10709).

A detailed analysis of trade between Zambia and China is presented in Cerutti et al. (2018) (see https://www.iied.org/sites/default/files/pdfs/migrate/13603IIED.pdf)

Some trade data from transit permit data in Namibia is supplied in a TRAFFIC report on a critical assessment of the economic and environmental sustainability of the Namibian indigenous forest/timber industry (Knott et al., 2021) (see https://www.traffic.org/site/assets/files/12756/namibia-timber-final-vweb.pdf)

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

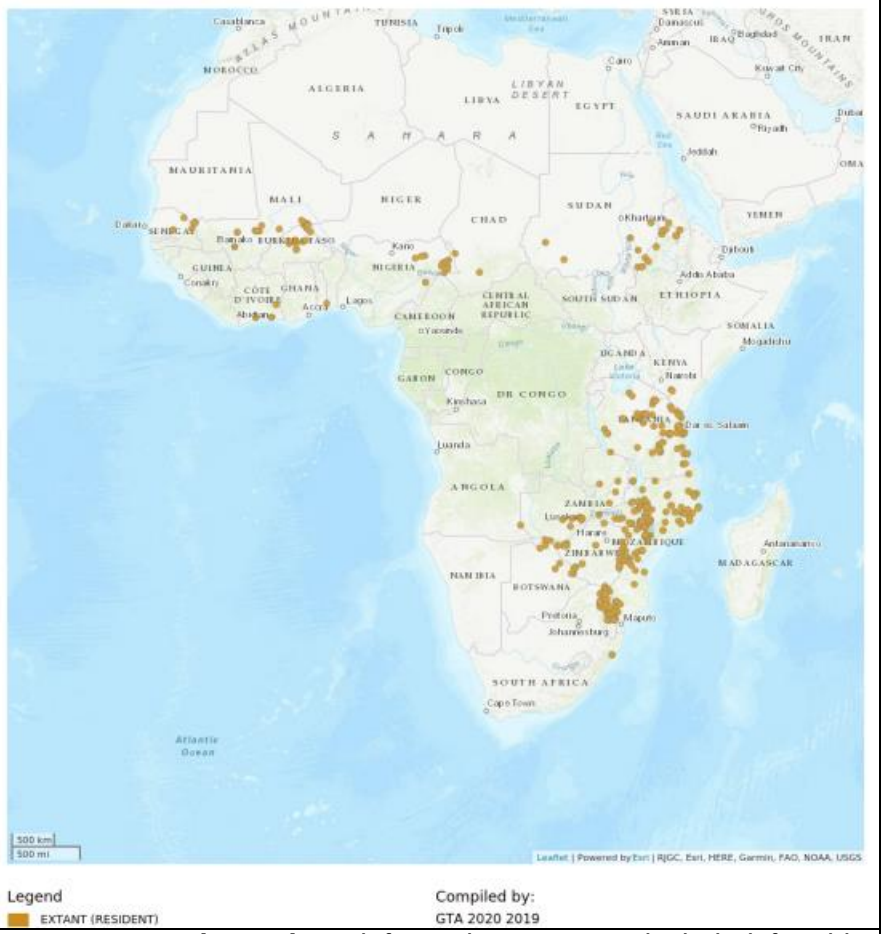
Some data relevant to the germination of the species, such as growth rates and productivity, are presented in Kaumbu et al. (2021) (see https://www.mdpi.com/1999-4907/12/2/117)

Factsheet 3: *Dalbergia melanoxylon*

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

Dalbergia melanoxylon	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g soil, climate)	The species occurs in dry savanna and tropical dry forests (Cowell et al., 2022). It occurs on a variety of substrates including dry, rocky sites, loamey-sandy and clayey soils (including black cotton) but is most common near water/in valleys with poor drainage (Lemmens, 2008). The species is said to refer clay clay-rich alluvial soils and termite mounds (Cunningham, 2016) and has shown high sensitivity to shallow soils on petroferric outcrops (Couteron and Kokou, 1997). The species is said to have a preference for dry miombo forests, where it often occurs on poor, rocky soils (Jenkins et al., 2012). It can grow from 0- 1,700 metres above sea level according to Barstow (2020) although Lemmens (2008) states the species is found up to 1,350 metres, or up to 1,900 metres in Ethiopia (CoP9 Proposal 79, 1994). Mean annual rainfall in the regions where it occurs vary between 700-1,200 mm (Lemmens, 2008). Temperatures in the species native range are between 18- 35 °C with no frost (CoP9 Proposal 79, 1994). In East and Southern Africa, the species is mainly an understorey tree found in open miombo woodland (Lemmens, 2008).
Tree characteristics (e.g maximum height and diameter)	The species is small and usually below 10 metres in height, rarely exceeding 15 metres according to Barstow (2020), although Lemmens (2008) states slightly greater height ranges of up to 12 (-20) metres tall. One source states the species 'rarely' exceeds 10 m in height (Jenkins et al., 2012). The trunk is usually fairly short and can be branchless for up to 2 (-3.5) metres, (Lemmens, 2008). The species can occur as a spiny shrub or a small tree (Lemmens, 2008). The species is commonly reported as having a diameter at breast height (DBH) of 30-50 cm, although it can reach a DBH over 1.5 metres (Barstow, 2020). Lemmens (2008) states diameters can be up to 50(–100) cm. Assumedly this measure refers to DBH but this is not explicitly stated by the author. Another source states the species 'rarely' exceeds 100 cm in diameter (again, assumedly DBH but not explicitly stated) (Jenkins et al., 2012).
Growth rates *	The species is generally slow-growing and it's been estimated it would take 70-100 years for the tree to be large enough to yield a fair amount of heartwood (Lemmens, 2008). Rotation rates are said to be up to 200 years in unmanaged forests, and 50-80 years under intensive management (Malimbwi et al., 2000)

	Annual increments in diameter have been documented to vary from 1cm in four years in natural woodland in Tanzania to 1.5 cm a year for cultivated trees (location not specified) (Lemmens, 2008). Height after seven years averaged between 2.8 metres (Senegal and northern Cameroon) to 3 metres (Malawi), with faster growth rates in Senegal they reached the same height in under four years (Lemmens, 2008). One study states that the species can be fast growing and can produce wood of a size and quality suitable for high value carving in less than ten years (Sprent and Parsons, 2000). Another estimate stated it would take around 133 years for the species to reach a minimum diameter at breast height (24cm in this instance) for felling (Cunningham, 2016). It has been reported that it is only in East Africa that the tree reaches a harvestable size in sufficient abundance for it to be of commercial use (Ball, 2004)
Role of species in Ecosystem*	Almost all mature trees are hollow and provide habitats for animals such as snails, reptiles and small mammals (Cunningham, 2016). The roots of the tree are able to fix nitrogen (Lemmens, 2008). The foliage and fruits of the tree are browsed by livestock/large mammals, and the flowers are a source of nectar for honey bees, which also pollinate it (Lemmens, 2008).
Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)	The logs may be affected by tunnel-boring larvae of cerambycid beetles. The species have an extensive root system which can help them to survive drought, and mature trees are fairly fire tolerant (Lemmens, 2008). One study found that seeds and young seedlings are vulnerable to high moisture levels, whilst older trees are water and light demanding (Washa and Nyomora, 2012). The species is deciduous (Lemmens, 2008). The development of fruits after pollination takes 6-8 months, and the timing of fruit maturity can vary; for example in South Africa, fruits mature between January and March and in Tanzania, between July and September (Washa, 2014). Threats documented by Winfield et al (2016) from various sources include diseases (specifically the heartwood being susceptible to fungal rot after fire damage), forest fires and predation (specifically from beetles and herbivores).
B. Species range	
Global/geographic distribution	The species is widespread and occurs in multiple sub-Saharan countries (Barstow, 2020). The Dalbergia checklist states the species is native to Angola, Burkina Faso, Botswana, Democratic Republic of the Congo, Central African Republic, Côte d'Ivoire, Cameroon, Eritrea, Ethiopia, Kenya, Mali, Mauritania, Malawi, Mozambique, Namibia, Nigeria, Sudan, Senegal, South Sudan, Eswatini, Chad, Togo, United Republic of Tanzania, Uganda, South Africa, Zambia, Zimbabwe (Cowell et al., 2022). The IUCN Red List

	assessment conflicts with this and states the species is also native to Guinea (Barstow, 2020). See below for the global distribution map from the 2020 IUCN Red List assessment, compiled by the Global Tree Assessment (GTA). The overall extent of occurrence is estimated at 18 million km^2 and the area of occupancy at least 2,428 km^2, although it is thought likely to be at least double this (Barstow, 2020). The species has also been introduced in India and Australia (Lemmens, 2008) 
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 global population is decreasing, with an estimated of a global decline between 20-30% in the last 150 years (Barstow, 2020). Barstow (2020) states that with the species so widespread, the extent of declines varies between localities and at a country level. Despite it's wide distribution, it is only in East Africa that the tree reaches harvestable sizes in abundance great enough to be commercially viable; this has led to exhaustion of commercial stocks in Kenya, with most timber from the species now coming from Mozambique and Tanzania (Ball, 2004).

	The IUCN Red List assessment states the species shows poor regenerative abilities, is subject to high rates of exploitation (particularly in Mozambique and Tanzania) and is also threatened by habitat decline across its range. It is thought likely to continue declining at a rate of 20-30% in the next 100 years, although some 'unmerchantable' trees will remain in the species' habitat, making declines greater than this unlikely. Legislation of the species-protected status is poorly enforced in some countries, with the species illegally harvested. Logging of commercial-sized trees can impact regeneration due to the loss of mature trees, and although the natural rotation is said to be 100 years, most rotations used are thought to be shorter than this e.g., 60-80 years (Barstow, 2020). Cunningham (2016) stated that if current levels of exploitation continue, commercial logging is likely to become non-viable and stated habitat loss due to clearing for commercial/subsistence agriculture, poor fire management, and felling of trees across a range of diameter classes for domestic and export purposes have led to population declines in the species. The slow growth of the species makes plantations a poor option from an economic perspective (Lemmens, 2008). Threats documented by Winfield et al (2016) from various sources include climate change induced habitat degradation and fragmentation, selective logging for domestic markets/use, and harvest for export.
E. Historical and current species-specific levels and patterns of harvest and mortality	
Global legal/illegal trade	A series of studies on the distribution of the species between 2001 and 2016 show the majority have unstable populations, unsustainable harvest, and poor recruitment in both protected and unprotected areas (a reference to studies collated by Winfield et al., 2016 in UNEP-WCMC, 2017). The species was said to have been previously common across Southern, Eastern, Central and Western Africa and now only viable for commercial extraction in Tanzania (mainly Southeast) and Mozambique (mainly Northern) (Jenkins et al., 2012). Overexploitation in Kenya has previously led to a need for importation of the species from other countries (CoP9 Proposal 79, 1994). In 2013, the species was classified as ordinary/low end price class based on observations from various rosewood markets (Forest Trends, 2013). A 2022 TRAFFIC report from a rosewood market survey stated most of the timber in this species comes from Mozambique (Zhang and Kin Keong, 2022a). The authors state that although the quality of finished furniture from the species is good, it is difficult and expensive to process, and has a black colour most Hongmu consumers in China do not favour. Furniture from the species was said to have first been observed in markets in around 2005 and is used by some well known brands. They also state the price has been stable for a 'long time', although due to differences in the quality of specimens the price for some could be ten times above the average for the species. Stock for the species in markets

	in China is reportedly 'medium' based on interviews conducted as part of the market survey (Zhang and Kin Keong, 2022b).
Known uses	The heartwood is very dark brown to purplish black and the wood is very heavy; the sapwood has a density of about 1180 kg/m^3 and the heartwood of 1230–1330 kg/m^3 at 12% moisture content. Wood harvested from drier regions is said to be of higher quality (thought to be due to slower growth), whereas wood grown under 'optimal' conditions may be lower quality (e.g lighter coloured and lower density) heartwood (Lemmens, 2008). The highest quality wood is said to originate from slow-growing natural forests, with trees grown in plantations and therefore usually artificially watered not considered to be of sufficiently high quality (Jenkins, 2012). The species is in international demand for musical instruments, for reproduction furniture in China, and for African wood carvings often exported by tourists (Cunningham, 2016). Timber from the species has a high durability against termite and fungal attacks based on experimental data (Nakai and Yoshimura, 2020). In 2008 Europe was said to be the main importer of commodities from the species (Lemmens, 2008). In 2017, UNEP-WCMC reported that demand had shifted from the tonewood industry, based mainly in Europe and the USA, to furniture production in China, with most of the trade now for the Chinese Hongmu furniture industry (UNEP-WCMC, 2017). The species is recognised as a Hongmu species in China's National Hongmu Standard (last revised in 2017) (Zhang and Kin Keong, 2022a). It may also be used locally for construction, production of household goods, charcoal production and firewood, and livestock fodder (Barstow, 2020). The species may also be used in windbreaks and live fences and has multiple medicinal uses from parts including the stem, roots, leaf sap and bark (Lemmens, 2008). The species may also be planted for nitrogen fixation and to reduce soil erosion (Barstow, 2020), which it helps prevent through it's extensive root system (Lemmens, 2008).
F. Management measures	
Capacity for regeneration*	Small seedlings are vulnerable to fire and require light, with regeneration absent in a closed forest and reduced by regular fires. The species can reproduce via seeds, coppice shoots and root suckers, with regeneration 'often plentiful' after land clearance in regions where the species is common (Lemmens, 2008). Evidence from a study in Tanzania indicated that the regeneration of the species was higher in the absence of competition and/or the presence of light (Ball, 2004).

Minimum felling diameter/rotation cycle*	One guide references mature trees being a maximum of 38-40cm DBH, with some trees having been found with a DBH of more than 60 cm (Nshubemuki, 1993). Existing regulations for minimum diameters at breast height for commercial logging varies. There is a minimum legal size of 20 cm in Mozambique and 24 cm in Tanzania (Cunningham, 2016). Previously Lemmens (2008) stated logs of at least 70cm long, and 22cm in diameter, were considered of exploitable size in Tanzania.
Conversion factors*	Salvage rates in Tanzania were estimated to be 5-8% of the felled stems, with the use of circular saws instead of band saws, and limited investment in equipment, said to increase wastage rates, and reject instrument blanks with minor flaws likely to be burnt for charcoal (Cunningham, 2016). Lemmens (2008) stated the bent/twisted logs of this species could make sawing difficult and increase wastage, with recovery rates of wood from the species sawn for export estimated at 9%. One study in Southern Tanzania estimated 83% of the volume of standing trees was composed of heartwood, with the remaining 17% sapwood and bark (Malimbwi et al., 2000). The Cop9 proposal (CoP9 Proposal 79, 1994) stated only the best parts of the heartwood are suitable for export with up to 90% being discarded. Wood volumes of 10m^3/ha in inland forests produced merchantable volumes of 4.4 m^3/ha (43% of the total volume) and wood volumes of 5m^3/ha in coastal forests produced much lower merchantable volumes of 1.7m^3/ha (33%) in one study in Tanzania (Malimbwi et al., 2000). One study indicated the volume of timber harvested from an average tree varied between 0.1-0.2m ^{3} (Jenkins, 2002 in UNEP-WCMC, 2017). Conversion factors used by UNODC for estimates of the conversion of mass in trade to the number of logs for *Dalbergia* species are 125 kg of timber: 1 log (UNODC, 2023). Conversion factors for various units (e.g., container, cubic meter, kilogram) to live tree equivalents for *D. melanoxylon* are also 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)
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	*Dalbergia melanoxylon* has most recently been assessed for The IUCN Red List of Threatened Species in 2020 and is listed as globally Near Threatened under criteria A2cd+3cd+4cd (Barstow, 2020)
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Useful resources for other information related to NDFs for *Dalbergia melanoxylon*

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.

Details on factors such as trends and quantities of trade in the species, indications of illegality, management and population sizes/trends (e.g multiple categories) in Mozambique, South Africa and United Republic of Tanzania are outlined in UNEP-WCMC (2017) (see p.20-24 in https://www.blackwoodconservation.org/wp-content/uploads/2019/07/UNEP-WCMC_Review-of-selected-Dalbergia-species-and-Guibourtia-demeusei.pdf)

Species range (Category B) Population structure, status and trends (in the harvested area and nationally) (Category C)

The 2020 IUCN Red List makes reference to some population studies and trends (although many outdated) in countries including Tanzania, Kenya, Mozambique, Malawi, Senegal, Mali, Sudan and Zimbabwe (see 'population' in https://www.iucnredlist.org/species/32504/67798379). Some data (also largely outdated) on populations in Angola, Botswana, Chad, Democratic Republic of Congo, Ethiopia, Burkina Faso, Kenya, Malawi, Mozambique, Namibia, Nigeria, Senegal, South Africa, South Sudan,

Sudan, Tanzania, Uganda, Zambia and Zimbabwe are also referenced in CoP 17 Inf. Doc. 47, a trade study of select East African timber production species (see p.37-38 in https://cites.org/sites/default/files/eng/cop/17/InfDocs/E-CoP17-Inf-47.pdf

An approach to the inventory of populations of the species in Tanzania is outlined in Malimbwi et al. (2000). See https://www.jstor.org/stable/23616468 and also in Opulukwa et al. (2002) see https://jambo.africa.kyoto-u.ac.jp/kiroku/asm_normal/abstracts/pdf/23-1/1-10.pdf, in Hamza et al. (2004) (see https://www.ajol.info/index.php/tjfnc/article/view/40701)) and Nakai et al. (2019) (see https://link.springer.com/article/10.1186/s10086-019-1818-0)

Winfield et al (2016) also make reference to some population data for the species for various countries (see p. 99-103 and 114-116 in https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Global-Status-of-Dalbergia-and-Pterocarpus-Rosewood-CITES-2017-.pdf)

There are various reports on populations of the species in Tanzania. An approach to collecting data on density of the species, and diameter at base height distribution is demonstrated in Modest et al., 2010 (see https://www.ajol.info/index.php/ejesm/article/view/63964) and data on factors such as height, stems and volume per hectare, and diameter classes in Opuluwa et al., 2002 (see https://jambo.africa.kyoto-u.ac.jp/kiroku/asm_normal/abstracts/pdf/23-1/1-10.pdf), and distribution and harvestable worth of trees in Tanzania in Ball, 2004 (see https://doi.org/10.1017/S0030605304000493)

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

Further details on uses of the species in Mozambique and Tanzania are referenced in Cunningham (2016) throughout the document, inclusive of comparative costs for timber versus use in musical instruments (e.g p. 55-57, 59, 61 in https://cites.org/sites/default/files/eng/cop/17/InfDocs/E-CoP17-Inf-47.pdf). Winfield et al (2016) also document a range of known uses (see p. 146 in https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Global-Status-of-Dalbergia-and-Pterocarpus-Rosewood-CITES-2017-.pdf) and a study in 2004 surveys individuals in a district in Tanzania to identify uses of the species (see https://www.ajol.info/index.php/tjfnc/article/view/40701)

A Timber flow study export/import discrepancy analysis by the International Institute for Environment and Development uses customs data to show reported imports of the species into China from Mozambique between 2004-2013 (see p. 18 and 30 in https://www.iied.org/sites/default/files/pdfs/migrate/13579IIED.pdf)

Although now outdated, a 2007 TRAFFIC report summarises evidence of harvest and trade in the species in Tanzania (see https://www.trafficj.org/publication/07_Forestry_Governance_and_national.pdf)

An approach to estimating merchantable volumes from volumes in forests is outlined in Malimbwi et al. (2000). See https://www.jstor.org/stable/23616468

One study (Couteron and Kokou, 1997) shows a method used to estimate mortality rates in the species (see https://link.springer.com/article/10.1023/A:1009723906370)

Prior levels of export from Tanzania and Cabo Delgado province in Mozambique, with some price data given, are outlined in Winfield et al (2016) (see p.147 in https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Global-Status-of-Dalbergia-and-Pterocarpus-Rosewood-CITES-2017-.pdf) and some other historic harvest and trade data for both countries in Jenkins et al., 2012 (see p.50-51 in https://www.traffic.org/site/assets/files/7279/precious-woods.pdf)

An approach to calculating harvest rate, calculated using the number of stumps per hectare, is demonstrated in Modest et al., 2010 (see https://www.ajol.info/index.php/ejesm/article/view/63964)

A 2020 TRAFFIC report presenting findings from a rosewood market survey in China provide data on prices and trade dynamics for the species (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)

CoP 17 Inf. Doc. 47 refers to some success in cultivation of the species, as well as barriers (see p. 47-50, 72, 77-78 in https://cites.org/sites/default/files/eng/cop/17/InfDocs/E-CoP17-Inf-47.pdf)

A protocol for micropropagation of the species is outlined in a 2014 published article (see http://www.usa-journals.com/wp-content/uploads/2014/11/Kiondo_Vol212.pdf) and other protocols relevant to propagation and management are outlined in Lemmens (2008) (see propagation and planting, management and harvesting in https://prota.prota4u.org/protav8.asp?h=M4&t=Dalbergia,melanoxylon&p=Dalbergia+melanoxylon#Synonyms)

There are multiple studies available on techniques for propagation and germination of the species (see https://link.springer.com/article/10.1007/s11056-009-9163-6, https://www.cabdirect.org/cabdirect/abstract/20093223040 , http://www.usa-journals.com/wp-content/uploads/2014/10/Kiondo_Vol211.pdf , http://repository.costech.or.tz/handle/20.500.11810/1816 , https://www.ajol.info/index.php/tjs/article/view/79847 , http://www.usa-journals.com/wp-content/uploads/2014/11/Kiondo_Vol212.pdf and https://www.ajol.info/index.php/huria/article/view/110858)

A summary of studies on propagation and conservation of the species is provided in a literature review by Washa (2014). See https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Washa-B.-Washa-A-Review-of-the-Literature-of-DM-IJPFS-PAPER-2014.pdf

Conservation status (Category H)

The 2020 IUCN Red List makes reference to national red list assessments in South Africa, Zimbabwe, Malawi, Zambia and Uganda (see 'conservation actions' in https://www.iucnredlist.org/species/32504/67798379)

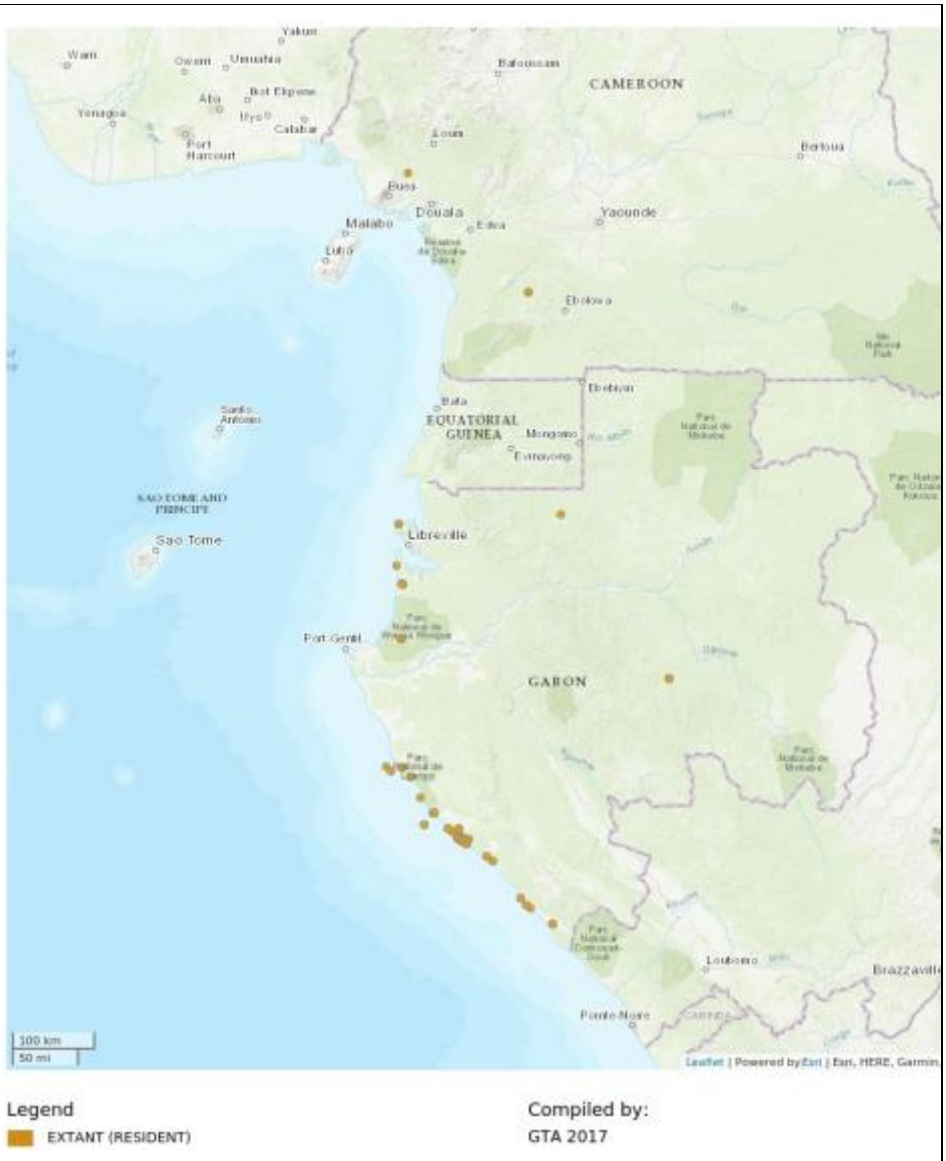
Factsheet 4: *Guibourtia pellegriniana*

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

Guibourtia pellegriniana Note; given the similarity of this species morphologically with *Guibourtia tessmannii*, it is not possible to separate the population and trade data for the two species (Barstow et al., 2021).	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g soil, climate)	The species occurs in evergreen coastal forests (Tosso et al., 2015), with anecdotal evidence that the species may also occur further inland (Doucet, personal communication in (CoP17 Proposal 56, 2016). The species occurs on well drained soils (Leemens et al., 2012 in (CoP17 Proposal 56, 2016). A report from Gabon states the species (and *G. tessmannii*) is semi heliophilous (e.g adapted to, or tolerant of, high levels of sunlight) and non-gregarious (e.g., does not occur in close groups) (Meunier et al., 2015).
Tree characteristics (e.g maximum height and diameter)	A guide to tree species in Gabon states the species (and *G. tessmannii*) can grow up to 60 m high and 2 m in diameter (Meunier et al., 2015), whilst specimens of Bubinga (a trade term for this species, *G. tessmannii* and *G. demeusei*) and Kevazingo (a trade term for this species and *G. tessmannii*) have been observed to reach base diameters of over 2 m (CoP17 Proposal 56, 2016).
Growth rates *	The growth rate of the species estimated at 0.35 cm to 0.45 cm in diameter per year (assumedly DBH but not explicitly stated by the author) (Oteng-Amoako, 2012 in Barstow et al., 2021)

Role of species in Ecosystem*	Dispersers identified in the CoP17 Proposal to list the species (with *G. tessmannii and G. demeusei*) include the emien's rat (*Crycetomis emini*), the striped funisciurus (*Funiciurus anerythrus*), the black guinea fowl (*Agelastes niger*), the Mandril (*Mandrillus sphynx*), the giant turaco (*Corythaeola cristata*) , the great black-helmeted hornbill (*Ceratogymna atrata*) and the pygmy hornbill (*Toackis camurus*) (CoP17 Proposal 56, 2016). Like other forest species, the species plays a role in determining the spatial structure of plant communities CoP17 Proposal 56, 2016). The IUCN Red List assessment references a paper on seed dispersal in *G. tessmannii,* (a species morphologically similar to this species), which states that a primate (*Cercopithecus nictitans nictitans*) and a hornbill (*Ceratogymna atrata*) were important seed dispersers in Gabon (Tosso et al., 2017), and states these are likely to be seed dispersers of this species too (Barstow et al., 2021). The same study states a rodent (*Cricetomys emini*), could be both a predator and disperser of seeds of *G. tessmannii* in Cameroon (Tosso et al., 2017).
Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)	In Gabon, the species has been documented to fruit from December to July (Aubréville, 1968 in Tosso et al., 2015). The species is hermaphroditic (CoP17 Proposal 56, 2016).

B. Species range	
Global/geographic distribution	The CITES Checklist of species states the species is native to Cameroon, Congo, Gabon, Nigeria (UNEP-WCMC, 2023). The IUCN Red List assessment, which references the proposal to list the species in CITES Appendix II, conflicts with this and does not include Nigeria in the list of countries *G. pellegriniana* is native to (CoP17 Proposal 56, 2016 in Barstow et al., 2021). See below for a distribution map from the IUCN Red List Assessment with data compiled by the Global Tree Assessment (Barstow et al., 2021) The species has an estimated extent of occurrence of over 180,000 km^2 (Barstow et al., 2021). The populations of this species (and that of *G. tessmannii*) are scattered in relatively low densities in narrow overlapping ranges across the three range States (CoP17 Proposal 56, 2016). See below for a distribution map from the IUCN Red List Assessment (Barstow et al., 2021)

	
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 IUCN Red List assessment states Illegal logging and trade of the species (driven by a decline in other rosewood species such as *Dalbergia* species) occurs and this is thought to present the greatest threat to the species in the short/medium term. The species has been over exploited for its timber, and market demand has significantly increased since the 1990s. Although there is a lack of inventory and population data for the species, experts estimated a 50% decline in populations in the next 100 years based on all information available at present (Barstow et al., 2021).

	A surge in the value of Bubinga (a trade term for this species, *G. tessmannii* and *G. demeusei*) and Kevazingo (a trade term for this species and *G. tessmannii*) has led to illegal harvest and export of these species, which was reportedly (in 2016) the most expensive wood from the rainforests of Central Africa. Harvest of the species is reported to have been particularly high between 1990 and 2010. The species occurs in low densities likely due to commercial exploitation, and national export statistics for the Bubinga and Kevazingo are likely to be underestimates of true quantities, due to undeclared/illegal export (CoP17 Proposal 56, 2016).
E. Historical and current species-specific levels and patterns of harvest and mortality	
Global legal/illegal trade	When collecting and interpreting trade data for this species, it is important to note that confusion between this species, *G. tessmannii* and *G. demeusei* are 'widespread' in the international market (CoP17 Proposal 56, 2016). The species is traded under the common term Bubinga (a trade term for this species, *G. tessmannii* and *G. demeusei*) and Kevazingo (a trade term for this species and *G. tessmannii*) (CoP17 Proposal 56, 2016). Bubinga and Kevazingo have been sold on international tropical wood markets since the first half of the 20th century. In earlier years, timber from the species was reported to be exported mainly to Europe, but since 2009-2010 commercial pressure has increased due to growing demand from Chinese markets for rosewood in Hongmu furniture and cabinetmaking, with the species having aesthetic qualities similar to Asian species of rosewood most valued by consumers of Hongmu products. The price value for Bubinga and Kevazingo is reported to have increased markedly between 2012 and 2016 (CoP17 Proposal 56, 2016).
Known uses	The wood is red in colour, fine grained and heavy (Barstow et al., 2021). A more detailed description in the CoP17 Proposal to list the species states the wood of this species (and *G. tessmannii*) is hard and heavy, pinkish or reddish brown, and with fine purplish red, or darker brown, veins. The grain is sometimes wavy but generally fine (e.g not varying in size) (CoP17 Proposal 56, 2016). The timber from the species has a density of 940 kg/m^3 at 12% moisture content (Obeng 2011). The species is used mostly for rosewood, which is in demand in China to produce Hongmu furniture. Locally, the species is traded at a lower price than internationally and used to produce high quality furniture (Barstow et al., 2021). Bubinga and Kevazingo have been considered one of the most valuable woods for carpentry and cabinetmaking for sale in domestic markets (CoP17 Proposal 56, 2016). Timber from *Guibourtia* species is generally hard, stable and resistant to fungi and termites (Tosso et al., 2015). The species also has socio-cultural importance throughout its range (CoP17 Proposal 56, 2016). Locally, the leaves and bark are used in medicine, e.g., for treatment of malaria and the species is also used in fuel for domestic lighting (Meunier et al., 2015, Tosso et al., 2015). Trees in the surrounding areas of villages are often heavily utilised for this purpose according to a publication onuseful trees in Gabon (Meunier et al., 2015).
F. Management measures	

Capacity for regeneration*	Although the influence of harvesting on regeneration capacities of the species has not been evaluated, regeneration in the species is thought to be limited due to exploitation for timber, low population densities and modifications to populations of seed dispersers (CoP17 Proposal 56, 2016).
Minimum felling diameter/rotation cycle*	The minimum felling diameter for the species (assumedly DBH, but not explicitly stated by the author) is 90 cm in Gabon and 80 cm in Cameroon. There is a lack of data on fruiting diameter for the species, or scientific evidence to inform these current diameters. It is therefore recommended operators increase these values if they do allow for sufficient recovery after a first rotation (Tosso et al., 2015). For tree species in Central African countries with unfavourable population densities and structures, as well as low regeneration rates (criteria met by both *Guibourtia tessmannii* and *Guibourtia pellegriniana*) scientific communities in the early 2000s recommended that a minimum tree density was set for exploitation. It was recommended that only trees with density thresholds above 5 stems / km^2 be exploited. As of 2016, it was reported these had not been translated into legislation in the range States but were implemented in some FSC-certified concessions (CoP17 Proposal 56, 2016). A report produced for the ITTO states that the Minister of Forestry and Wildlife in Cameroon banned the harvest of Bubinga (defined in the report as *Guibourtia tessmannii, G. demeusei, G. pellegriniana, G. ehie, G. arnoldiana)* where density was low, classified as below 0.5 stem/ha (Betti, 2012).
Conversion factors*	No conversion factors could be found for this species.
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	The species was most recently assessed on the IUCN Red List in 2020 and classified as Endangered under criteria A4d (Barstow et al., 2021).

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Useful resources for other information related to NDFs for *Guibourtia pellegriniana*

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 (in the harvested area and nationally (category C)

A paper on animal communities involved in seed dispersal and predation of the species (Tosso et al., 2017) summarises population density information for *G. tessmanni* in a forest concession in Gabon and Cameroon (see https://onlinelibrary.wiley.com/doi/full/10.1111/aje.12480) This species is morphologically similar to *Guibourtia tessmannii* so the Red List Assessment refers to this study for population data for this species and notes that population data is for both species combined, although the reference provided (Tosso et al., 2017) refers to *G. tessmanni* only.

Other data on population abundance and structure in Gabon is presented in the CoP17 proposal to list the species in Appendix II (CoP17 Proposal 56) (see p.7-8 in https://speciesplus.net/api/v1/documents/9141) , although again this data is for *Guibourtia*

tessmannii and *Guibourtia pellegriniana* combined. See also annexes 1.3 and 6a for further details on forest concessions with both species, and densities, volumes, and equivalent commercial volumes in each concession.

A 2020 report on the evaluation of the state of progress of research on taxonomy, genetics, biology, ecology and governance of forest resources in Gabon produced under the CTSP (Midoko Iponga et al., 2020) presents data from the Gabonese National Herbarium site to show known distribution maps for *Guibourtia* species in Gabon (see p. 27 in https://cites-tsp.org/sites/default/files/project_files/2023-03/1.%20Revue%20Bibliographique.doc.pdf)

A 2020 study on the production, processing, transport, trade, control and surveillance of Kévazingo in Gabon produced under the CTSP (Essondo Ondo and Midoko Iponga, 2020) uses data from consultations with around fifteen forestry company development plans and summarises stems per hectare of *Guibourtia* species in different diameter classes for each forest concession, and potentially exploitable volumes of *Guibourtia* species for seven (see p. 13-21 in https://cites-tsp.org/sites/default/files/project_files/2023-03/1.%20Revue%20Bibliographique.doc.pdf). This data does not however provide data specific to *Guibourtia pellegriniana*

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

The IUCN Red List assessment references historic trade and country specific uses for logs from 'Kévazingo' (a trade name shared with *G. tessmannii* in Gabon) and Bubinga (a trade name for this species, *G. tessmannii* and *G. demeusei* in Cameroon) (see p.4-5 in https://www.iucnredlist.org/species/62026140/62026142)

Some information on domestic use of the Kevazingo and Bubinga in Cameroon are given in the CoP17 proposal to list the species in Appendix II (CoP17 Proposal 56) (see p.9 in https://speciesplus.net/api/v1/documents/9141). Trade data for Kevazingo and Bubinga (not species specific) from Gabon and Cameroon between 1987 and 2001 and 2006-2015, are also outlined in the CoP17 Proposal (see p.9-11).

Some recent trade data for *Guibourtia* spp. in China is summarised in a TRAFFIC rosewood market survey (see https://www.traffic.org/site/assets/files/19229/rosewood_market_full_report_final.pdf)

The 2020 study on the production, processing, transport, trade, control and surveillance of Kévazingo in Gabon produced under the CTSP (Essondo Ondo and Midoko Iponga, 2020) provides data on volumes of commodities from *Guibourtia* species harvested and exported between 2016-2018 (see p. 20 in https://cites-tsp.org/sites/default/files/project_files/2023-03/1.%20Revue%20Bibliographique.doc.pdf). This data does however not provide data specific to *Guibourtia pellegriniana*

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

Some information relevant to management, legislation, and protection of the species in Gabon and Cameroon is outlined in the CoP17 Proposal (see p.13-14 in https://speciesplus.net/api/v1/documents/9141).

The 2020 report on the evaluation of the state of progress of research on taxonomy, genetics, biology, ecology and governance of forest resources in Gabon (Midoko Iponga et al., 2020) summarises relevant policy and legislative frameworks relevant to management of the species in Gabon, and review the success of plantations (see p. 34-60 in https://cites-tsp.org/sites/default/files/project_files/2023-03/1.%20Revue%20Bibliographique.doc.pdf).

A national strategy and action plan for the sustainable management of species of *Guibourtia* species in Gabon has also been produced under the CTSP is also available at https://cites-tsp.org/sites/default/files/project_files/2023-03/2.%20Strategie-Plan%20Action_Keva.pdf, and a study on the production, processing, transport, trade, control and surveillance of Kévazingo in Gabon produced under the CTSP (Essondo Ondo and Midoko Iponga, 2020) summarises current control and traceability systems for *Guibourtia* species in Gabon, with recommendations for improvements to the current systems. (see p.22 – 42 in https://cites-tsp.org/sites/default/files/project_files/2023-03/Rapport_Tra%C3%A7abilit%C3%A9_Keva.pdf).

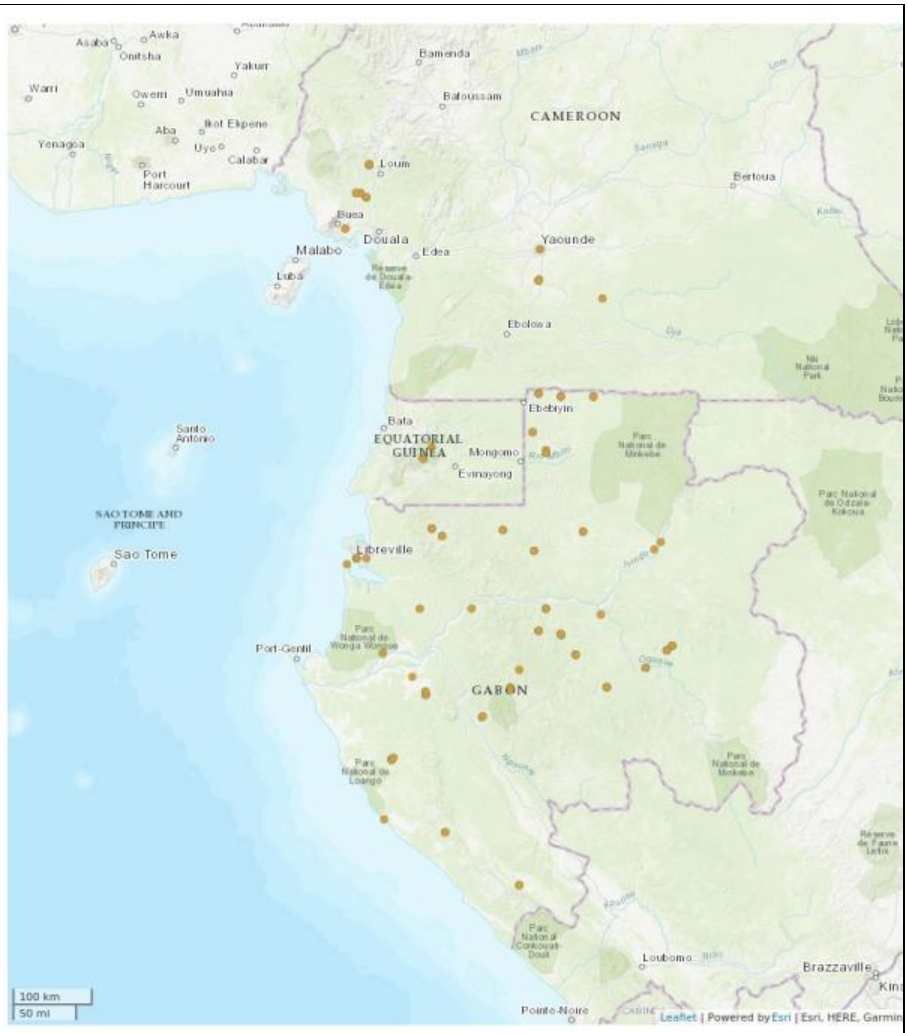
Factsheet 5: *Guibourtia tessmannii*

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

Guibourtia tessmannii Note; given the similarity of this species morphologically with *Guibourtia pellegriniana*, it is not possible to separate the population and trade date for the two species (Barstow et al., 2021).	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g soil, climate)	The species occurs in dense humid evergreen forests (Tosso et al., 2015). A study of the species in two evergreen forest concessions managed by Forest Stewardship Council (FSC)-certified logging companies (one in Gabon and one in Cameroon) characterises the concession areas as having rainfall between 1,686 mm (Cameroon) to 1700 mm (Gabon) a year, and annual average temperatures of 23.8°C (Cameroon) and 25.3°C (Gabon). In Cameroon, the soil in the forest concession is classified as yellow lateritic on acid rocks, and in Gabon ferralitic on Francevillien sandstone (Tosso et al., 2017). The species occurs on well-drained soils (Obeng, 2011) A report from Gabon states the species (and *G. pellegriniana*) is semi heliophilous (e.g adapted to, or tolerant of, high levels of sunlight) and non-gregarious (e.g., does not occur in close groups) (Meunier et al., 2015).

Tree characteristics (e.g maximum height and diameter)	Obeng (2011) states the tree is medium-sized and can grow up to 40m, but a guide to tree species in Gabon states the species (and *G. pellegriniana*) can grow up to 60 m high (Meunier et al., 2015). Both sources state the tree can grow up to 2 m in diameter (assumedly DBH, but not explicitly stated by either author). The trunk is straight and can be branchless for up to 20 m (Obeng, 2011). Specimens of Bubinga (a trade term for this species, *G. pellegriniana* and *G. demeusei* and Kevazingo (a trade term for this species and *G. pellegriniana*) have been observed to reach base diameters of over 2 m (CoP17 Proposal 56, 2016).
Growth rates *	The species is considered to be slow growing, with a growth rate of the species estimated at 0.35 cm to 0.45 cm in diameter per year (Oteng-Amoako, 2012 in Barstow et al., 2021).
Role of species in ecosystem	The seed is eaten by monkeys, chimpanzees and hornbills, which may also act as dispersers (Obeng, 2011). Dispersers identified in the CoP17 Proposal to list the species (with *G. pellegriniana and G. demeusei*) include the emien's rat (*Crycetomis emini*), the striped funisciurus (*Funiciurus anerythrus*), the black guinea fowl (*Agelastes niger*), the Mandril (*Mandrillus sphynx*), the giant turaco (*Corythaeola cristata*), the great black-helmeted hornbill (*Ceratogymna atrata*) and the pygmy hornbill (*Toackis camurus*) (CoP17 Proposal 56, 2016). A number of species were observed as dispersers of seeds from the species in a recent study; in Gabon, the putty-nosed monkey *Cercopithecus nictitans nictitans,* the black-casqued wattled hornbill *Ceratogymna atrata* and in Cameroon Thomas's rope squirrel *Funisciurus anerythrus* and the African pied hornbill *Tockus fasciatus.* The Emin's pouched rat *Cricetomys emini* is thought likely to be disperser of seeds in both Gabon and Cameroon. The Thomas's rope squirrel and Emin's pouched rat are also predators of seeds from the species (Tosso et al., 2017). Like other forest species, the species plays a role in determing the spatial structure of plant communities CoP17 Proposal 56, 2016).
Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)	In Gabon, the species fruits from December to July, and in Cameroon, during August (Aubréville, 1968 in Tosso et al., 2015). The species is hermaphroditic (CoP17 Proposal 56, 2016).

B. Species range	
Global/geographic distribution	The CITES Checklist of species states the species is native to Cameroon, Democratic Republic of the Congo (DRC), Equatorial Guinea and Gabon (UNEP-WCMC, 2023). This IUCN Red List assessment does not include DRC in the list of countries in the species' native range, and states the species is possibly extant in Congo and Nigeria (Barstow et al., 2021). See below for a distribution map from the IUCN Red List Assessment with data compiled by the Global Tree Assessment. The estimated extent of occurrence of the species is at least 265,847 km^2 across it's confirmed range (Barstow et al., 2021). The populations of this species (and that of *G. pellegriniana*) are scattered in relatively low densities in narrow overlapping ranges across its' range States (CoP17 Proposal 56, 2016).

	
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	Growing demand for the species in Asian markets has led to a sharp increase in illegal logging, which is the prominent threat to the species (Barstow et al., 2021). This threat is exacerbated by low population densities in this species. Although there is a lack of inventory and population data for the species, experts estimated a decline of over 50% in populations in the next 100 years based on information available at present (Barstow et al., 2021). Changes to hunting dynamics of mammal and bird species identified dispersing the seeds of the species in Tosso et al (2017) could impact upon regeneration of the species (Barstow et al., 2021).

	A surge in the value of Bubinga (a trade term for this species, *G. pellegriniana* and *G. demeusei* and Kevazingo (a trade term for this species and *G. pellegriniana*) has led to illegal harvest and export of these species, which was reportedly (in 2016) the most expensive wood from the rainforests of Central Africa. Harvest of the species is reported to have been particularly high between 1990 and 2010. The species occur in low densities due to commercial exploitation, and national export statistics for the Bubinga and Kevazingo are likely to be underestimates of true quantities, due to undeclared/illegal export (CoP17 Proposal 56, 2016).
E. Historical and current species-specific levels and patterns of harvest and mortality	
Global legal/illegal trade	When collecting and interpreting trade data for this species, it is important to note that confusion between this species, *G. pellegriniana* and *G. demeusei* are 'widespread' in the international market (CoP17 Proposal 56, 2016). This species is morphologically similar to other *Guibourtia* species, which have common trade terms that incorporate one or more different species, making identification of species in trade challenging. The species is traded as 'Bubinga' in Cameroon (which includes *G. tessmannii, G. pellegriniana* and *G. demeusei*) and Kévazingo in Gabon (which includes *G. tessmannii* and *G. pellegriniana*) (Barstow et al., 2021). Bubinga and Kevazingo have been sold on international tropical wood markets since the first half of the 20th century. In earlier years, timber from the species was reported to be exported mainly to Europe, but since 2009-2010 commercial pressure has increased due to growing demand from Chinese markets for rosewood in Hongmu furniture and cabinetmaking, with the species having aesthetic qualities similar to Asian species of rosewood most valued by consumers of Hongmu products. The price value for Bubinga and Kevazingo were reported to have increased markedly between 2012 and 2016 (CoP17 Proposal 56, 2016).
Known uses	The heartwood is reddish brown, often with violet-brown or purplish streaks, and distinct from the sapwood, which can be up to 7.5 cm. The grain of the timber is straight or interlocked, with a fine texture, and even (Obeng, 2011). A description in the CoP17 Proposal to list the species states the wood of this species (and *G. pellegriniana*) is hard and heavy, pinkish or reddish brown, and with fine purplish red, or darker brown, veins. The CoP17 Proposal also states the grain is sometimes wavy but generally fine (CoP17 Proposal 56, 2016). The wood has a scent when freshly cut. The wood is heavy and hard, with a density of 860–930 kg/m³ at 12% moisture content. It is fairly easy to saw and work with machines and hand tools. The heartwood is resistant to the absorption of preservatives (Obeng, 2011). The species has high commercial and social importance (Tosse et al., 2016). Uses of commodities from the species include medicine, for protection against bad luck, in pesticides in agriculture, and as a fuel for domestic lighting (Tosso et al., 2015). The species is a sacred tree for pygmies and is also known as a lucky tree in one region in

	Cameroon, with powers to protect against evil (Barstow et al., 2021). A study in a market in Libreville, Gabon surveyed 29 herbalists and found that *G. tessmannii* was one of the most used plant species, with stem bark the part of the plant used to prepare a medicinal drink (Koumba Madingou et al., 2011). Timber from *Guibourtia* species is generally hard, stable, and resistant to fungi and termites (Tosso et al., 2015). The wood of this species is durable and resistant to termites, *Lyctus* and other wood-boring beetles (Obeng, 2011). The species is also used locally for furniture and carpentry, at prices for sale lower than in international markets (Barstow et al., 2021). Bark from the tree is also thought to be used in Chinese medicine (J. Betti pers. Com. 2017 in Barstow et al., 2021). Bubinga and Kevazingo have been considered one of the most valuable woods for carpentry and cabinetmaking for sale in domestic markets (CoP17 Proposal 56, 2016). Wood from the species is used in China to produce traditional Hongmu furniture. As other rosewood species become less abundant and subject to increased trade restrictions, market demand for *Guibourtia* species (including this one) has increased (Barstow et al., 2021).
F. Management measures	
Capacity for regeneration*	Available data for the species on population structures suggest that regeneration is at risk over the long term (Barstow et al., 2021). Although the influence of harvesting on regeneration capacities of the species has not been evaluated, regeneration in the species is thought to be limited due to exploitation for timber, low population densities and modifications to populations of seed dispersers (CoP17 Proposal 56, 2016).
Minimum felling diameter/rotation cycle*	The minimum cutting diameter for the species (assumedly DBH, but not explicitly stated by the author) is 90 cm in Gabon and 80 cm in Cameroon (Tosso et al., 2015). The proposal to list the species. In one forest management area in Cameroon, *G. tessmannii* is felled at a minimum diameter 30 cm higher than the administrative minimum, e.g., 110 cm instead of 80 cm (again, assumedly DBH, but not explicitly stated by the author) (CoP17 Proposal 56 ,2016). There is a lack of data on fruiting diameter for the species, or scientific evidence to inform these current diameters. It is therefore recommended operators increase these values if they do allow for sufficient recovery after a first rotation (Tosso et al., 2015). For tree species in Central African countries with unfavourable population densities and structures, as well as slow regeneration rates (criteria met by both *Guibourtia tessmannii* and *Guibourtia pellegriniana)* scientific communities in the early 2000s recommended that a minimum tree density was set for exploitation. It was recommended that only trees with density thresholds above 5 stems / km^2 be exploited. As of 2016, it was reported these had not been translated into legislation in the range States but were implemented in some FSC-certified concessions (CoP17 Proposal 56, 2016).

	A report produced for the ITTO states that the Minister of Forestry and Wildlife in Cameroon banned the harvest of Bubinga (defined in the report as *Guibourtia tessmannii, G. demeusei, G.pellegriniana, G. ehie, G. arnoldiana)* where density was low, classified as below 0.5 stem/ha (Betti, 2012). This report also states the minimum exploitable diameter for this species is 60 cm, conflicting with Tosso et al (2015), although the source of this data is not stated.
Conversion factors*	There are data from Cameroon for volumes of wood derived from trees with varying trunk diameters: a tree with a trunk diameter of 80 cm yielded 5.6 m^3 of wood, one of 100 cm 8.6 m^3 and one of 150 cm 19.1 m^3 (Obeng, 2011). It is not clear in what commodity forms of wood this refers to, or if this refers to total harvested volume or heartwood only.
H. Conservation status	
Global Red List assessment	The species has most recently been assessed on the IUCN Red List in 2020 and classified as Endangered under criteria A4d (Barstow et al., 2021).

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Useful resources for other information related to NDFs for *Guibourtia tessmannii*

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.

Despite uncertainty concerning the distribution range for *Guibourtia tessmannii*, an NDF for the species in Congo has data relevant to all aspects of NDF formulation https://cites.org/sites/default/files/eng/com/sc/74/F-SC74-30-01-A5a.pdf

Population structure, status and trends (in the harvested area and nationally) (Category C)

A paper on animal communities involved in seed dispersal and predation of the species (Tosso et al., 2017) summarises population density information for the species in a forest concession in Gabon and Cameroon (see 'study area' in https://onlinelibrary.wiley.com/doi/full/10.1111/aje.12480)

Other data on population abundance and structure in Gabon and Cameroon is presented in the CoP17 proposal to list the species in Appendix II (CoP17 Proposal 56) (see p.7-8 in https://speciesplus.net/api/v1/documents/9141), although this data is for *Guibourtia tessmannii* and *Guibourtia pellegriniana* combined in the case of Gabon. See also annexes 1.3, 1.4, 6a and 6b for further details on forest concessions with both species, and densities, volumes, and equivalent commercial volumes in each concession.

A 2012 report produced for the International Tropical Timber Organization (ITTO) summarises the density and conservation status of the species in forest management units based on inventories collected from 2004-2008 (Betti, 2012) (see p.31-34 in https://www.itto.int/files/user/cites/cameroon/Background%20information-Bubinga%20and%20Weng%C3%A9%20in%20Africa.pdf). The same report details population structures of the species in forest management units in Cameroon, and harvest request volumes (see p 42-48).

A 2020 report on the evaluation of the state of progress of research on taxonomy, genetics, biology, ecology and governance of forest resources in Gabon produced under the CTSP (Midoko Iponga et al., 2020) presents data from the Gabonese National Herbarium site to show known distribution maps for *Guibourtia* species in Gabon (see p. 27 in https://cites-tsp.org/sites/default/files/project_files/2023-03/1.%20Revue%20Bibliographique.doc.pdf)

A 2020 study on the production, processing, transport, trade, control and surveillance of Kévazingo in Gabon produced under the CTSP (Essondo Ondo and Midoko Iponga, 2020)

uses data from consultations with around fifteen forestry company development plans and summarises stems per hectare of *Guibourtia* species in different diameter classes for each forest concession, and potentially exploitable volumes of *Guibourtia* species for seven (see p. 13-21 in https://cites-tsp.org/sites/default/files/project_files/2023-03/1.%20Revue%20Bibliographique.doc.pdf).

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

Detailed uses of the species, including some specific to Cameron, are detailed in Obeng, 2011 (see https://prota.prota4u.org/protav8.asp?h=M4&t=Guibourtia,tessmannii&p=Guibourtia+tessmannii#Synonyms)

A 2013 rapid assessment of sustainability issues using market surveys and species distribution models includes market research, interviews, observation of harvest practices and other information to assess sustainability of harvest/trade for the species in Gabon (Guinée, 2013) (see https://www.researchgate.net/profile/Tinde-Andel/publication/326462644_A_rapid_assessment_of_sustainability_issues_using_market_surveys_and_species_distribution_models_Supervision/links/5b4f19efaca27217ff9f1c7a/A-rapid-assessment-of-sustainability-issues-using-market-surveys-and-species-distribution-models-Supervision.pdf)

The IUCN Red List assessment references historic trade and country specific uses for logs from 'Kévazingo' (a trade name shared with *G. tessmannii* in Gabon) and Bubinga (a trade name for this species, *G. pellegriniana* and *G. demeusei* in Cameroon) (see p.4-5 in https://www.iucnredlist.org/species/62026140/62026142)

Some information on domestic use of the Kevazingo and Bubinga in Cameroon are given in the CoP17 proposal to list the species in Appendix II (CoP17 Proposal 56) (see p.9 in https://speciesplus.net/api/v1/documents/9141). Trade data for Kevazingo and Bubinga (not species specific) from Gabon and Cameroon between 1987 and 2001 and 2006-2015, are also outlined in the CoP17 Proposal (see p.9-11).

Some recent trade data for *Guibourtia* spp. in China is summarised in a TRAFFIC rosewood market survey (see https://www.traffic.org/site/assets/files/19229/rosewood_market_full_report_final.pdf)

Trade data for export volumes of Bubinga (the author states it is assumed this includes both *Guibourtia demeusei* and *G. tessmannii*) from Doula port in Cameroon between 2008 and 2012 are presented in the 2012 report produced for the International Tropical Timber Organization (ITTO) summarises the density and conservation status of the species in forest management units based on inventories collected from 2004-1008 (Betti, 2012) (see p.52-53, and Appendix II, in https://www.itto.int/files/user/cites/cameroon/Background%20information-Bubinga%20and%20Weng%C3%A9%20in%20Africa.pdf). The same report, in Annex 5, also gives anecdotal statements as to have Bubinga (defined as *Guibourtia tessmannii, G. demeusei, G. pellegriniana, G. ehie, G. arnoldiana)* and Wengé (defined as *Millettia laurentii*) are illegally traded in Cameroon (although note no information given is species specific and may involve other species aside from *G. tessmannii*).

The 2020 study on the production, processing, transport, trade, control and surveillance of Kévazingo in Gabon produced under the CTSP (Essondo Ondo and Midoko Iponga, 2020) provides data on volumes of commodities from *Guibourtia* species harvested and exported between 2016-2018 (see p. 20 in https://cites-tsp.org/sites/default/files/project_files/2023-03/1.%20Revue%20Bibliographique.doc.pdf).

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

Some information relevant to management, legislation, and protection of the species in Gabon and Cameroon are outlined in the CoP17 Proposal (see p.13-14 in https://speciesplus.net/api/v1/documents/9141).

Although potentially outdated and relevant more broadly to species from Bubinga (defined as *Guibourtia tessmannii, G. demeusei, G.pellegriniana, G. ehie, G. arnoldiana)* and Wengé (defined as *Millettia laurentii*) the 2012 report produced for the International Tropical Timber Organization (ITTO) summarises threats specific to Bubinga and Wengé species in Cameroon, and management measures (Betti, 2012) (see p.35-42 in https://www.itto.int/files/user/cites/cameroon/Background%20information-Bubinga%20and%20Weng%C3%A9%20in%20Africa.pdf)

The 2020 report on the evaluation of the state of progress of research on taxonomy, genetics, biology, ecology and governance of forest resources in Gabon (Midoko Iponga et al., 2020) summarises relevant policy and legislative frameworks relevant to management of the species in Gabon, and reviews the success of plantations (see p. 34-60 in https://cites-tsp.org/sites/default/files/project_files/2023-03/1.%20Revue%20Bibliographique.doc.pdf) .

A national strategy and action plan for the sustainable management of species of *Guibourtia* species in Gabon produced under the CTSP is also available at https://cites-tsp.org/sites/default/files/project_files/2023-03/2.%20Strategie-Plan%20Action_Keva.pdf, and a study on the production, processing, transport, trade, control and surveillance of Kévazingo in Gabon produced under the CTSP (Essondo Ondo and Midoko Iponga, 2020) summarises current control and traceability systems for *Guibourtia* species in Gabon, with recommendations for improvements to the current systems. (see p.22 – 42 in https://cites-tsp.org/sites/default/files/project_files/2023-03/Rapport_Tra%C3%A7abilit%C3%A9_Keva.pdf)

Conservation status (Category H)

Although potentially outdated as previously mentioned, the 2012 report produced for the International Tropical Timber Organization (ITTO) refers to the national conservation status of Bubinga in Cameroon, and management measures (Betti, 2012) (see p.35 in https://www.itto.int/files/user/cites/cameroon/Background%20information-Bubinga%20and%20Weng%C3%A9%20in%20Africa.pdf)

b) Asia

Factsheet 6: ***Dalbergia cochinchinensis***

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

Dalbergia cochinchinensis	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g soil, climate)	The species is mostly found at elevations of 400-500m mean sea level (msl) and occasionally at altitudes of up to 1,200 msl (CoP16 Proposal 60, 2013). The *Dalbergia* checklist states the species occurs at ranges of 0-700m above sea level (Cowell et al., 2022). It thrives in open mixed semi-deciduous forests, and sometimes in seasonal evergreen and riparian forests (CoP16 Proposal 60, 2013). The *Dalbergia* checklist states the species occurs in tropical dry forest, and tropical moist lowland forest (Cowell et al., 2022). An NDF for the species in Cambodia stated the species had a habitat preference for mature, climax forests (Forestry Administration, 2021). One source states the species prefers deep sand, clays, or calcareous soils (Khorn, 2002 in CTSP, 2004), although another source states the species has no specific demands for soil conditions (DFSC, 2000). The NDF for the species in Cambodia stated the species was reported mostly along streams and gentle slopes with well-drained soils (Forestry Administration, 2021). The species natural habitat is lowland forests with uniform rainfall ranging from 1,200-1,650 mm annually. Average temperatures range from 20-32 °C with tolerance to minimum temperatures of 10 °C. The species is light demanding (DFSC, 2000).
Tree characteristics (e.g maximum height and diameter)	The species is a large evergreen tree species, reaching maximum heights of 15–35 m in height according to one source (Eiadthong and Tangmitcharoen 2015 in Barstow et al., 2022), or up to 30 m according to other sources (DFSC, 2000, Cowell et al., 2022). The trunk can reach maximum diameters of 60-120 cm (assumedly diameter at base height, although not explicitly stated by the author) (DFSC, 2000).
Growth rates *	The species is generally slow growing (DFSC, 2000) with few trees reaching maturity (Barstow et al.,2022). One study in China found that growth rates for the species varied according to planting environments (Hong et al., 2020). The heartwood has been reported to reach an average diameter of 13 cm (assumedly DBH but not explicitly stated by the author) at 20 years of age (CoP16 Proposal 60, 2013).
Role of species in Ecosystem*	The species has nitrogen fixing abilities so can be suitable for use in agroforestry and for soil improvement (DFSC, 2000). The species often co-occurs with *Syzygium* spp., *Hopea ferrea* and *Pterocarpus macrocarpus* (CoP16 Proposal 60, 2013). The species is also often found growing in association with *Dalbergia oliveri* (Winfield et al., 2016).

Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)	The species is reported to flower between May and July, with fruits in September-November, in Viet Nam. In Lao PDR the seed matures around December-January (the beginning of the dry season) but can be collected in September-October (the rainy season). The CoP16 proposal to list the species in 2013 states it is pollinated by insects (CoP16 Proposal 60, 2013). A study in 2018 found the species reproduces clonally, with root suckers assumed to be the primary method of clonal reproduction based on observations (Hartvig et al., 2018). An NDF for the species in Cambodia stated the species often produces self-pollinated crops (Forestry Administration, 2021). The species is drought-tolerant (DFSC, 2000). An NDF for the species in Cambodia stated fires may burn out the seedlings of the species, however more research was needed to confirm these observations (Forestry Administration, 2021). Younger individuals of the species are shade tolerant, but this quality is reduced in older individuals. (CoP16 Proposal 60, 2013). A 2018 study found populations of *D. cochinchinensisis* in Lao PDR, Cambodia and Viet Nam had generally medium levels of genetic diversity, although this varied greatly across the range with the highest levels in the northern border area between Cambodia and Thailand and the lowest levels in populations sampled in Lao PDR (Hartvig et al. 2018).
B. Species range	
Global/geographic distribution	The species is native to Cambodia, Lao PDR, Thailand and Viet Nam (Cowell et al., 2022, Barstow et al., 2022). Within these range States its' distribution is widespread but scattered. Based on herbarium and observation records, the extent of occurrence is 624,595 km^2 (Barstow et al., 2022). The predicted distribution range for the species is estimated to be 441,912 km^2 (Gaisberger et al. 2022).
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 IUCN Red List assessment states the species is threatened by loss of habitat within its range, which can limit the area in which the species can regenerate, and logging activities also create an inhospitable environment for regeneration. Logging of mature trees also reduces reproductive capacity. Climate change may further exacerbate existing threats to the species (Barstow et al., 2022). The species also often self-pollinates, resulting in limited genetic variation in natural populations (CoP16 Proposal 60, 2013). In 2012, a report by TRAFFIC referred to reports from the media and other sources to suggest the species was a particular focus for those seeking profits from illegal trade in timber (Jenkins et al., 2012). The 2013 Proposal to list the species in CITES Appendix II stated the species had become rare and was disappearing from most of it's natural habitat due to over-exploitation, with all timber from illegal logging of wild populations (CoP16 Proposal 60, 2013). A study of the species in 2017 stated populations of the species are now fragmented into many subpopulations, each composed of only a few individuals. The study reported large trees capable of producing flowers/fruits are rarely seen, and illegal logging continues to rapidly decrease the number of individuals/populations (Moritsuka et al., 2017) A 2022 study modelled the predicted impact of various threats on the species across its range based on known distribution records. The study estimated 75% of the modelled distribution range of the species is under medium to very high threat from a combination of threats including over-exploitation, fire, over-grazing, habitat conversion and climate change. Of these threats, over-exploitation impacted the highest proportion of the modelled distribution range (60%), followed by habitat conversion (41%) and fire (28%), with climate change the lowest (7%) (Gaisberger et al. 2022).
E. Historical and current species-specific levels and patterns of harvest and mortality	
Global legal/illegal trade	Based on anecdotal evidence for population declines from each range state, and the growing price of the species in timber markets (indicative of an increasing rarity from wild sources) the IUCN Red List assessment estimated the population has experienced a decline of at least 90% over three generations, with the majority of these between 2000 and 2013 (Barstow et al., 2022). The 2013 Proposal to list the species in CITES Appendix II stated the species had recently become one of the most expensive woods in the world (CoP16 Proposal 60, 2013). An EIA report in 2016 stated that stocks of the species had become so depleted in the Greater Mekong sub-region that most standing stocks were now restricted to protected areas (EIA, 2016). A TRAFFIC report on rosewood policies in China also reports few or no *D. cochinchinensisis* trees remain in range States. The report states Thailand is an exception with around

	100,000 standing trees, most of which exist in the country's world heritage sites, based on a 2015 source (Zhang and Kin Keong, 2022b). Logging of wild specimens for commercial purposes is banned in all four range States (Barstow et al., 2022). A 2022 paper states high demand for Asian rosewood (e.g *Dalbergia*) species trade had driven illegal logging across the Greater Mekong. The paper state that trade had initially focused on *D. cochinchinensisis* but as the species became increasingly rare, this has now shifted more to *Dalbergia oliveri*, and other genera such as *Pterocarpus* species (Gaisberger et al. 2022). A 2020 TRAFFIC report on a rosewood market survey in China stated the species was found to be hardly selling even at lower prices due to the strength of domestic protection in source countries. The same report stated that even though there is practically no legal harvest of the species in range States, there is a loophole in which it can be imported "legally" as a finished product after being simply and roughly sawn. The authors report that international trade in the species spiked between 2000-2014. As the price is high and requires substantial upfront investment by Hongmu furniture manufacturers, most have stopped using it as sales turnover volume is low (Zhang and Hin Keong, 2022a). Stock for the species in markets in China is reportedly 'medium' based on interviews conducted as part of the market survey (Zhang and Kin Keong, 2022b). More details on trade dynamics of the species in China, including price changes over time and some reference to range States, are provided in the report (see link to report in other useful sources below)
Known uses	The tree produces a red to dark red heartwood with a fine grain (Barstow et al.,2022). One source reports the heartwood to be almost black in colour (DFSC, 2000). The wood is heavy and considered a 'first class timber' due to not only it's colouration, but also its' durability and ability to be worked (CoP16 Proposal 60, 2013). Timber from the tree is not locally popular, so logging is driven primarily by international demand (Barstow et al., 2022). Teakwood was reported to be more popular than wood from this species on a domestic scale in the 2013 Proposal to list the species in Appendix II (CoP16 Proposal 60, 2013). The species is primarily used for timber. Timber from this tree is very hard and durable (DFSC, 2000) and resistant to insects and termites (CoP16 Proposal 60, 2013). This species is listed as an official hongmu species, so is under significant pressure in the wild for it's use in traditional Ming and Qing Dynasty style furniture. As parts of it's range is also in countries neighbouring China, it was one of the first species to be targeted in trafficking once China had depleted their national supplies of rosewood (Barstow et al., 2022). A 2004 description of the species from Cambodia stated that the wood can be exported at a high price, and is used for making high quality furniture, art handicrafts, and musical instruments.

	The same source states the root base and root can be used to make high quality art handicrafts (CTSP, 2004).The root, bark and sap from the species can be used as part of traditional medicine (CoP16 Proposal 60, 2013). A 2020 TRAFFIC report on a rosewood market survey in China stated products from the species were being used primarily for the China collectables market (Zhang and Hin Keong, 2022).
F. Management measures	
Capacity for regeneration*	If stumps or roots of the tree are left, it has the potential to coppice and regenerate (Barstow et al., 2022). The regenerative capacity of seedlings regrowing from stumps on the species may be relatively fast (Forestry Administration, 2021c). The species can reproduce by air layering, cuttings, and grafting (DFSC, 2000). This species was amongst three Dalbergia species stated to be examples of well-coppicing species in the CoP17 Proposal to list all Dalbergia species in CITES Appendix II (CoP17 Proposal 55, 2016). The 2013 proposal to list the species in Appendix II stated natural regeneration in *D. cochinchinensisis* is quite poor but also stated the species regenerates well by coppicing. The 2013 proposal also stated a low percentage of seedlings from *D. cochinchinensisis* reach maturity (CoP16 Proposal 60, 2013).
Minimum felling diameter/rotation cycle*	An NDF for the species in Lao PDR states that reports from academic researchers indicate *D. cochinchinensis* can produce seeds when the tree reaches 10 cm DBH. The same NDF classifies mature trees as those with 20 cm DBH (NAFRI, 2022). An NDF for the species in Cambodia stated the age at which trees become mature (e.g. start fruiting) varies. Early maturity was defined as instances where trees flowered at less than 15 cm DBH, medium between 15-30 cm DBH and late at greater than 30cm DBH. Anecdotal evidence from interviews with locals indicated some started to flower at 5 years old when DBH ranged from 13-15 cm, although these may be from trees which have regrown from planted stumps/roots. The same NDF states the minimum felling diameter for *D. oliveri* in Cambodia is 45 cm DBH, as it is classified as a luxury species (Forestry Administration, 2021c). (Forestry Administration, 2021c).
Conversion factors*	The tree is reported to have a 'bad stem form' with a tendency to produce buttresses (DFSC, 2000). This quality is also referred to by the 2013 proposal to list the species in Appendix II, which states the trees often have crooked trunks with multiple stems and branches (CoP16 Proposal 60, 2013). A 2021 report on the harvest of both *D.oliveri* and *D. cochinchinensis* in Cambodia produced under the CTSP stated that 'according to the conventional practice of measuring the sawn wood at sawmills, a conversion ratio of 1 m^3 of log being equal to 0.6 m^3 of sawn wood or 0.5 m^3 of processed wood for export was used', although does not reference the source of this

	conversion factor. They also estimate that the amount of wood harvested for processing accounted for around 40% of the volume of standing roundwood inventoried prior to harvest, with this thought to be due to around 30% of the wood being damaged and used as fuelwood, and another 30% comprised of small trees with DBH between 5-30 cm (e.g poles) (Forestry Administration, 2021c) Conversion factors used by UNODC for estimates of the conversion of mass in trade to the number of logs for *Dalbergia* species are 125 kg of timber: 1 log (UNODC, 2023). Conversion factors for various units (e.g., container, cubic meter, kilogram) to live tree equivalents for *D. cochinchinensis* are also 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)
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	The species was most recently assessed on the IUCN Red List in 2020 and was found to be Critically Endangered A2cd+4cd (Barstow et al., 2022).

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Useful resources for other information related to NDFs for *Dalbergia cochinchinensis*

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.

NDFs for the species in Cambodia, Viet Nam, and Lao PDR, provide more detail on most aspects relevant to NDFs in each country (see Lao PDR here https://cites.org/sites/default/files/documents/E-SC77-Inf-04.pdf, Cambodia here https://cites-tsp.org/sites/default/files/project_files/2023-01/CITES_KH_NDF_D_cochinchinensis_D_oliveri_20210923.pdf and Viet Nam here https://cites-tsp.org/sites/default/files/project_files/2023-01/Vietnam_NDF_report_for_D_cochinchinense_D_oliveri_CTSP-CITES-2022_compressed.pdf

Species range (Category B)

The 2022 IUCN Red List Assessment provides further detail on the areas in which the species is distributed in all four range States (Barstow et al., 2022) (see https://www.iucnredlist.org/species/215342548/2822125#bibliography)

Although outdated, a distribution map for the species in Cambodia from a 2004 reported is shown in a species' description (CTSP, 2004) (see https://www.aefek.fr/wa_files/WholeBook.pdf#page=10). The 2013 CoP16 proposal to list the species in Appendix II also refers to a global distribution map, as well as a distribution map in Thailand, with details of distribution in all range States (see https://speciesplus.net/api/v1/documents/620)

A 2022 study (Gaisberger et al., 2022) uses known distribution records to predict distribution ranges for the species in each range state, inclusive of the percentage that includes protected, and protected and stable, areas (see p. 5 in https://doi.org/10.1016/j.biocon.2022.109560) .

Population structure, status and trends (in the harvested area and nationally) (Category C)

Although now outdated, the 2013 CoP16 proposal to list the species in Appendix II refers to known population trends and patterns of exploitation in Thailand and Viet Nam (see https://speciesplus.net/api/v1/documents/620)

Threats (Category D)

The 2022 IUCN Red List Assessment references some threats specific to Thailand and Cambodia (Barstow et al., 2022) (see threats in https://www.iucnredlist.org/species/215342548/2822125#bibliography)

A study that assessed the genetic diversity in populations across the range States of the species and provides details according to localities sampled is provided in Hartvig et al.

(2018) (see https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.3626). Another 2015 study assesses genetic diversity of the species specifically in Viet Nam (Vu Thi Thu Hien and Dinh Thi Phong, 2015) (see https://www.ajol.info/index.php/ajb/article/view/127424)

A detailed genetic study of the species in Cambodia was conducted in 2017 and discusses conservation implications of the findings (Moritsuka et al., 2017) (see https://link.springer.com/article/10.1007/s11295-017-1199-8

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

A detailed analysis of trade in each range state (although with a focus on Lao PDR and Cambodia), inclusive of estimates of trade in proportion to standing stocks, is presented in a 2016 EIA report (see https://eia-international.org/wp-content/uploads/EIA-Red-Alert-FINAL.pdf)

A summary of historic trade figures in the species is provided in Winfield et al (2016) (see https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Global-Status-of-Dalbergia-and-Pterocarpus-Rosewood-CITES-2017-.pdf)

A report on trade in the species specifically in Viet Nam is provided in a 2018 EIA report https://eia-international.org/wp-content/uploads/EIA-report-Vietnam-in-violation-spreads.pdf

A 2018 study compiled seizure data from online news sites between January 2013 to December 2017 and details the number of reported seizures over time, and locations (Siriwat and Nijman, 2018) (see https://www.sciencedirect.com/science/article/pii/S1389934118302648#s0090) . The same authors (Siriwat and Nijman, 2023) also use seizure reports from online news sites between 2013 and 2019 to identify modes of illegal trade, and although the study does not detail the number of seizures for each species, the authors state datasets used available on 'reasonable request' (see https://www.sciencedirect.com/science/article/pii/S0006320722003792#da0005)

A 2020 TRAFFIC report on a rosewood market survey in China provides some recent trade dynamic and prices for the species and includes reference to some range States (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)

The 2022 IUCN Red List Assessment references legislation specific to each range state of the species (Barstow et al., 2022) (see conservation actions in https://www.iucnredlist.org/species/215342548/2822125#bibliography)

Some information relevant to germination and propagation under management can be found in CTSP (2004) (see https://www.aefek.fr/wa_files/WholeBook.pdf#page=10) and a factsheet for thr species produced by the Cambodia Tree Seed Project (2001) provides information on germination (see https://www.aefek.fr/wa_files/WholeBook.pdf#page=10)

A summary of germination and propagation techniques are also provided in the 2013 proposal to list the species in Appendix II (see artificial propagation in CoP16 Proposal 60, 2013).

Average yearly growth rates for the species under plantation conditions in Cambodia for various stages are outlined in Table 15 of Winfield et al (2016), with survival and growth rates over seven years in Lao PDR in Table 16 (see https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Global-Status-of-Dalbergia-and-Pterocarpus-Rosewood-CITES-2017-.pdf

A 2010 summary of management strategies (e.g silivcultural techniques) for the species in Cambodia is available at https://www.publish.csiro.au/pc/PC100101 although this is not publicly available and may require purchase or a request to the authors

A 2020 study investigates variability in growth rat es in different habitat conditions in China One study in China found that growth rates for the species varied according to planting environments (Hong et al., 2020) (see http://nldxb.njfu.edu.cn/EN/abstract/abstract5736.shtml)

A 2020 study compares the impact of various pre treatments on germination in the species (Seng and Cheong, 2020). See https://www.tandfonline.com/doi/full/10.1080/21580103.2020.1758801

A 2020 study assesses genetics of populations across the range to identify priority areas and populations for conservation across the species range; these areas could be prioritised in management plans as protected areas/populations (Hartvig et al., 2020) (see https://link.springer.com/article/10.1007/s10592-020-01279-1)

A 2022 study (Gaisberger et al., 2022) recommends potential and restoration actions for the species across its range (see https://doi.org/10.1016/j.biocon.2022.109560).

Factsheet 7: *Dalbergia latifolia*

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

Dalbergia latifolia	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g soil, climate)	The species occurs in evergreen or deciduous sub-tropical forests (Lakhey et al., 2020), and in it's native area of distribution it occurs in deciduous forests with periodically very dry localities (Lemmens, 2008). Ranges of elevations for the species documented vary slightly between sources, from 200-1000 metres above sea level (Lakhey et al., 2020), to between 0-1,500 metres (Kadambi, 1954 in Prasad and Sukandi, 2023), whilst Lemmens (2008) states the species grows at altitudes between 900-1,500 metres in its native distribution area. Documented temperature ranges for the species vary from 8-44°C in Orwa et al. (2009), to 0-50 °C in Prasad and Sukandi (2023). Lemmens (2008) states the species can tolerate minimum temperatures of between 0-6 °C. Annual rainfall in its natural habitat ranges from 750- 5,000 mm and the tree can tolerate relative humidity of 40-100% (Prasad and Sukandi, 2023), although it grows well in areas with up to six dry months with mean monthly rainfall of less than 40 mm (Lemmens, 2008). The species requires moderate light, although seedlings can withstand moderate shade (Lemmens, 2008). The species can grow on a variety of soils including gneiss, trap, laterite, alluvial, and bolder deposits. It grows best on well-drained, deep, moist soils but also grows well on black cotton soils, whilst shallow dry soils with poor drainage can stunt growth. (Orwa et al., 2009). Best growth is said to be observed in deep loam or clayey soil containing lime, as these soils are deep with sufficient moisture (Luna 1992 and Tewari 1995, in Arunkumar et al., 2022). One study reported the species occurs in rocky, infertile and dry soils in Java, Indonesia (Dwianto et al., 2019). The species commonly grows with *Tectona grandis*, *Terminalia* sp., *Anogeissus latifolia* and bamboos (Prasad and Sukandi, 2023).
Tree characteristics (e.g maximum height and diameter)	The tree size varies dependent on the locality and conditions in which it grows (Troup, 1921 in Arunkumar et al., 2022). The 2020 IUCN Red List assessment states the tree can grow up to 40 metres tall (Lakhey et al., 2020). Orwa et al. (2009) state the trees grow to maximum heights of 20-40 metres tall, and another source states maximum height generally varies between 10-40 metres (and up to 45m in the southern regions of the Western Ghats in India) (Troup, 1921 in Arunkumar et al., 2022). The trunk can be branchless for up to 12(–24) metres (Lemmens, 2008).

	The maximum 'girth' of the trunk reported by Orwa et al. (2009) is 1.5-2 metres, with another source stating maximum 'girths' of 1-5 metres (Troup, 1921 in Arunkumar et al., 2022). It is not clear if girth refers to DBH. The diameter is said to be up to 80 (–150) cm (Lemmens, 2008), although a diameter up of to 3 meters has been recorded in India (Prasad et al., 1993 in Prasad and Sukandi, 2023). Assumedly, these measures are for DBH, but this is not explicitly stated by either author.
Growth rates *	The species has a slow growth rate, and requires a long rotation period (Lakhey et al., 2020). The growth rate has also been shown to be highly variable and dependent on locality; for example, trees in Andhra Pradesh, India were found to reach a girth of 1.83 m in 110 years, whilst the same girth was reached in 80 years in Karnataka (Arunkumar et al., 2022). Growth is comparatively faster in moist regions than dry, and in well managed plantations growth rates can be much faster ranging from 4-8 cm in diameter a year (Arunkumar et al., 2022). Its best growth is said to occur in the Western Ghat forests of Karnataka, Kerala, and Tamil Nadu (Prasad and Sukandi, 2023). Estimates for annual girth increments range from 1.8-3.2 cm a year, and diameter increments have been shown to be 0.34 cm a year in one study, with close to 150 years needed to reach 60 cm diameter at breast height (Arunkumar et al., 2022). Data collected in Indonesia for a 2022 report found that in West Java (annual rainfall 3,000-4,000 mm) there was an average diameter increment of 1.4 cm a year, compared to 0.7 cm in Yogyakarta where annual precipitation was 1,000- 2,000 mm (Fambayun et al., 2022). Estimates of annual growth in height are 2 metres a year for populations in Indonesia (Java) (Lemmens, 2008).
Role of species in Ecosystem*	The species is known to be a nitrogen fixing tree, and its leaf litter decomposes slowly, releasing nutrients and enabling it to be used as mulch (Arunkumar et al., 2022). Over 65 species of insects, not thought likely to become pests, are associated with trees of the species Arunkumar et al., 2022). Seedlings and saplings are browsed by cattle and goats (Orwa et al., 2009). Studies in India and Indonesia have identified a variety of insects and birds visit the flowers of the tree for nectar/pollination, with insects *Apis cerana* and *Xylocopa confuse* dominant pollinators in the study in Indonesia, and a subspecies of Indian honeybee *Apis cerana indica* the main pollinator in India (Arunkumar et al., 2022).

	A study of the species in the Botanical Garden of Purwodadi, Indonesia, found five types of insects visiting the plant: *Xylocarpa confusa, X. fenestrate,X. iridipennis, Apis cerrana*, and *Polistes metricus.* Data on the abundance of each insect in visits indicated *X. confusa* and *A. cerana* were pollinators (Damaiyani and Heri, 2019).
Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)	As a seedling, the species is shade tolerant but sensitive to both drought and fire, whilst in maturity it is tolerant of drought and ground fire but susceptible to crown fire. Establishment can be restricted by frost (Prasad and Sukandi, 2023). Flowering begins in December and continues until March or rarely October in drier habitats, whilst the trees remain evergreen throughout the year in moister conditions. Seeds are usually wind-dispersed. (Orwa et al., 2009). The species can reproduce through root suckers, as well as seeds (Prasad and Sukandi, 2023). Pathogens reported to be able to cause infections in the species include rust fungi *Uredo sissoo, Maravalia achroa* and *Maravalia pterocarpi* (in nursery seedlings), with a *Meliola* species said to cause a 'sooty mould' in seedlings, and *Coriolopsis sanguinaria* and *Phellinus gilvus* root rot, in reports from India. (Orwa et al., 2009). The species is also said to be commonly attacked by fungi from *Fusarium* species, termites, and browsing wild animals (Prasad and Sukandi, 2023). A wide variety of named pathogens that may infect the tree are also detailed in Arunkumar et al. (2022).

B. Species range	
Global/geographic distribution	The Dalbergia checklist states the species is native to Indonesia, India, Mynamar and Nepal (Cowell et al., 2022). Other sources conflict with this: the IUCN Red List assessment states the species in also native to Bangladesh, and that the CITES Management and Scientific authorities of Indonesia indicate that it is an introduced species in Indonesia (Lakhey et al., 2020). Prasad and Sukandi (2023) state *D. latifolia* is an introduced species in Myanmar and Nepal (as well as in Kenya, Nigeria, and Sri Lanka), whilst Orwa et al. (2009) also state the species is introduced in Myanmar and Nepal, and native only to Indonesia and India. Lemmens (2008) states that in Africa, *D. latifolia* is planted on a small scale, usually as an ornamental plant e.g., in botanical gardens. See below for a distribution map from the IUCN Red List assessment using data compiled by Royal Botanic Gardens Edinburgh. 

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 high demand of rosewood timber from the species, alongside a slow growth rate and a decrease in natural habitat has led to a 'drastic decline' of the population throughout its range. Although the species is grown in commercial plantations, the slow growth rates and long rotation periods required make it difficult for these plantations to meet the demand for timber. Although population reductions are thought to have ceased, the high commercial value and slow regeneration rate of the species means it is still assessed as Vulnerable on the IUCN Red List (Lakhey et al., 2020). Threats identified in Winfeld et al. (2016) include disease, insects and logging (legal or illegal). The species is susceptible to crown fires, which can be common in the dry ecosystems it inhabits (Prasad and Sukandi, 2023).
E. Historical and current species-specific levels and patterns of harvest and mortality	
Global legal/illegal trade	The timber of this species is of high commercial value and wild subpopulations are widely overexploited (Lakhey et al., 2020). A TRAFFIC rosewood market survey report in China stated that demand for *D. latifolia* was stable but low, and peaked in 2016-2017, with sales turnover in Shanghai currently at least 12,500 tonnes annually. In one area (Dayong, Zhongshan) it was reported that furniture made from *D. latifolia* has increased in popularity after it's inclusion in the National Hongmu Standard and due to it's 'favourable' price (Zhang and Kin Keong, 2022).
Known uses	The heartwood varies in colour from light golden brown to shades of light purple with dark streaks, or deep purple with distant black lines, and is said to darken with age. The wood is fragrant. It weighs ~ 850 kg per cubic meter and is said to be difficult to work due to its high density (Prasad and Sukandi, 2023). Wood density at 12% moisture content varies from 750 to 880 kg/m^3 (Lemmens, 2008). There are also said to be two varieties of this species, at least in Indonesia; in Java, the native variety goes by the common name sonokeling, which is a wood used in agroforestry, whilst the other form is called sonobrits, which is fast growing but less valuable variety due to a duller coloured heartwood (Joker, 2004 in Winfield et al., 2016). The species is used as a timber species and valued particularly for the colour and fragrance of it's wood. It is particularly prized for use in musical instruments (e.g., guitars), furniture, veneer, flooring, plywood, carvings, and moulding (Lakhey et al., 2020). The TRAFFIC rosewood market survey report in China stated that China's imported *D. latifolia* came mainly from Indonesia, and was mainly used for the manufacture of Hongmu furniture. The species is recognised as a Hongmu species in China's National Hongmu Standard (last revised in 2017) (Zhang and Kin Keong, 2022). The

	sapwood is perishable but the heartwood of the tree is extremely durable, and it has been classified as very resistant to wood decay fungi (Arunkumar et al., 2022). Orwa et al. (2009) state medicines can be made from tannins in the bark for treatment of diarrhoea, worms, indigestion, and leprosy, and can also be used as an appetizer. Farmers use the nitrogen-rich foliage from the tree for fodder and manure (Prasad and Sukandi, 2023) and the species has been used as a shade tree in agroforestry in India and Indonesia, and in coffee plantations (Lemmens 2008)
F. Management measures	
Capacity for regeneration*	The species has a slow regeneration rate (Lakhey et al., 2020)
Minimum felling diameter/rotation cycle*	Although minimum cutting diameters are not specified, trees are usually harvested at 30-40 years of age (Orwa et al., 2009) and in Java, 50 year cutting cycles have been recommended to obtain 30 cm of heartwood (DMI, 1980 in Prasad and Sukandi, 2023).
Conversion factors*	Some conversion factors for estimating the volume of trees from characteristics such as diameter at base height based on a population in Java are outlined by Siswanto and Imanuddin (2008), with conversion tables in the Appendices to the published study (see bibliography for link). These are used in the NDF for the species produced by Indonesia to convert the number of logs reported in illegal trade into likely volumes of timber; they estimate for an assumed diameter of 15 cm and a height of 5 m, the value of 2,934 logs is equal to 205.38 m^3 of timber and for an assumed diameter of 20 cm and a height of 5 m, the value of 2,934 logs is equal to 366.75 m^3 (Yulita et al., 2022). Conversion factors used by UNODC for estimates of the conversion of mass in trade to the number of logs for *Dalbergia* species are 125 kg of timber: 1 log (UNODC, 2023). Conversion factors for various units (e.g., container, cubic meter, kilogram) to live tree equivalents for *D.laitfolia* are also 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)
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	*Dalbergia latifolia* has most recently been assessed for The IUCN Red List of Threatened Species in 2020 and is listed as globally Vulnerable under criteria A1cd. (Lakhey et al., 2020)

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Useful resources for other information related to NDFs for *Dalbergia latifolia*

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.

Population structure, status and trends (in the harvested area and nationally) (Category C)

The 2020 Red List assessment refers to estimates of population declines in Nepal and India, although does not provide references for these data (see https://www.iucnredlist.org/species/32098/67777757)

An approach to collecting and presenting data on population structure, abundance, and regeneration rates for the species in India is detailed in a 2020 https://www.ijarr.in/Admin/pdf/population-structure-and-regeneration-of-dalbergia-latifolia-roxb-and-d-sissoides-wight-arn-in-kerala-and-tamil-nadu-india.pdf . Another paper details an inventory and methods used to collect similar data in a 2021 paper in Indonesia, with data on trade and management, including prices, gathered through interviews (see https://iopscience.iop.org/article/10.1088/1755-1315/762/1/012015/pdf).

There is a 2022 NDF for the species in Indonesia produced under the CITES Tree Species Programme, with approaches to inventories of the population (see https://cites-tsp.org/sites/default/files/project_files/2023-01/NDF_Report_for_Dlatifolia.pdf) and a more detailed account of data collection and calculation of factors such as growth and regeneration rates here https://cites-tsp.org/sites/default/files/project_files/2023-01/Report_on_the_Establishment_of_Growth_and_Yield_Plots.pdf and here https://cites-

tsp.org/sites/default/files/project_files/2023-01/Distribution_Ecology_Modelling_Regeneration_Dlatifolia.pdf

Trends in populations of the species in India and Indonesia are outlined by UNEP-WCMC (2017) (see p.12-15 in https://www.blackwoodconservation.org/wp-content/uploads/2019/07/UNEP-WCMC_Review-of-selected-Dalbergia-species-and-Guibourtia-demeusei.pdf)

An approach to population inventory and assessment of population structure for the species in West Java, Indonesia is given in Atikah et al (2021) (see https://iopscience.iop.org/article/10.1088/1755-1315/762/1/012015/pdf)

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

An example of the use of conversion factors for the species based on a population in Java in the annexes of Siswanto and Imanuddin (2008) are demonstrated in the 2022 NDF by Indonesia, where diameter and heights in tables are used to estimate volumes of trees from reports of illegal harvest (see p.23 in https://cites-tsp.org/sites/default/files/project_files/2023-01/NDF_Report_for_Dlatifolia.pdf)

A TRAFFIC China Rosewood Market Survey (Zhang and Kin Keong, 2022) refers to some recent trade dynamics of the species (see https://www.traffic.org/site/assets/files/19229/rosewood_market_full_report_final.pdf)

Some recent price data for the species in Java are given in (Dwianto et al., 2019) (see p.4 in https://iopscience.iop.org/article/10.1088/1755-1315/374/1/012063/pdf

Trade dynamics for the species in West Java, Indonesia, including changes to pricing since the Appendix II listing are referred to by Atikah et al (2021) (see https://iopscience.iop.org/article/10.1088/1755-1315/762/1/012015/pdf)

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

The 2020 Red List assessment refers to plantations in Nepal, and also refers to management plans for the species in Nepal in the forests it occurs in. It also mentions 14 *ex situ* conservation collections worldwide (see https://www.iucnredlist.org/species/32098/67777757)

Orwa et al. (2009) document some best practices in plantations, such as minimum distances between trees, here https://apps.worldagroforestry.org/treedb/AFTPDFS/Dalbergia_latifolia.PDF. There are similar recommendations summarised by Prasad and Sukandi (2023) related to agroforestry practices in Indonesia, general management, and silvicultural practices in the Winrock International factsheet here https://winrock.org/factnet-a-lasting-impact/fact-sheets/dalbergia-latifolia-the-high-valued-indian-rosewood/ . Lemmens (2008) also refers to management of the species under 'management' and 'prospects' (see https://uses.plantnet-project.org/en/Dalbergia_latifolia_(PROTA))

The 2022 NDF for the species in Indonesia overviews harvest and management (see https://cites-tsp.org/sites/default/files/project_files/2023-01/NDF_Report_for_Dlatifolia.pdf) with a more detailed assessment and description of management plans in Indonesia here https://cites-tsp.org/sites/default/files/project_files/2023-01/Assessment_of_Management_Practices_Control_and_Monitoring_and_Conservation_

Status_of_Dlatifolia.pdf. Exports of the species from Indonesia are reported to be from plantations and non-native populations.

Some information on proposed techniques for plantations of the species are summarised in (Dwianto et al., 2019) (see p.4 in https://iopscience.iop.org/article/10.1088/1755-1315/374/1/012063/pdf)

Information relevant to management and protection measures for the species in India and Indonesia is outlined by UNEP-WCMC (2017) (see p.12-15 in https://www.blackwoodconservation.org/wp-content/uploads/2019/07/UNEP-WCMC_Review-of-selected-Dalbergia-species-and-Guibourtia-demeusei.pdf)

A 2021 paper (Mahatara et al., 2021) models potential suitable habitats for the species in Nepal to aid with conservation planning and habitat management (see **https://www.silvafennica.fi/article/10441/author/20006**)

There are multiple studies investigating propagation techniques for this species: see https://link.springer.com/article/10.1007/BF00232164, https://link.springer.com/article/10.1007/s40502-022-00664-x and https://link.springer.com/article/10.1007/BF00269818 and https://ir.lib.ruh.ac.lk/handle/iruor/7906

Factsheet 8: *Dalbergia oliveri*

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

Dalbergia oliveri	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g soil, climate)	The species occurs in a variety of forest types including primary and secondary forests, evergreen, semi-evergreen and semi-deciduous forests (Barstow et al., 2022), categorised more broadly as temperate and tropical moist lowland forests (Cowell et al., 2022). It is most often found occurring in moist areas along streams and rivers (CTSP, 2004). An NDF for the species in Cambodia stated the species had a habitat preference for mature, climax forests and may have relatively low adaptability in a habitat context (Forestry Administration, 2021c). The species occurs in lowland areas from 100-800 m asl, and rarely above 1,000 m asl according to the IUCN Red List assessment (Barstow et al., 2022), although another states the species can be found at elevations of up to 1,500 m (Niyomdham, 2014). The species prefers fertile soils (Barstow et al., 2022). A 2021 NDF for the species in Viet Nam states the species grows on loamy soil, and ferralsol soil established from basalt, shale and ancient alluviam, in areas with an average temperature of 24-26.5 °C and annual rainfall ranging between 1,600- 2,175 mm. (Center for Nature Conservation and Development, 2021). A study in Thailand found the species could be found growing on heavily weathered, acidic acrisols, and on shallow,

	eroded regosols which were exposed to recurrent drought stress during the dry season (Aerts et al., 2009) The species is often found growing in association with *Dalbergia cochinchinensis* (Barstow et al., 2022).
Tree characteristics (e.g maximum height and diameter)	*Dalbergia oliveri* is classified as a medium to large tree and can reach maximum heights of 20-25 (-35) m (CTSP, unpublished in CTSP, 2004). CTSP (2004) stated that *D. oliveri* has a maximum diameter at breast height (DBH) of over 60 cm, whilst other sources state the species can reach greater sizes: one states a maximum DBH up of to 90 cm (Hartvig et al., 2018), and another a maximum diameter (assumedly at breast height but not explicitly stated) of between 60-90 cm (Nguyen et al., 2019).
Growth rates *	*Dalbergia oliveri* is slow-growing in both natural and man made forests (CTSP, unpublished in CTSP, 2004). The species requires a long rotation cycle between harvests, and selective sustainable logging practices to enable regeneration, with multiple decades required to reach maturity and a harvestable diameter (Barstow et al., 2022). One study in a nursery found that for seedlings, average height growth was 2.14 cm a month and that the tree reached an average height of 19.3 cm, and diameter of 0.31 cm, in nine months (Pham et al., 2013 in Center for Nature Conservation and Development, 2021). There is reportedly little data for growth rates of the species in the wild (Center for Nature Conservation and Development, 2021). Another study in Cambodia found one specimen of *D. oliveri* reached a height of 11 metres and 24 cm DBH in 16 years (Narong & Sobon, 2014 in Forestry Administration, 2021b)
Role of species in Ecosystem*	The 2019 NDF for the species in Viet Nam states the species can carry out nitrogen fixation, and subsequently can protect soil fertility for other species and contribute to degraded forest rehabilitation. The same NDF states *D. oliveri* is a food source for large ungulates (Center for Nature Conservation and Development, 2021). One study found the species was likely to be suitable for restoration of degraded forests. It was thought the species may be able to improve soil conditions in degraded areas through fast decomposing lead litter from the species, which is rich in nitrogen, phosphorus, and carbon as has been observed for other Dalbergia species (e.g *Dalbergia sissoo* and *Dalbergia retusa*) (Aerts et al., 2009).
Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)	A 2018 study found populations of *D. oliveri* in Lao PDR, Cambodia and Viet Nam had generally high levels of genetic diversity, although this varied across the range with the highest levels in Cambodia and North East Viet Nam and the lowest levels in southern Viet Nam and one of the south eastern Cambodian populations (Hartvig et al. 2018). Another study *D. oliveri* existed across a wide range of environmentally limiting factors within the deciduous forests of Northern Thailand (Aerts et al., 2009). Trees of younger ages can tolerate shade but generally the species prefers lighter conditions (CTSP, 2004). An NDF for the species in

	Cambodia stated fires may burn out the seedlings of the species, however more research was needed to confirm these observations (Forestry Administration, 2021c). Seed production varies between individuals and trees do not necessarily produce seeds every year. The species can be coppiced and can also reproduce using root suckers (Barstow et al., 2022). It is thought likely that the seeds are dispersed by wind and water (Hartvig et al. 2018). It is assumed that the species is insect-pollinated (Barstow et al., 2022). A CTSP report on the ecology and biology of *D. oliveri* in Viet Nam states the tree flowers from April to May, with fruit from September to December (Nguyen et al., 2019) whilst a similar CTSP report in Cambodia states the tree flowers from May to July, with fruit from November to January (Forestry Administration, 2021a). A study of a wild population of *D. oliveri* in Thailand found there was a large diversity in bark characteristics, fruit morphology and phenology both within and between years (Aerts et al., 2009).
B. Species range	
Global/geographic distribution	The Dalbergia checklist states the *D. oliveri* is native to India, Cambodia, Lao People's Democratic Republic, Myanmar, Malaysia, Thailand and Viet Nam (Cowell et al., 2022). This differs to the list of countries the species is native to outlined in the IUCN Red List assessment, which does not include Malaysia (Barstow et al., 2022). The species has a wide geographic range and is widespread in each country but with small and scattered subpopulations. It is usually found growing in small densities. The estimated extent of occurrence is 1,489,222 km^2 (Barstow et al., 2022). The predicted distribution range for the species is estimated to be 997,383 km^2 (Gaisberger et al. 2022). No distribution map could be found for *D. oliveri.* CTSP (2004) stated the trees usually occur individually or in groups of five to ten trees.
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 population is in decline across its range due to overexploitation for timber and illegal harvest and trade, as well as the conversion of lowland habitats for agriculture and settlement space (Barstow et al., 2022). The species has a long regeneration time and it now rarely seen becoming established in the wild. Factors contributing to this are logging activities making the environment inhospitable for regeneration and cutting of mature trees that can contribute seeds (Barstow et al., 2022). A report produced under the CTSP programme in Cambodia refers to reports from survey teams and local villagers that indicate *D. oliveri* trees do not produce flowers every year, which may limit reproduction rates (Forestry Administration, 2021b). A 2022 study modelled the predicted impact of various threats on the species across its range based on known distribution records. The study

	estimated 75% of the modelled distribution range of the species is under medium to very high threat from a combination of threats including over-exploitation, fire, over-grazing, habitat conversion and climate change. Of these threats, over-exploitation impacted the highest proportion of the modelled distribution range (57%), followed by habitat conversion (38%) and fire (20%), and climate change the lowest (13%) (Gaisberger et al. 2022).
E. Historical and current species-specific levels and patterns of harvest and mortality	
Global legal/illegal trade	The species has previously been documented to be one of the most expensive timber species in the world (CoP16 Prop. 60,2013, in Barstow et al., 2022). In 2016, it was reported that this species accounted for a third of all rosewood trade into China (CoP17 inf 79, 2016, in Barstow et al., 2022). In 2013, the species was classified as an ordinary (e.g not collectable), or mid-end class Hongmu species based on observations from rosewood markets (Forest Trends, 2013). Pressure on the harvest of wild populations of the species has increased in the last decade due to a shift in demand to *D. oliveri* from *Dalbergia cochinchinensis*, which became increasingly rare due to exploitation (Hartvig et al., 2018). The price of the species is thought to be increasing due to its rarity. This value, and a limited capacity to enforce regulations, are thought to be driving factors in the continued illegal trade of the species (Barstow et al., 2022). The species continues to be exploited across its range despite logging bans and depleted populations and is subject to illegal logging and harvesting (Barstow et al., 2022). A 2020 TRAFFIC report on a rosewood market survey in China stated the species was one of the most popular in trade and was preferred in part due to the moderate colour and smooth pattern but also because of its similarities to *Dalbergia odorifera* and a texture that can easily be distinguished from other species, meaning buyers are unlikely to be 'cheated'. The price was stated to be comparatively middle to low-end (Zhang and Hin Keong, 2022). Stock for the species in markets in China is reportedly 'medium' based on interviews conducted as part of the market survey (Zhang and Kin Keong, 2022b).
Known uses	*Dalbergia oliveri* produces a desirable rosewood timber (Barstow et al., 2022). Commercial varieties of the species differ according to wood colour, which can be rose-yellow, brown veined, red with black veins, or purple streaked with yellow (CTSP, 2004). A report in Viet Nam states the heartwood is dark brown (Nguyen et al., 2019), and another from Cambodia that the heartwood is brown, red or yellow with shades of lemon-pink, red-scarlet, or reddish-brown (Forestry Administration, 2021a). The wood is hard and heavy and resistant to termites (CTSP, 2004). A 2020 TRAFFIC report stated consumers in China valued the timber from *D. oliveri* for its stability and hardness and is recognised as a Hongmu species in China's National Hongmu Standard (last revised in 2017) (Zhang and Hin Keong, 2022). Uses for the species documented from various sources by Winfield et al. (2016) include high quality furniture, luxury cabinets, art and handicrafts, decorations, handles of agricultural implements, tone wood

	and medicine. The species has been used locally for items such as crafts, furniture, and construction prior to international demand (Barstow et al., 2022).
F. Management measures	
Capacity for regeneration*	Natural regeneration in this species is often poor due to low germination rates or poor weather/site conditions (CTSP, 2004), although coppice regeneration is reportedly very strong (Hartvig et al. 2018). Natural regeneration varies according to factors such as forest type and climate conditions (Center for Nature Conservation and Development, 2021). A study in Viet Nam showed that the coppicing ability for the species varied markedly between three national parks (reference to findings from Dinh et al., 2021 in Center for Nature Conservation and Development, 2021).
Minimum felling diameter/rotation cycle*	An NDF for the species stated the minimum felling diameter for *D. oliveri* in Cambodia is 45 cm DBH as it is classified as a luxury species (Forestry Administration, 2021c).
Conversion factors*	A 2021 report on the harvest of both *D.oliveri* and *D. cochinchinensis* in Cambodia produced under the CTSP stated that 'according to the conventional practice of measuring the sawn wood at sawmills, a conversion ratio of 1 m^3 of log being equal to 0.6 m^3 of sawn wood or 0.5 m^3 of processed wood for export was used', although does not reference the source of this conversion factor. They also estimate that the amount of wood harvested for processing accounted for around 40% of the volume of standing roundwood inventoried prior to harvest, with this thought to be due to around 30% of the wood being damaged and used as fuelwood, and another 30% comprised of small trees with DBH between 5-30 cm (e.g poles) (Forestry Administration, 2021c) Conversion factors used by UNODC for estimates of the conversion of mass in trade to the number of logs for *Dalbergia* species are 125 kg of timber: 1 log (UNODC, 2023). Conversion factors for various units (e.g., container, cubic meter, kilogram) to live tree equivalents for *D. oliveri* are also 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)
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	The species was most recently assessed on the IUCN Red List in 2020 and was found to be Critically Endangered under criteria A2cd+3cd+4cd (Barstow et al., 2022).

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Useful resources for other information related to NDFs for *Dalbergia oliveri*

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.

NDFs for the species in Cambodia, Viet Nam, and Lao PDR, provide more detail on most aspects relevant to NDFs in each country (see Lao PDR here https://cites.org/sites/default/files/documents/E-SC77-Inf-04.pdf, Cambodia here https://cites-tsp.org/sites/default/files/project_files/2023-01/CITES_KH_NDF_D_cochinchinensis_D_oliveri_20210923.pdf and Viet Nam here https://cites-tsp.org/sites/default/files/project_files/2023-01/Vietnam_NDF_report_for_D_cochinchinense_D_oliveri_CTSP-CITES-2022_compressed.pdf

The 2022 IUCN Red List assessment provides some country-level information on population sizes, trends in populations, and illegal trade in all range States (see p.4-5 in https://www.iucnredlist.org/species/215341339/2813403)

Species range (Category B)

A 2022 study (Gaisberger et al., 2022) uses known distribution records to predict distribution ranges for the species in each range state, inclusive of the percentage that includes protected, and protected and stable, areas (see p. 5 in https://doi.org/10.1016/j.biocon.2022.109560) .

A 2019 NDF for the species refers to the distribution range of the species in Viet Nam (see https://cites-tsp.org/sites/default/files/project_files/2023-01/Vietnam_NDF_report_for_D_cochinchinense_D_oliveri_CTSP-CITES-2022_compressed.pdf)

A 2021 review of the taxonomy, biology, ecology, and the status, trend, and population structure of the species in Cambodia refers to areas in Cambodia where the species is distributed (see p.8 in https://cites-tsp.org/sites/default/files/project_files/2023-01/CITES_KH_*Dalbergia_cochinchinensis*_Taxonomy-Review_20210712A.pdf)

Population structure, status and trends (in the harvested area and nationally) (Category C)

A 2021 report on a systematic field survey of the population distribution, abundance and stock of *D. oliveri* in four key protected areas in Vietnam outlines approaches to collecting data for the species, with results (see https://cites-tsp.org/sites/default/files/project_files/2023-01/Report_on_systematic_survey_of_Dcochinchinensis_and_Doliveri_in_Vietnam.pdf).

The 2021 review of the taxonomy, biology, ecology, and the status, trend, and population structure of the species in Cambodia produced under the CTSP outlines approaches to collecting data on abundance, distribution and population trends of the species, with results (see https://cites-tsp.org/sites/default/files/project_files/2023-01/CITES_KH_*Dalbergia_cochinchinensis*_Taxonomy-Review_20210712A.pdf). A more detailed methodology for surveying the species is also provided in another report produced under the CTSP (see https://cites-tsp.org/sites/default/files/project_files/2023-01/CITES_KH_Systema_Inventory_*D_cochichinensis_D_oliveri*_Report_20210712.pdf).

Threats (Category D)

Some threats specific to Viet Nam are detailed in a review of the current harvest control and monitoring of the species in Viet Nam (see p. 10 in https://cites-tsp.org/sites/default/files/project_files/2023-01/A_Review_of_the_current_harvest_control_and_monitoring_of_Dalbergiaspp.pdf)

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

A 2018 study compiled seizure data from online news sites between January 2013 to December 2017 and details the number of reported seizures over time, and locations (Siriwat and Nijman, 2018). The study uses the synonym *Dalbergia bariensis* (see https://www.sciencedirect.com/science/article/pii/S1389934118302648#s0090) . The same authors (Siriwat and Nijman, 2023) also use seizure reports from online news sites between 2013 and 2019 to identify modes of illegal trade, and although the study does not detail the number of seizures for each species, the authors state datasets used available on 'reasonable request' (see https://www.sciencedirect.com/science/article/pii/S0006320722003792#da0005)

A 2019 NDF for the species in Viet Nam produced under the CTSP refers to instances of illegal harvest from four protected areas, as well as reported quantities of legal (2018-2021) and illegal (2017-2021) trade (see p.17-18 and 23-24 in https://cites-tsp.org/sites/default/files/project_files/2023-01/Vietnam_NDF_report_for_D_cochinchinense_D_oliveri_CTSP-CITES-2022_compressed.pdf)

A 2021 assessment report on the conservation status, management practices, and harvest monitoring the species in Cambodia produced under the CTSP gives a more detailed account of trends in illegal harvest, and impact of harvest, in the species (see https://cites-tsp.org/sites/default/files/project_files/2023-01/CITES_KH_Management_practice_harvesting_control_on_D_cochinchi_Report_20210719.pdf)

A 2020 TRAFFIC report on a rosewood market survey in China provides some recent trade dynamic and prices for the species (see https://www.traffic.org/site/assets/files/19229/rosewood_market_full_report_final.pdf) whilst the CoP17 Proposal for inclusion of *Dalbergia* species in Appendix II provides some historic global trade data for the species (see p.12 in https://speciesplus.net/api/v1/documents/9182)

Winfield et al. (2016) references a range of population studies conducted for the species in its range States (see p.61-64 in https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Global-Status-of-Dalbergia-and-Pterocarpus-Rosewood-CITES-2017-.pdf)

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

A 2022 study (Gaisberger et al., 2022) recommends potential restoration actions for the species across its range (see https://doi.org/10.1016/j.biocon.2022.109560). A study published in 2020 assesses the species' response to drought and heat stresses to help further identify its' suitable ecological niche (Hung, 2020) (see https://onlinelibrary.wiley.com/doi/full/10.1002/ece3.6744)

Relevant legislation and protection measures, as well as other management plans relevant to the species in Viet Nam, are provided in the 2019 NDF for the species (see https://cites-tsp.org/sites/default/files/project_files/2023-01/Vietnam_NDF_report_for_D_cochinchinense_D_oliveri_CTSP-CITES-2022_compressed.pdf). Management plans for the species are further detailed in a summary from a training workshop on management and conservation (see https://cites-tsp.org/sites/default/files/project_files/2023-01/Training_workshop_report_on_the_management_and_conservation_plan_piloting_it.pdf) with a detailed step by step management plan outlined in a 2022 document (see https://cites-tsp.org/sites/default/files/project_files/2023-01/Vietname_Management-and-conservation-plan-April-2022.pdf).

A 2021 assessment report on the conservation status, management practices, and harvest monitoring the species in Cambodia produced under the CTSP outlines management mechanisms and relevant legislation for the species (see https://cites-tsp.org/sites/default/files/project_files/2023-01/CITES_KH_Management_practice_harvesting_control_on_D_cochinchi_Report_20210719.pdf). Another report produced under the CTSP summarises guidelines and incentives for encouraging plantations of the species in Cambodia (see https://cites-tsp.org/sites/default/files/project_files/2023-

01/KH-Guidelines-and-Incentives-for-Dalbergia-cochinchinensis-and-D.-oliveri-Estabishment_compressed.pdf)

A 2018 study reports on best conditions for germination of the species (ZhangFei, 2018) (see https://www.cabdirect.org/cabdirect/abstract/20183147714)

Conservation status (Category H)

The 2022 IUCN Red List assessment gives a national red list assessment of endangered in Viet Nam (see p. 8 in https://www.iucnredlist.org/species/215341339/2813403), which was also referred to in a 2021 report on strengthening the management and conservation of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in Vietnam produced under the CTSP (see p.6 in https://cites-tsp.org/sites/default/files/project_files/2023-01/A_Review_of_the_current_harvest_control_and_monitoring_of_Dalbergiaspp.pdf).

The 2021 review of the taxonomy, biology, ecology, and the status, trend, and population structure of the species in Cambodia produced under the CTSP says the species is considered to be 'critically endangered', based on a report by Cambodia's Forestry Administration (see p. 9 in https://cites-tsp.org/sites/default/files/project_files/2023-01/CITES_KH_Dalbergia_cochinchinensis_Taxonomy-Review_20210712A.pdf). These are also referred to in the 2021 NDF for the species, also produced under the CTSP (see https://cites-tsp.org/sites/default/files/project_files/2023-01/CITES_KH_NDF_D_cochinchinensis_D_oliveri_20210923.pdf)

Three national red list assessments are referred to on BGCI, although it is not clear which country two of these refer to (see https://www.bgci.org/resources/bgci-databases/globaltree-portal/species-search/?species=Dalbergia+oliveri)

Factsheet 9: *Pterocarpus santalinus*

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

Pterocarpus santalinus; Note that this species is endemic to India, although has been introduced and/or cultivated in other countries	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g soil, climate)	*Pterocarpus santalinus* is native to tropical dry deciduous forests in elevations ranging from 150-900 metres, with rainfall as low as 100- 1,000 mm annually (Arunkumar and Joshi 2014). The species generally prefers hot and dry climates, with higher average temperatures and low rainfall (e.g 500-800mm) (Hegde et al., 2012). It occurs in temperatures ranging from 11-46 °C (Arunkumar and Joshi 2014), although one source states it can tolerate temperatures as low as 7 °C, with optimum temperatures 26-32 °C (FAO and IIASA, 2023). FAO and IIASA (2023) also report that *P. santalinus* can tolerate annual rainfall between 875 -2,800 mm, although with optimal rainfall slighter higher than reported by Hedge et al. (2012) of 1,000-1,900 mm a year. *Pterocarpus santalinus* occurs in well-drained loamy lateritic soils. (Ahmedullah & Nayar, 1984 in Ahmedullah et al., 2019). It prefers very shallow to shallow brown-coloured, sandy loam, or stony soils and is not found in compact soils (Hegde et al., 2012). Another source also states the species said to occur in soils that are generally shallow, poor, stony and well drained (Arunkumar and Joshi 2014). The species prefers acidic soils, tolerating those in the range of pH 4.5-6.5 but with optimal pH of 5-5.5, and can tolerate soils of low fertility (FAO and IIASA, 2023). The species requires high levels of sunlight and cannot tolerate water-logged soils (Arunkumar and Joshi, 2014). The species occurs almost exclusively in quartzite and shales (Raju and Nagaraju, 1999) and has a preference for hilly terrain (Arunkumar and Joshi, 2014). There are reported to be two types of wood from *P. santalinus* that are popular in trade: one that is wavy/ripple-grained and another straight-grained. The natural occurrence of the wavy grain variety is rare in natural populations (Henge et al., 2012, Arunkumar and Joshi, 2014) and may have a preference for friable (e.g easily crumbled) soils, with an absence in compact soils (Arunkumar and Joshi, 2014).
Tree characteristics (e.g maximum height and diameter)	The species is a small to medium sized deciduous tree species, reaching between 10-15 metres in height in its natural habitat (Arunkumar and Joshi 2014) and up to 15-18 metres in height in plantations (ICFRE, 1992 in Hegde et al., 2012). The trunk is branchless for 1.5-6 metres in the wild and up to 9 metres in plantations (Hegde et al., 2012).

	The girth of the species ranges from 150-190 cm metres in the wild according to Henge et al (2012), with a smaller range of 90 – 160 cm according to Arunkumar and Joshi (2012). The girth is reported to reach to up to 250 cm in plantations ((ICFRE, 1992 in Hegde et al., 2012). No data on maximum diameter at base height could be identified for *P. santalinus* and it is unclear if the term 'girth' used throughout the academic and grey literature for this species is synonymous with DBH, or diameter. An unreferenced source states the maximum diameter ranges from 60-100 cm, although the source does not state if this refers to DBH (Wood database, 2023).
Growth rates *	The species has a slow growth rate and takes an estimated 80-100 years to reach a harvestable size and 18-22 years to start developing the valuable heartwood (Ahmedullah et al., 2019). The growth, inclusive of girth, has been observed to be greater in wet/moist climates, e.g. those in West Bengal and Kerala (Babu, 1992 in Ahmedullah et al., 2019). The species is estimated to take 50-60 years to move from a girth of 30 cm to a harvestable girth of 70 cm, and an average of 10-12 years to move from one girth class to the next (e.g. an increment of around 10 cm) (Hegde et al., 2012). The species has low fruit set, exhibits poor regeneration, and may self-pollinate in adverse conditions (e.g with a lack of pollinators). Self pollination is thought to have a lower success rate and contribute to low fruit set (Ahmedullah et al., 2019). The low fruit set is also thought likely due to smaller mature tree populations resulting from logging. The fruit is wind dispersed, with seeds germinating shortly after the rainy season (Ahmedullah, 2021).
Role of species in Ecosystem*	The species is reported to be pollinated by rock bees (*Apis dorsata*) and carpenter bees (*Apis xylo-copa*) (Ahmedullah et al., 2019), with an earlier NDF stating the species was exclusively pollinated by honey bees *Apis dorsata*, *A. cerana indica* and *A. florea* (Hegde et al., 2012). The species is known to be associated with *Pterocarpus marsupium*, *Chloroxylon swietenia, Hardwickia binata, Anogeissus latifolia* and *Albizia lebbeck* (Arunkumar and Joshi 2014)
Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)	The seedlings of the species are adversely affected by repeated forest fires although when fire occurs in only one or two instances, this may encourage germination and seedling growth (Ahmedullah et al., 2019). Some seed-borne diseases that may infect the species are *Aspergillus niger*, *A. flavus*, *Cladosporium ladosporides* and *Fusarium* spp. (Ahmedullah, 2021).
B. Species range	
Global/geographic distribution	*Pterocarpus santalinus* is endemic to India (UNEP-WCMC, 2023). The species has a geographic range restricted to the Eastern Ghats, and specifically to forest tracts in the Kadapa, Chittoor, Nellore, Kurnool and Prakasam districts of Andhra Pradesh (Ahmedullah et al., 2019).

	The estimated extent of occurrence for the species is around 20,000 km^2, and the area of occupancy just over 1,000 km^2 (Ahmedullah, 2021). The species is also cultivated in Sri Lanka, China, and in Kerala, Maharashtra, Gujarat, Karnataka, Telangana, Tamil Nadu, Odisha and West Bengal within India. (Ahmedullah, 2021). There are records of its introduction in Sri Lanka, Philippines and Taiwan Province of China (Ahmedullah et al., 2019).
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 (India)	The species has experienced a severe decline since the 16th century due to illegal harvest driven by demand for it's high value heartwood, with an estimated decline of 50-80% over the last three generations. This has led to a skewed population structure, with less than 5% of trees remaining in the wild of harvestable size/maturity. The species is at risk from selective logging for international trade, which leads to a lack of mature trees and impacts upon the species' regenerative abilities (Ahmedullah et al., 2019). A comparison of data gathered from inventories conducted from the 2012 NDF and the 2019 NDF showed a drastic reduction in the proportion of species in wild populations in harvestable girth classes of greater than 70 cm. The 2012 NDF found 7.8% of trees across eight forest divisions to be of harvestable girth classes, whilst the 2019 NDF found only 2.2%, with most in lower girth classes and over 50% in the lowest class of less than 30 cm. Those in higher girth classes were also widely scattered across the range of the species, or absent altogether in areas where they were previously documented to occur (Ahmedullah et al., 2019) Although the species has been cultivated, this cannot meet international demand due to the long generation lengths of the species. The species is also at risk from habitat loss caused by both grazing of cattle and use of the forest for timber and fuelwood, risk of frequent forest fires in its native habitat, competition with invasive species, and the threat of invasive pests and diseases. The species can also be at risk from infestations after smugglers remove bark to test the heartwood formation in the tree (Ahmedullah et al., 2019). Threats to the species documented in Winfield et al (2016) include agricultural cultivation, forest fires, and logging (legal or illegal).
E. Historical and current species-specific levels and patterns of harvest and mortality	

Global legal/illegal trade	Although export of the species is banned in India, there is still evidence of illegal harvest and trade, driven by high international demand for its coloured heartwood. The impact of illegal harvest has been reported as of medium to high severity across its natural range (Ahmedullah et al., 2019). The species was stated to have a stock shortage based on interviews conducted in China (Zhang and Hin Keong, 2022b) and in another study on rosewood markets in China, the species was said to cater to luxury markets due to its scarcity, with commodities from *P. santalinus* (alongside *Dalbergia odorifera* and *Dalbergia cochinchinensis*) the most expensive commodities from rosewood tree species for sale (Zhang and Kin Keong, 2022a).*Pterocarpus santalinus* was also classified as a 'collectible' class of Hongmu species (alongside *D.odorifera* and *Dalebergia tonkinensis praion*) based on rosewood market surveys in 2013 (Forest Trends, 2013). The timber from the species has been reported to be worth over USD 58,000 per metric tonne in India, with this cost said to have doubled in illicit trade (Ahmedullah et al., 2019).
Known uses	The heartwood of the species is deep red, which can turn scarlet red upon exposure (Hegde et al., 2012). The colour of the heartwood is what the species is valued for. In plantations the colour has been observed to be paler than that from wild grown specimens, with plantation trees also appearing to contain more sapwood than in wild species (Ahmedullah, 2019). The proportion of heartwood in trees growing in plnatations have been found to vary from 0-65% heartwood content in a 20 year old plantation, and 6-82% heartwood content a 45 year old plantation (Arunkumar and Joshi, 2014). The species has been in trade since the 16th century, when the timber was sold to Europe and used as a dye (Arunkumar and Joshi, 2014). In the last few centuries, the demand has changed to use in furniture production as well as for medicinal purposes (e.g., the powdered heartwood is used to treat diabetes, and the species is also used for immunity medicine in China) (Ahmedullah, 2021). Primary markets for the species are now China (mostly for furniture) and Japan (for musical instruments, furniture, and toys) (Jenkins, 2012, Ahmedullah, 2021). The species is recognised as a Hongmu species in China's National Hongmu Standard (last revised in 2017) (Zhang and Kin Keong, 2022b). The timber is 'immune' to white ants and other insects (Anonymous, 1969 in Arunkumar and Joshi, 2014). Use of the species within the country is reported to be negligible (in comparison to international trade), with leaves of the species used as fodder for livetock and trees cut for use as timber or fuel wood (Ahmedullah, 2021). The timber has two varieties; straight and wavy grained. The latter is more popular and valuable in international markets (primary to Japan, to make the neck of a stringed lute known as 'Shamisen') (Henge et al., 2012, Arunkumar and Joshi, 2014) and can be

	identified by removing bark from the tree to check the heartwood (see threats for the possible negative impact of this practice).
F. Management measures	
Capacity for regeneration*	The species has a high capacity for coppicing and the potential for good natural regeneration in soil conditions conducive to their growth. These are thought to be factors that have allowed it to survive despite heavy exploitation (Ahmedullah et al., 2019). The 2012 NDF states the species is fire hardy and refers to saplings regenerating from stumps subject to repeated fires (Hegde et al., 2012), although the 2019 NDF states repeated forest fires may remain a threat to the species throughout its life (Ahmedullah et al., 2019).
Minimum felling diameter/rotation cycle*	The recommended 'harvestable girth' of the species in India is greater than 70 cm, although the species is cut at all size classes to meet demand (Ahmedullah, 2021). It is not clear if girth refers to DBH. One study of heartwood proportions showed moderate amounts of heartwood could be harvested in 40-50 years rotation cycles (Suresh et al., 2017 in Ahmedullah et al., 2019).
Conversion factors*	Studies conducted in India suggest that only 30% heartwood content can be expected from the total harvestable stem volume of the trees (Henge et al., 2012), although the proportion of heartwood may vary (see tree and timber characteristics from Arunkumar and Joshi, 2014). Conversion factors for various units to live tree equivalents for *P. santalinus* 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)
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	The species was most recently assessed on the IUCN Red List in 2020 and was globally Endangered under criteria A2cd (Ahmedullah, 2021).
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Useful resources for other information related to NDFs for *Pterocarpus santalinus*

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.

Population structure, status and trends (in the harvested area and nationally) (Category C)

An approach to population inventory and determination of age structures and relative abundance across it's native range is presented in the 2019 NDF (see p.39-51 in https://cites.org/sites/default/files/eng/com/sc/74/E-SC74-30-01-A5c.pdf)

A range of previous population studies for the species are compiled in Winfield et al. (2016) (see p.69-70 in https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Global-Status-of-Dalbergia-and-Pterocarpus-Rosewood-CITES-2017-.pdf)

A paper published in 2017 details an approach to inventory of population structure and regeneration potential in a protected area in India (Ankalaiah et al., 2017) (see https://threatenedtaxa.org/index.php/JoTT/article/view/2869) and another in 2022 (see https://www.proquest.com/scholarly-journals/distribution-population-structure-pterocarpus/docview/2756779937/se-2)

Threats (Category D)

More specific threats according to each forest division the species occurs in within it's native range in India are outlined in the 2019 NDF for the species (see p.34-38 in https://cites.org/sites/default/files/eng/com/sc/74/E-SC74-30-01-A5c.pdf).

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

Detailed descriptions of current and historic volumes of legal and illegal trade are given in the 2019 NDF (see p.59-64 in https://cites.org/sites/default/files/eng/com/sc/74/E-SC74-30-01-A5c.pdf).

Some illegal trade incidents for the species are referred to in CoP19 Proposal 50 (see https://speciesplus.net/api/v1/documents/15663)

A 2020 TRAFFIC report from a rosewood market survey in China details evidence of some trade in the species in China (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)

The 2019 NDF for the species in India outlines techniques for improving regeneration, and recent techniques and challenges identified in micropropagation (see p.8-9 in https://cites.org/sites/default/files/eng/com/sc/74/E-SC74-30-01-A5c.pdf). The same document (p.28-31) also shows an approach to calculating and monitoring annual harvest quotas from plantation sites for the species (summary p.28-31), and relevant legislative, enforcement and protective measures (p.65-74)

A 2012 paper (Kekrety et al., 2012) refers to management mechanisms to facilitate advanced regeneration in the species (see https://onlinelibrary.wiley.com/doi/10.1111/j.1526-100X.2012.00890.x)

A 2019 paper refers to use of native soil symbionts that had the nest impact on seedling growth (Karthikeyan and Arunprasad, 2019) (see https://link.springer.com/article/10.1007/s11676-019-01072-y) and a 2018 paper experiments with the impact of different pre sowing treatments on germination and growth (Patel et al., 2018) (see https://www.chemijournal.com/archives/2018/vol6issue4/PartD/6-3-332-635.pdf)

A 2011 paper refers to techniques for propagation of the plant (Balaraju et al., 2011) (see https://link.springer.com/article/10.1007/s11738-011-0795-8)

c) North America, and Central and South America and the Caribbean

Factsheet 10: *Dalbergia granadillo*

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

Dalbergia granadillo *Note, that this species is endemic to Mexico*	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g soil, climate)	The species grows in a variety of forest types including tropical deciduous forest, tropical semideciduous forest, tropical evergreen forest, oak forest, and disturbed oak-pine forest, and grows at altitudes of 80- 1,950 metres (Cervantes et al., 2010).
Tree characteristics (e.g maximum height and diameter)	The species can grow up to 20 metres in height (Martínez Salas and Linares, 2019), with a trunk diameter of up to 40 cm (assumedly this measure is for DBH, but this is not explicitly stated by the author) (CEC, 2017). The amount of sapwood varies according to the age of the tree and its habitat (CoP16 Proposal 61, 2013).
Growth rates *	The species is classified as slow-growing, alongside other *Dalbergia* species (reference to CoP17 Proposal 54, 2016 in Martínez Salas and Linares, 2019), and Mexico reports an average annual growth of between 0.4 cm and 1.14 cm for species in the genus *Dalbergia*, which most likely refer to diameter (see p.6 of. PC24 Doc. 22 (Rev. 1)
Role of species in ecosystem	One study found that bees frequently visited the tree and are likely major pollinators, with a wide variety of other insects (e.g coleopterans, dipterans, lepidopterans, hemipterans and non-bee hymenopterans) and other invertebrates (a few individuals of Blattodea and Arachnida) observed visiting *Dalbergia granadillo* (and *Dalbergia stevensonii*) likely for food, mates and refuge (Martínez-Peralta et al., 2022). The species often co-occurs with *Krameria* spp., *Byrsonima crassifolia* and *Psidium guineense* Sw. (G Arroyo-Cosultchi, unpublished data in Martínez-Peralta et al., 2022).

Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)	One study found the species flowers between mid-April and early May (Martínez-Peralta et al., 2022).
B. Species range	
Global/geographic distribution	The species is endemic to Mexico (Cowell et al., 2022, Martínez Salas and Linares, 2019). It occurs specifically on the Pacific Coast of Mexico in Chiapas, Guerrero, Jalisco, Michoacán, Nayarit and Oaxaca (Martínez Salas and Linares, 2019).
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 is reported to be the most sought after *Dalbergia* species in Mexico and Central America, with the population declining due to harvest for international trade. The population is inferred to have experienced an 80% decline over three generations mainly due to exploitation, but also due to declines in the species' native habitat. The species is amongst 33 identified as Hongmu, making it particularly valuable. Logging of the species for trade causes both habitat conversion and loss of the most reproductive individuals, with a subsequent impact on species regeneration (Martínez Salas and Linares, 2019).
E. Historical and current species-specific levels and patterns of harvest and mortality	
Global legal/illegal trade	When interpreting CITES Trade data for *Dalbergia granadillo*, it is worth noting a 2015 workshop in Mexico held by Conabio (Mexico's CITES Scientific Authority) concluded that *Dalbergia retusa* is not native to Mexico (CEC, 2017) with this later confirmed in Cervantes et al., (2019). Direct exports of *Dalbergia retusa* from Mexico reported prior to this (e.g 2009-2014) are therefore likely to be in *Dalbergia granadillo* instead (Camarena Osorno, in litt., in CEC, 2017). The species is at risk from illegal logging in Mexico, with the reported volume of illegal sawn wood from the tree previously documented to have more than doubled from ~ 318,000 m^3 in 2012 to ~ 728,000 m^3 in 2014. There are very small quantities of legal trade reported on the CITES trade database (based on data accessed in 2019) (Martínez Salas and Linares, 2019). A TRAFFIC rosewood market survey report in China stated that the price of *Dalbergia granadillo* imported from Mexico was about twice that of *Dalbergia retusa* imported from other source countries (Zhang and Kin Keong, 2022).

Known uses	The density of wood is documented to range from 0.90-1.35 g/cm^3 (Richter et al., 1996). The heartwood can vary in colour from yellow to orange, red, and shades of brown, with streaks of black or purple (CEC, 2017). Uses of the species documented by Winfield et al. (2016) with reference to a 2015 CONABIO Workshop for risk assessment of extinction of the genus *Dalbergia* timber species include furniture and cabinetwork, tonewood and musical instruments, decorative crafts and medicinal. Timber from the species was classified as 'very durable' in field tests in Mexico (Colín-Urieta, S., et al., 2018). The species is recognised as a Hongmu species in China's National Hongmu Standard (last revised in 2017) (Zhang and Kin Keong, 2022).
F. Management measures	
Capacity for regeneration*	No data could be found on regeneration or recovery capacity for this species, but generally regeneration rates of *Dalbergia* species are low (CoP17 Prop 55, 2016).
Minimum felling diameter/rotation cycle*	The minimum felling diameter for *Dalbergia* spp. in Mexico is 35 cm (assumedly DBH not not explicitly stated by the author), and forest management plans for the genus generally involve 10-year cutting cycles (PC24 Doc. 22 (Rev. 1)
Conversion factors*	Conversion factors used by UNODC for estimates of the conversion of mass in trade to the number of logs for *Dalbergia* species are 125 kg of timber: 1 log (UNODC, 2023). Conversion factors for various units (e.g., container, cubic meter, kilogram) to live tree equivalents for *D. granadillo* are also 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)
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	The species was assessed on the IUCN Red List in 2019 and classified as Critically Endangered (Martínez Salas and Linares, 2019).
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Useful resources for other information related to NDFs for *Dalbergia granadillo*

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.

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

A TRAFFIC China Rosewood Market Survey (Zhang and Kin Keong, 2022). refers to some recent trade dynamics of the species (see https://www.traffic.org/site/assets/files/19229/rosewood_market_full_report_final.pdf)

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

A 2017 action plan for sustainable trade in timber in North America refers to several action points required to enable sustainable management in species including *Dalbergia granadillo.* (e.g p. 8-9 in http://www.cec.org/files/documents/publications/11701-sustainable-trade-in-timber-action-plan-north-america-en.pdf).

The Useful Tropical Plants database refers to techniques required for propagation of *Dalbergia granadillo* (see https://tropical.theferns.info/viewtropical.php?id=Dalbergia+granadillo), and a recent study also evaluated variability and quality of seeds from a population of the species in Chiapas (see https://revista-agroproductividad.org/index.php/agroproductividad/article/view/2156/1727)

H. Conservation status (Category H)

The species is classified as endangered in Mexico based on a 2019 update of the national red list (see https://www.dof.gob.mx/nota_detalle.php?codigo=5578808&fecha=14/11/2019#gsc.tab=0)

Factsheet 11: *Dalbergia retusa*

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

Dalbergia retusa	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g soil, climate)	The species is a tropical dry forest species and can also be found in woodland and scrub along coastlines and pasturelands (Barstow and Linares, 2020). The species occurs on flatlands or moderate slopes (Marín and Flores, 2003). In Nicaragua, it is also known to occur in a wider variety of habitats including humid forests, gallery forests and savanna (Stevens et al., 2001 in Barstow and Linares, 2020). An NDF in Costa Rica in 2010 found that the species was restricted to tropical dry forest of in transitional areas to dry humid forest based on population sampling data (Rivera-Luther and Víquez-Mora, 2010). Annual rainfall where the species occurs is under 2,000 mm and temperatures range from 24 – 30°C, with the species growing in soils of various pH, texture, drainage and fertility according to one source (Marín and Flores, 2003). The Tropical Plants Database (2023) reports the species in the wild is found growing mainly on sandy soils and limestone escarpments, and in cultivation would benefit most from fertile loam soils in direct sunlight. An NDF for the species in Panama stated that in tests carried out by by scientists from the Smithsonian Tropical Research Institute, the species grows relatively well on most sites with well drained soils, and did not require fertile soils (Ministry of Environment, 2023). The species grows well in open areas (Marin and Flores, 2003 in UNEP-WCMC, 2017) and belongs to an ecological group (heliophytes) intolerant to shade (Rivera-Luther and Víquez-Mora, 2010). It typically occurs at elevation ranges of 50-300m (Marín and Flores, 2003) but has been documented to occur at up to 800 m in Nicaragua (Missouri Botanical Garden, 2023).
Tree characteristics (e.g maximum height and diameter)	Marín and Flores (2003) state the species grows to a maximum height of 15- 20 m, however Barstow and Linares (2020) state the species can grow to a maximum height of 15-30 m (Barstow and Linares, 2020). An NDF in Costa Rica in 2010 identified individuals of greater than 30 m in height (Rivera-Luther and Víquez-Mora, 2010). The tree is classified as small to medium in size and can grow up to 40 cm DBH according to Marín and Flores (2003), although more recent fieldwork found a maximum DBH of 77 cm (FAUSAC-FNPV, 2015 in Cop17 Prop 55). An NDF in Costa Rica in 2010 identified a small proportion individuals of greater than 40 cm DBH in their population sample, and state it is possible to find individuals of 100 cm DBH (Rivera-Luther and Víquez-Mora, 2010).The trunk has irregular growth and branches at a low height (Marín and Flores, 2003).

Growth rates *	The species has a slow growth rate (CoP14 Prop. 31 2007 in Barstow and Linares, 2020). Data from plantations in Guatemala found the species reached an average diameter of 15.93 cm after 20 years (FNPV, 2016 in UNEP-WCMC, 2017). An NDF for the species in Costa Rica states species have been documented to reach 10m in 15 years (Rivera-Luther and Víquez-Mora, 2010). An NDF for the species in Panama contradicts other reports of slow growth, and states the species shows a rapid growth rate even in infertile soils, based in tests in plantation projects/test sites conducted by various research projects (Ministry of Environment, 2023).
Role of species in Ecosystem*	The species is pollinated by honeybees (Barstow and Linares, 2020) and up to 60 species of bees are known to visit the flowers in Costa Rica (Frankie et al., 2002 in CoP16 Prop. 61, 2013). and can carry out nitrogen fixation (Tropical Plants Database, 2023, Rasolomampianina et al., 2005 in CoP16 Prop. 61, 2013). The species has is known to grow in association with *Tabebuia ochracea, Astronium graveolens, Tabebuia impetiginosa, Sideroxylon capiri* and *Swietenia macrophylla* (Jiménez Madrigal, 1993 in (Marín and Flores, 2003). The species belongs to an ecological group of heliophytes, which are capable of colonising new areas, including open areas, crop areas, and abandoned grazing areas (Rivera-Luther and Víquez-Mora, 2010). A study in 2017 classified the species as a long lived pioneer species that can carry out nitrogen fixation, and has a high level of water use efficiency. The research showed that there was an increase in productivity in one species (*Pachira quinata*) when it was grown with *D. retusa*, thought to be due to increased nitrogen availability (Mayoral et al., 2017). An NDF for the species in Panama states its ability to grow and carry out nitrogen fixation, as well as having a narrow crown which allows light to reach the understory below, could make it well suited to provide benefits in agroforestry systems and ecosystem restoration (Ministry of Environment, 2023).
Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)	An NDF for the species in Panama states it is drought tolerant and can also cope with a lack of nutrition (Ministry of Environment, 2023). The species exhibits mast flowering every four to five years, and fruit production in this species is usually high. It is pollinated by honeybees, as well as by wind and water (Barstow and Linares, 2020) Ripe fruits and found between March and May, with flowering occurring from January to May, and again in August and September (Marín and Flores, 2003). An NDF for the species in Panama states flowering and fruiting occurs mainly between March and April, with fruit production between July and October (Ministry of Environment, 2023). This species is deciduous (CEC, 2017).

	Seed abortion and self incompatibility have been observed in this species (Gibbs and Sassaki, 1998).
B. Species range	
Global/geographic distribution	The Dalbergia checklist states the species is native to Belize, Colombia, Costa Rica, Guatemala. Honduras, Nicaragua, Panama and El Salvador (Cowell et al., 2022). The IUCN Red List assessment conflicts with this slightly: the authors do not list Colombia among the countries the species is native to, stating there is one record of the species in Colombia, but further verification of the species in this country is required (Barstow and Linares, 2020). The species was previously believed to be distributed in Mexico but this was a misunderstanding, likely resulting from a misinterpretation of a cultivated herbarium record introduced from Costa Rica (Cervantes et al., 2019).
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 was already described as 'scarce' in 1979 (CoP14. Prop. 31, 2007) and since then trade and exploitation of the species have continued, with increased international demand and continued conversion of the species' natural habitat, leading to large declines in the population (Barstow and Linares, 2020). Reports of stock being completely exhausted from areas where the species was widespread due to intense exploitation was reported as early as 1998 (Americas Regional Workshop, 1998 in UNEP-WCMC, 2017). The species is subject to illegal logging, and mis-declarations (EIA, 2016 in Cop17 Prop 55) and is thought to be commercially exhausted or extinct in some sites (CoP16 Prop. 61, 2013). Between 2013 and 2014, there was a fourfold increase in trade in this species reported in CITES Trade Data, and it was the most prominent tree species exported from the region in CITES Trade data between 2010 and 2014 (Winfield et al., 2016). The species has a similar red colour to *Dalbergia cochinchinensis* and is used by some high end Hongmu furniture companies due to its lower price (Zhang and Hin Keong, 2022). The species is also at risk from deforestation, selective logging/wood extraction, road construction and forest fires (Winfield et al., 2016). Some habitat loss is due to cattle ranching and burning (Barstow and Linares, 2020). Based on rates of habitat loss and harvest of the species across its range, it is inferred that over the last three generations (e.g 150 years), the population size has declined by over 80% (Barstow and Linares, 2020).

E. Historical and current species-specific levels and patterns of harvest and mortality	
Global legal/illegal trade	When interpreting CITES Trade data for *Dalbergia retusa*, it is worth noting a 2015 workshop in Mexico held by Conabio concluded that *Dalbergia retusa* is not native to Mexico (CIC,2017) with this later confirmed in Cervantes et al., (2019). Direct exports of *Dalbergia retusa* from Mexico are therefore likely to be in *Dalbergia granadillo* instead (Camarena Osorno, in litt., in CEC, 2017). This species has previously been identified as the second most frequent Dalbergia species identified in trade, and is used in furniture and cabinet making, as well as to produce musical instruments and decorative crafts (Barstow and Linares, 2020). It entered the Chinese market for it's use in furniture before 2004, and gradually became a replacement for *Dalbergia cochinchinensis*, which has a similar red colour. The Chinese Timber Index indicates that sales of the species have fallen by 9% annually in one province since 2017 (Zhang and Hin Keong, 2022a). In 2013, the species was classified as an ordinary (e.g non collectible) but high end class Hongmu species based on observations from rosewood markets (Forest Trends, 2013). Stock for the species in markets in China is reportedly 'high' based on interviews conducted as part of a TRAFFIC rosewood market survey (Zhang and Kin Keong, 2022b)
Known uses	One source reports the heartwood as very dark red, with streaks of black (Tropical Plants Database, 2023), whilst another states it varies from yellow to dark reddish-brown, with darker irregular markings (CoP16 Prop. 61, 2013). Marín and Flores (2003) state the heartwood becomes a deep, rich orange red with black stripes or mottling after exposure to air. It can be very difficult to distinguish between timber from this species and that of *Dalbergia granadillo*, a Mexican endemic species (CEC,2017). The wood is fragrant, hard, heavy, strong and sometimes brittle with an air dry density of 750-1000 kg/m3. It exhibits a natural polish due to its high oil content (Marín and Flores, 2003). The heartwood produced from the species is termite resistant (Barstow and Linares, 2020) and has high natural durability (Marín and Flores, 2003). Timber from the species is reported to be good for marine use as it secrets compounds toxic to bacteria, fungi, algae and other destructive insects (NAS, 1979 in CEC, 2017). The species is documented to be used in medicine, furniture/cabinet work, tonewood and musical instruments, decorative crafts, and as a fuel (Winfield et al., 2016) It is easy to work, and one of the most important woods in the cutlery trade for handles, as well as for use in inlays, brush backs, musical and scientific instruments, jewellery boxes, chessmen and other specialised items (Marín and Flores, 2003). Interviews conducted for a TRAFFIC rosewood market survey in China indicated this species may no longer be processed given unfavourable dry weather conditions for preserving its timber within northern China, although the pecies is recognised as a Hongmu species in China's National Hongmu Standard (last revised in 2017) (Zhang and Hin Keong, 2022).

F. Management measures	
Capacity for regeneration*	The species regenerates well in open or disturbed areas and within secondary vegetation (Barstow and Linares, 2020). Natural regeneration is scarce, although sapling and juveniles up to 4 m can be found growing in areas periodically exposed to fire (Marín and Flores, 2003). An NDF for the species in Costa Rica in 2010 re-iterated that the species needs light and space to establish itself, and that it had been observed to resprout a few years after felling; for example trees known to have been cut previously were now observed to have reached heights of 15 metres, and regrowth on exposed roots was observed (Rivera-Luther and Víquez-Mora, 2010).
Minimum felling diameter/rotation cycle*	In Nicaragua, the minimum felling diameter for the species is 40 cm DBH (CITES Scientific Authority, 2020).
Conversion factors*	Wastage of the wood is reported to be high due to the sapwood being low value (CoP14. Prop. 31, 2007). An NDF for the species in Panama states that during commercial felling at least 50% of the tree is destroyed (Ministry of Environment, 2023). Conversion factors used by UNODC for estimates of the conversion of mass in trade to the number of logs for *Dalbergia* species are 125 kg of timber: 1 log (UNODC, 2023). Conversion factors for various units (e.g., container, cubic meter, kilogram) to live tree equivalents for *D. retusa* are also 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)
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	The species was most recently assessed on the IUCN Red List in 2020, and classified as Critically Endangered under criteria A2bcd (Barstow and Linares, 2020).

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Useful resources for other information related to NDFs for *Dalbergia retusa*

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.

There are three NDFs for this species: one is from Costa Rica (2010) and one from Nicaragua (2020) (see CITES NDF database for both https://cites.org/eng/virtual-college/ndf) and another from Panama (see Annex 3 to https://cites.org/sites/default/files/documents/E-PC26-16-02_1.pdf). These detail approaches to inventory and management in the countries, as well as providing other data relevant to NDFs **(e.g contains data relevant to multiple categories)**

The CTSP has produced documents mainly related to identification and genetic analysis of the species (amongst other *Dalbergia* spp.) in El Salvador, Guatemala and Nicaragua (see https://cites-tsp.org/regions/el-salvador, https://cites-tsp.org/regions/nicaragua and https://cites-tsp.org/regions/guatemala) that may be of use to Parties

C. Population structure, status and trends (in the harvested area and nationally) (Category C)
Some country level information on habitat loss, or data on declines in the species, are provided for Guatemala, Costa Rica, Honduras, Panama, El Salvador and Nicaragua (see p.3 in https://www.iucnredlist.org/species/32957/67799410).

The 2016 CoP17 Prop 55 document also lists similar information for Guatemala and El Salvador (see p.7 in https://speciesplus.net/api/v1/documents/9182), whilst UNEP-WCMC (2017) report on population size, distribution and trends in El Salvador, Guatemala and Nicaragua (see p.29-32 in https://www.blackwoodconservation.org/wp-content/uploads/2019/07/UNEP-WCMC_Review-of-selected-Dalbergia-species-and-Guibourtia-demeusei.pdf).

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

Some data on illegal trade in the species in various range States is presented in 2016 CoP17 Prop 55 (see p.11 in https://speciesplus.net/api/v1/documents/9182)

Data on legal trade from the CITES Trade Database between 2013-2015 for El Salvador, Guatemala and Nicaragua is summarised in UNEP-WCMC (2017) (see p.27-28 in https://www.blackwoodconservation.org/wp-content/uploads/2019/07/UNEP-WCMC_Review-of-selected-Dalbergia-species-and-Guibourtia-demeusei.pdf).

Some recent trade dynamics, inclusive of average prices, for the species in China are presented in a TRAFFIC rosewood market survey (see https://www.traffic.org/site/assets/files/19229/rosewood_market_full_report_final.pdf) and a

policy review (see https://www.traffic.org/site/assets/files/19234/rosewood_policy_full_report_final.pdf)

A 2020 paper details trends and patterns in illegal harvest/trade between 2000-2018 in Panama (Vardeman and Velásquez Runk, 2020) (see https://www.sciencedirect.com/science/article/pii/S2351989419309126)

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

Some information on propagation and germination of the species is provided on the Tropical Plants Database (see https://tropical.theferns.info/viewtropical.php?id=Dalbergia+retusa) and additionally in Marín and Flores (2003) (see p.429-430 in https://assets.echocommunity.org/publication_issue/2d0cff12-2c59-44b8-a731-2470f0f957b5/en/tropical-tree-seed-manual.pdf) and also in an experiment on the impact of temperature on germination (see https://www.cabdirect.org/cabdirect/abstract/20013006608)

Some information on management and protection status for the species in El Salvador, Guatemala and Nicaragua is given in UNEP-WCMC (2017) (see p.29-32 in https://www.blackwoodconservation.org/wp-content/uploads/2019/07/UNEP-WCMC_Review-of-selected-Dalbergia-species-and-Guibourtia-demeusei.pdf).

An experimental study that monitored growth and productivity in monocultures and mixed plantations for Dalbergia retusa, Anacardium excelsium, Pachira quinata, Tabebuia rosea and Terminalia Amazonia has information that could be relevant to plantation design for this species (Mayoral et al., 2017) (see https://www.sciencedirect.com/science/article/pii/S037811271730806X)

Conservation status (Category H)

Although now outdated, the 2013 CoP16 Prop. 61 document listed some national threat assessments of the species in its range States El Salvador, Honduras, Nicaragua, Costa Rica and Guatemala (see p.4 in https://speciesplus.net/api/v1/documents/1523)

Factsheet 12: *Dalbergia stevensonii*

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

Dalbergia stevensonii	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g soil, climate)	The forest type inhabited by the species is characteristic of the Petén-Veracruz moist forest ecoregion of Central America, which occurs only in Belize, Guatemala, and Mexico (UNEP-WCMC, 2019). The exact habitat of the species varies according to each country (Martínez Salas et al., 2021) but is classified in the Dalbergia checklist as tropical moist lowland forest, with the altitude range said to be between 0-750 m asl (Cowell et al., 2022). In Belize, *D. stevensonii* is known to occur in the highest abundances on highly weathered and acidic, nutrient-poor soils with poor vertical drainage, derived from mostly igneous material, and is also 'infrequent to occasional' along streams over igneous rock. It is also (rarely) found in Belize on limestone at higher elevations. *Dalbergia stevensonii* is known to occur near watercourses (with deep soils) in Mexico (Martínez Salas et al., 2021).
Tree characteristics (e.g maximum height and diameter)	The species can grow to maximum heights of 15-30m, with trunks that commonly fork at around 6-8 m from the ground and maximum trunk diameters (assumedly DBH, but not explicitly stated by the author) of 91 cm (e.g 3 ft) (Chudnoff, 1979). Recent field work in Guatemala found lower maximum diameters of 83 cm DBH (FAUSAC-FNPV, 2015 in CoP17 Prop 55, 2016).
Growth rates *	The species is slow-growing (NAS, 1979 in CoP14 Prop 32, 2007). UNEP-WCMC (2019) reference two studies of populations of the species in Belize, with one identifying average annual diametric increases of 0.32 cm, and another 0.40 cm. One study referenced - a draft NDF for the species in Belize - indicated that annual growth increased with size class (e.g slowest at < 10 cm DBH, increasing between 25- 40cm DBH, and fastest at ~ 40 cm DBH) (Cho, 2016 in UNEP-WCMC, 2019). Mexico reports an average annual growth of between 0.4 cm and 1.14 cm for species in the genus *Dalbergia*, which most likely refer to diameter (see p.6 of. PC24 Doc. 22 (Rev. 1). One study estimated a sapling (5cm DBH) would take around 115 years to reach a merchantable diameter of 45 cm (Gutierrez and Dorgay, 2017).

Role of species in Ecosystem*	The species is thought likely to be pollinated by bees (Martínez Salas et al., 2021) and a recent study in Mexico confirmed that bees were the major pollinators of the species in the population studies. The study also identified a wide range of insects and invertebrates (533 insects from 10 orders and 12 Arachnida) visited the tree (Martínez-Peralta et al., 2022) Ant colonies are often found associated with the species (FAUSAC-FNPV, 2015 in CoP17 Prop 55, 2016)
Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)	Germination in the species can be challenging and it requires natural large scale canopy disturbance for successful recruitment (UNEP-WCMC, 2019 in Martínez Salas et al., 2021). Flowers have been documented to appear in this species in the first two weeks of July, with fruits ripening in late September or November (Martínez Salas et al., 2021). One study in Belize stated slightly early flowering between May and July, after trees shed their leaves between April and July (Gutierrez and Dorgay, 2017). This pattern was said to have been consistent yearly between 2013 and 2016. Another study in Mexico found mature fruits on trees in April, with flowering 10 months prior (Martínez-Peralta et al., 2022). The species has high seed abortion rates (Jenkins et al., 2012) and frequent flower abortion was observed in one study in Mexico (Martínez-Peralta et al., 2022).The seeds of the species are susceptible to damage from insects and the leaves and flowers to attacks from phytopathogens (Herrera et al., 2016).
B. Species range	
Global/geographic distribution	The species is native to Belize, Guatemala and Mexico (Cowell et al., 2022, Martínez Salas et al., 2021). The species has a limited geographic range in each country. Although data are limited, it is thought core subpopulations of the species are restricted to the south of Belize, in Cayo and Toledo districts. In Mexico the species is known to occur in eight localities in the state of Chiapas, and in Guatemala, the species is most frequent in the region of Peten. There are reports of occurrences of the species in Honduras, El Salvador and Nicaragua but they have not been verified (Martínez Salas et al., 2021). See below for a distribution map from UNEP-WCMC (2019)

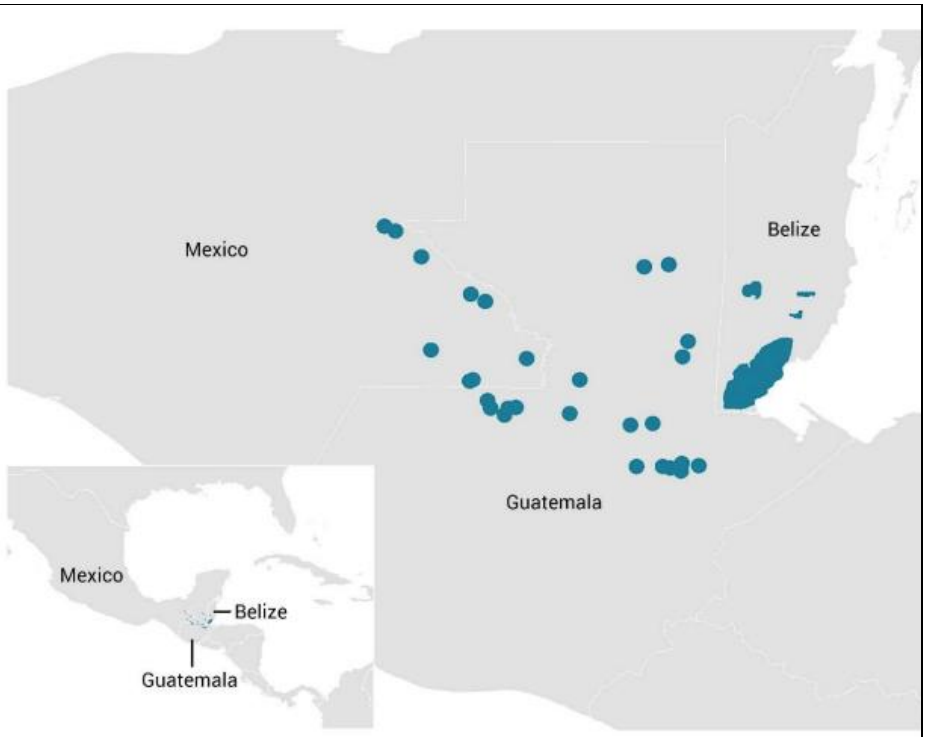

Figure 1: Distribution of *Dalbergia stevensonii*

Source: Belize Dalbergia stevensonii *population density data digitised from Cho (2016); Guatemala* D. stevenson *occurrence data digitised from Fundacion Naturaleza para la Vida (2016b); Mexico* D. stevensonii *occurrence da from CONABIO (2015 in de Stefano* et al., *2016).*

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	Key threats outlined in the most recent IUCN Red List assessment include over exploitation, and loss of habitat dye to human population growth and agricultural expansion (Martínez Salas et al., 2021). Subpopulations in all countries are decreasing based on export data and habitat loss, and the species has also been exploited for timber over the last two centuries, with a peak in the 21st century. The species is often described as 'rare' and it is estimated there has been a population reduction of 90% in the past 20 years, with a significant reduction in commercial stock between 2000 and 2014. The threat from timber harvest is continuing (Martínez Salas et al., 2021). One study reported a loss of 50% of commercial stock in Belize between 2008 and 2012 (Cho, 2016 in UNEP-WCMC, 2019). The species has a limited range likely in part as a result of habitat specificity and high levels of seed predation from insects. The species is also threatened by changes to land use (Martínez Salas et al., 2021). Winfield et al (2016) document forest fires and deforestation as threats to the species.

	One study reported the tree's reproductive activity was closely related to seasonal patterns which could be negatively impacted by changes in weather linked to climate change (Gutierrez and Dorgay, 2017). The authors also pointed out the species is particularly sensitive given its' poor dispersal abilities and long generation lengths. Selective commercial logging and the loss of large, seed-bearing individuals means regeneration is limited in populations of the species. Selective small scale removal of the species for construction and for production of smaller items such as carvings and boxes has also occurred for many years (Martínez Salas et al., 2021). Much trade is thought to be from illegal origin, with timber sourced from protected areas, or harvested and exported with the use of false permits. This is facilitated by a lack of traceability, corruption, and difficulties in identifying different *Dalbergia* species in trade. There are no plantations for this species, so all harvest is from the wild (Martínez Salas et al., 2021).
E. Historical and current species-specific levels and patterns of harvest and mortality	
Global legal/illegal trade	Trade In this species is greatest with China, the USA, and countries within the EU (Martínez Salas et al., 2021). A 2017 report stated that the species of available for sale in Canada and the United States but is especially rare, with a Canadian importer in 2016 stating their last import of wood from the species was more than two years previously (CEC, 2017). There were increased imports of the species reported into China from all range States between 2009 and 2012 (Martínez Salas et al., 2021). In 2013, the species was classified as an ordinary (e.g not collectable)/low-end class Hongmu species based on observations from rosewood markets (Forest Trends, 2013). Between 2007 (when it was listed) and 2020, there were only 73 export records for the species in the CITES Trade Database (Martínez Salas et al., 2021), although each record may represent multiple transactions. Much trade in this species is from wild and illegal origin, with timber sourced from protected areas or harvested and traded using false permits; illegal trade is enabled by a lack of traceability, corruption and poor identification of various Dalbergia species in trade (Martínez Salas et al., 2021), A rosewood market survey by TRAFFIC in 2020 reported the species is now used more for manufacturing crafts than furniture, stating it entered trade into China in around 2005 and was originally used in counterfeit *Dalbergia oliveri* furniture, but was gradually abandoned by furniture makers due to issues such as large colour variations and poor drying performance (Zhang and Hin Keong, 2022)
Known uses	Heartwood from the species is pinkish brown or purple with alternate dark and light zones, and fresh wood has an aromatic odor. (Chudnoff, 1979). The timber is hard and heavy and has a density of 0.93– 1.09 g/cm^3 when air dried (Record and Hess, 1943 in Wiemann and Ruffinatto, 2012). This timber from the species highly prized as tonewood for musical instruments, and is in increasing demand for Hongmu style furniture and cabinet making for an Asian market according to the IUCN Red List

	assessment (Martínez Salas et al., 2021). The species is recognised as a Hongmu species in China's National Hongmu Standard (last revised in 2017) (Zhang and Kin Keong, 2022). Wood from the species is very durable (Martínez Salas et al., 2021).
F. Management measures	
Capacity for regeneration*	One study reported the species is able to regrow from stumps (Gutierrez and Dorgay, 2017) and the CoP17 Proposal to list the genus *Dalbergia* states this this species responds well to coppicing (CoP17 Prop 55, 2016). The species is thought to require high levels of sunlight to successfully germinate, which may indicate that recruitment occurs during periods of severe canopy disturbance e.g after hurricanes (Cho, 2016 in UNEP-WCMC, 2019).
Minimum felling diameter/rotation cycle*	Guidance on minimum felling diameters for the species varies. A 'self imposed' minimum felling of greater than 30 cm DBH was noted in an NDF for the species in Belize, and between 35-70 cm DBH in community-based forest groups (Cho, 2016 and CITES SA of Belize in litt. to UNEP-WCMC, 2019). One forest concession in Belize previously set minimum cutting diameters of 45 cm DBH (Gutierrez and Dorgay, 2017). Mexico reports that it has forest management plans for species of the genus *Dalbergia* and, in general, the plans involve 10-year cutting cycles with a minimum cutting diameter of 35 cm (assumedly DBH, but not explicitly stated by the author) (PC24 Doc. 22 (Rev. 1)
Conversion factors*	There is reported to be a high level of wastage of up to 80% during the production of marimba bars for musical instruments from *Dalbergia stevensonii*, as only logs of the straightest grain are used (CoP16 Prop. 62, 2013). Conversion factors used by UNODC for estimates of the conversion of mass in trade to the number of logs for *Dalbergia* species are 125 kg of timber: 1 log (UNODC, 2023). Conversion factors for various units (e.g., container, cubic meter, kilogram) to live tree equivalents for *D. stevensonii* are also 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)
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	The species was most recently assessed on the IUCN Red List in 2020 and classified as Critically Endangered under criteria A2acd (Martínez Salas et al., 2021).

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Zhang, K., Hin Keong, C (2022). China's rosewood market survey. Available at https://www.traffic.org/site/assets/files/19229/rosewood_market_full_report_final.pdf. Accessed 13th October 2023.

Useful resources for other information related to NDFs for *Dalbergia stevensonii*

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.

Country profiles with data relevant to most aspects of NDFs (distribution, population status and trends, threats, trade and management) are presented for all range States for the species in UNEP-WCMC (2019) (see p. 16-29 in https://cdn.wcs.org/2019/08/05/1jm8hnazna_WCS_CITES_implementation in_C_America_Final_Report_EN_1_.pdf).

Species biology and life-history characteristics (Category A)

A recent paper details the floral biology of the species in Mexico (Martínez-Peralta et al., 2022) (see https://link.springer.com/article/10.1007/s40415-022-00787-3#citeas) and a 2016 report of CITES Appendix II tree species presents some data on botanical characteristics of the species, as well as distribution (see https://www.itto.int/files/user/cites/guatemala/

Manual%20de%20identificaci%C3%B3n%20de%20especies%20forestales%20CITES_Guatemala2.pdf)

The CoP 16 Proposal to list the species in Appendix II refers to further detail of the habitat types in each range state (see https://speciesplus.net/api/v1/documents/658)

Population structure, status and trends (in the harvested area and nationally) (Category C)
Available data on population abundance, structure and trends in each range state are given in the most recent Red List assessment (Martínez Salas, 2021) (see p.3-4 in https://www.iucnredlist.org/species/51004494/51004580)

Some data on density estimates in Belize and Guatemala are also given in UNEP-WCMC (2019) (see p. 13 in https://cdn.wcs.org/2019/08/05/1jm8hnazna_WCS_CITES_implementation in_C_America_Final_Report_EN_1_.pdf)

Winfield et al (2016) present findings from a population study in Guatemala (see p.204 in https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Global-Status-of-Dalbergia-and-Pterocarpus-Rosewood-CITES-2017-.pdf)

Threats (Category D)

Available data on threats specific to each range state are given in the most recent Red List assessment (Martínez Salas, 2021) (see p.6-7 in https://www.iucnredlist.org/species/51004494/51004580) and also in the 2013 CoP16 Proposal 62 (see p.6 in https://speciesplus.net/api/v1/documents/658)

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

Data on legal trade from the CITES trade database between 2013-2017 is summarised in UNEP-WCMC (2019) (see p. 14-16 in https://cdn.wcs.org/2019/08/05/1jm8hnazna_WCS_CITES_implementation in_C_America_Final_Report_EN_1_.pdf).

Some recent trade dynamics, inclusive of average prices, for the species in China are presented in a TRAFFIC rosewood market survey (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)

Some information on known management methods in each range state (e,g rotation cycles and presence in protected areas) are given in the most recent Red List assessment (Martínez Salas, 2021) (see p.3-4 and 7-8 in https://www.iucnredlist.org/species/51004494/51004580)

Some information on germination requirements in the species is given in UNEP-WCMC (2019) (see p. 12 in https://cdn.wcs.org/2019/08/05/1jm8hnazna_WCS_CITES_implementation in_C_America_Final_Report_EN_1_.pdf) and a 2021 thesis on the species also researches into germination requirements of the species http://riaa.uaem.mx/xmlui/bitstream/handle/20.500.12055/3625/AASKVT08.pdf?sequence=1&isAllowed=y

Conservation status (Category H)

Data on national conservation assessments for range States Guatemala and Mexico are given in the most recent Red List assessment (Martínez Salas, 2021) (see p.3-4 and 7-8 in https://www.iucnredlist.org/species/51004494/51004580) A 2015 document by Comisión Nacional para el Conocimiento (CONABIO) and Uso de la Biodiversidad assesses the risk of extinction to the species in Mexico and also has contains national data relevant to NDFs, (see https://bioteca.biodiversidad.gob.mx/janium/Documentos/15330.pdf)

Factsheet 13: *Dalbergia tucurensis*

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

Dalbergia tucurensis	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g soil, climate)	The species is found in broadleaved cloud forest and transition regions to pine forest. The species occurs at higher altitudes than other *Dalbergia* species (Linares and Martínez Salas, 2020). The Dalbergia checklist classifies the habitat of the species as tropical moist montane forest, with altitudes ranging from 1,500-2,900 m asl (Cowell et al., 2022). A dissertation thesis in Honduras states the species is found at lower altitudes (from 0 - 1,130 m asl), and with annual precipitation ranging between 2,000 and 3,5000 mm (Knoblauch, 2001, unpublished). Another thesis which studies the species in the department of El Petén in Guatemala found the species was found in areas with temperatures ranging from 24°C to 26°C, and annual rainfall from 1,400 to 2,000 mm, in shallow soils of calcareous material with clayey loam textures (Ruiz Mazariegos, 2017)
Tree characteristics (e.g maximum height and diameter)	The tree is classified as large, reaching a maximum height of 25-35 m (Linares and Martínez Salas, 2020). Field studies in Guatemala found the maximum DBH of the species was 90 cm (FAUSAC-FNPV, 2015 in CoP17 Proposal 55, 2016). The dissertation thesis for the species produced in Honduras states the species has a maximum diameter of 85 cm DBH, and a maximum height of 40 m (Knoblauch, 2001, unpublished). The thesis also states fruiting in this species is biannual, occurring between April to June, but most abundant in May.

Growth rates *	Species in the genus Dalbergia are slow growing (CoP17 Proposal 55, 2016). The dissertation thesis produced in Honduras states that growth data from sites of medium to high fertility found mean annual increases of more than 1 cm DBH and more than 1 m in height for the species (Knoblauch, 2001, unpublished). Mexico reports an average annual growth of between 0.4 cm and 1.14 cm for species in the genus *Dalbergia*, which most likely refer to diameter (see p.6 of. PC24 Doc. 22 (Rev. 1).
Role of species in Ecosystem*	A dissertation thesis in Honduras states in forests studied, the species was found associated with more than 97 other species, but most frequently with those from the *Leguminosae* family. Additionally the species was found with *Swietenja macrophylla*, *Cedrela odorata, Cojoba Arborea* and *Cordja alliodora.* The thesis provides a list of all species found in association (Knoblauch, 2001, unpublished).
Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)	The dissertation thesis produced in Honduras states most seeds fro the species in semi-open sites were attacked by pests or fungi, making natural regeneration difficult. The same thesis states the species is classified as a heliophyte and requires canopy disturbance (Knoblauch, 2001, unpublished).
B. Species range	
Global/geographic distribution	This species is native to El Salvador, Guatemala, Honduras and Mexico (Cowell et al., 2022, Linares and Martínez Salas, 2020) The estimated extent of occurrence for the species is 82,592 km^2, with a scattered distribution within its range (Linares and Martínez Salas, 2020)
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 population is thought likely to be decreasing due to habitat loss and use for timber and it is inferred the global population has declined by around 50% over the last twenty years. Habitat loss is the main threat to the species, and it occurs in threatened habitats (Linares and Martínez Salas, 2020). Threats documented by Winfield et al (2016) include deforestation, wood extraction/selective logging, and road construction.

E. Historical and current species-specific levels and patterns of harvest and mortality	
Global legal/illegal trade	A TRAFFIC report on a rosewood market survey in China states the species does not meet China's national Hongmu Standard due to it's low wood density, and that import volumes and sale data in China were hard to source for this species (Zhang and Kin Keong, 2022). As the species is not known in plantations, trade is from wild harvested individuals (Linares and Martínez Salas, 2020).
Known uses	The timber is red in colour according to CoP17 Proposal 55 (2016), with another source stating the heartwood is orange coloured with pronounced violet striping that becames brown or purplish upon exposure (Record and Hess, 1943 in Wiemann and Ruffinatto, 2012). The timber is moderately hard, heavy, tough and strong (Record and Hess, 1943 in Wiemann and Ruffinatto, 2012) with a density ranging from 0.68–0.79 g/cm^3 (mean 0.72 cm^3). The species is used to make musical instruments (marimbas) in Mexico and is also traded internationally as a decorative timber (Linares and Martínez Salas, 2020). The species is not recognised as a Hongmu species in China's National Hongmu Standard (last revised in 2017) (Zhang and Kin Keong, 2022). Uses documented by Winfield et al (2016) include construction, furniture and cabinetwork, medicine and fuel, whilst Cowell et al. (2022) state the species is used for construction/building materials, timber, carving/handicrafts and jewellery.
F. Management measures	
Capacity for regeneration*	The author of the dissertation thesis study on the species in Honduras states the tree responds well to coppicing, and that regeneration may be abundant on disturbed sites near roads and roadsides (Knoblauch, 2001, unpublished).
Minimum felling diameter/rotation cycle*	The minimum felling diameter for *Dalbergia* spp. in Mexico is 35 cm (assumedly DBH, but not explicitly stated by the author), and forest management plans for the genus generally involve 10-year cutting cycles (PC24 Doc. 22 (Rev. 1)
Conversion factors*	Conversion factors used by UNODC for estimates of the conversion of mass in trade to the number of logs for *Dalbergia* species are 125 kg of timber: 1 log (UNODC, 2023). Conversion factors for various units (e.g., container, cubic meter, kilogram) to live tree equivalents for *D. tucurensis* are also 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

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	The species was most recently assessed on the IUCN Red List in 2019 and classified as Endangered under criteria A2ac (Linares and Martínez Salas, 2020).

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Ruiz Mazariegos, P. I (2017) Phenological and botanical study of the species Swietenia macrophylla King., Dalbergia stevensonii Standl. And Dalbergia tucurensis Donn. Smith in the department of Petén. Presented to the honorable board of directors of the faculty of agronomy of the University of San Carlos of Guatemala. Available at https://core.ac.uk/download/pdf/132120365.pdf. Accessed 16th October 2023.

Wiemann, C. and Ruffinatto, F (2012). Separation of *Dalbergia stevensonii* from *Dalbergia tucurensis*. Research Paper FPL-RP-665. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. Available at https://www.fpl.fs.usda.gov/documnts/fplrp/fpl_rp665.pdf. Accessed 17th October 2023.

Winfield, K., Scott, M. and Grayson, C. (2016). CITES CoP17 Information Paper- Global status of *Dalbergia* and *Pterocarpus* rosewood producing species in trade. Available at https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Global-Status-of-Dalbergia-and-Pterocarpus-Rosewood-CITES-2017-.pdf. Accessed 2nd October 2023.

Zhang, K., Hin Keong, C (2022). China's rosewood market survey. Available at https://www.traffic.org/site/assets/files/19229/rosewood_market_full_report_final.pdf. Accessed 13th October 2023.

Useful resources for other information related to NDFs for *Dalbergia tucurensis*

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.

Given a lack of data for this species on many aspects above, it may be useful to refer to two thesis university projects, one an area in El Petén in Guatemala (see https://core.ac.uk/download/pdf/132120365.pdf) and one in Honduras (see https://bdigital.zamorano.edu/handle/11036/1506) which contain relevant data on species biology and life-history characteristics. The thesis on the species in Honduras also contains some information relevant to management (e.g best conditions for regeneration and germination)

The wood database, also contains data on factors such as maximum diameter size and durability, although sources are not referenced (see https://www.wood-database.com/yucatan-rosewood/)

Population structure, status and trends (in the harvested area and nationally) (Category C)
Some population trends inferred from habitat loss in Guatemala are outlined in the CoP17 Proposal to list the genus Dalbergia (CoP17 Proposal 55, 2016) (see p.7 in https://speciesplus.net/api/v1/documents/9182)

Winfield et al (2016) present findings from a population study in Guatemala (see p.205 in https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Global-Status-of-Dalbergia-and-Pterocarpus-Rosewood-CITES-2017-.pdf)

Threats (Category D)

Some threats specific to Guatemala and Honduras are outlined in the 2020 Red List Assessment (Linares and Martínez Salas, 2020) (see p.2 in https://www.iucnredlist.org/species/62022637/62022639)

A document compiled during a 2015 workshop in Mexico held by Comisión Nacional para el Conocimiento (CONABIO) details threats to the species specific to Mexico (see http://conabioweb.conabio.gob.mx/webservice/dalbergias/Dalbergia_tucurensis.pdf)

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

The document compiled during a 2015 workshop in Mexico held by CONABIO details uses for the species specific to Mexico (see http://conabioweb.conabio.gob.mx/webservice/dalbergias/Dalbergia_tucurensis.pdf)

Conservation status (Category H)

A 2015 document by CONABIO and Uso de la Biodiversidad assesses the risk of extinction to the species in Mexico and also has contains national data relevant to NDFs, (see https://bioteca.biodiversidad.gob.mx/janium/Documentos/15331.pdf)

2.1.2 Medium priority rosewood tree species: Profile overview

CITES-listed rosewood tree species assigned the category of 'medium' priority (e.g due to factors such as being globally threatened, trade from wild sources reported in CITES trade data between 2017-2021, and Parties stating the species was threatened by trade) are outlined in Table 5. There were 14 medium prioirty species in total, with five of these (highlighted in bold in Table 5) assigned medium priority as a precautionary measure due to being listed at CoP19 and having no CITES trade data reported between 2017 and 2021.

Table 5. CITES-listed rosewood tree species assigned the category of 'medium' priority for the purposes of this study, with those listed at CoP19 in bold.

Species (Appendix; annotation)	CITES Region	IUCN Red List status (assessment date)
Dalbergia baronii (II;15)	Africa	Vulnerable (1998)
Dalbergia calderonii (II;15)	Africa	Critically Endangered (2019)
Dalbergia maritima(II;15)	Africa	Endangered (2022)
Guibourtia demeusei (II;15)	Africa	Near Threatened (2020)
***Afzelia africana* (II;17)**	**Africa**	**Vulnerable (2019)**

***Khaya ivorensis* (II;17)**	**Africa**	**Vulnerable (1998)**
***Khaya senegalensis* (II;17)**	**Africa**	**Vulnerable (1998)**
***Pterocarpus angolensis* (II;17)**	**Africa**	**Least Concern (2018)**
***Pterocarpus soyauxii* (II;17)**	**Africa**	**Not assessed**
Dalbergia sericea (II;15)	Asia	Least Concern (2022)
Dalbergia spruceana (II;15)	Central and South America and the Caribbean	Vulnerable (2021)
Paubrasilia echinata (II;10)	Central and South America and the Caribbean	Endangered (1998)
Dalbergia congestiflora (II;15*)	North America and Central and South America and the Caribbean	Endangered (2019)
Dalbergia glomerata (II;15)	North America and Central and South America and the Caribbean	Critically Endangered (2019)

To prioritise efforts on species for which there is substantial evidence they are (or have been) negatively impacted by trade, detailed factsheets were produced for high priority species only. To support Parties with producing NDFs for medium priority species, a list of sources relevant to the 14 medium priority species identified in the literature review for high priority species are outlined for each information category relevant to Criteria A-H from Resolution Conf. 16.7 (Rev. CoP17) on *Non-detriment findings* in Table 6 below . Many of the sources provided have collated relevant information from various sources (e.g. IUCN Red List assessments, plant databases). Parties are encouraged to check and verify original sources referenced in each source linked where applicable, particularly for databases.

Table 6. Factsheet with sources that can be used to generate data relevant to NDFs for CITES-listed rosewood tree species assigned the category of medium priority in this study

CITES-listed rosewood tree species assigned the status of 'medium' priority	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g., soil, climate)	All species: • Recent IUCN Red List Assessments https://www.iucnredlist.org/ (e.g., conducted from 2018 onwards) available for all medium priority species apart from *Pterocarpus soyauxii* (not assessed), and three species (*Dalbergia baronii, Khaya ivorensis* and *Khaya senegalensis*) assessed in 1998) • Listing proposals (available for all species at https://speciesplus.net/) • Useful Tropical Plants database https://tropical.theferns.info/ (for all species except for *Dalbergia calderonii, Dalbergia congestiflora* and *Dalbergia sericea*) All *Dalbergia* species • The CITES *Dalbergia* checklist https://www.kew.org/sites/default/files/2022-05/CITES%20Dalbergia%20Checklist%202022%20%28EN%29%20%2
Tree characteristics (e.g maximum height and diameter)	
Growth rates *	

Role of species in Ecosystem*	8PDF%29.pdf (data specifically on maximum heights, habitat types and altitudinal ranges) • Global status of Dalbergia and Pterocarpus rosewood (https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Global-Status-of-Dalbergia-and-Pterocarpus-Rosewood-CITES-2017-.pdf) (for all species except for *Dalbergia sericea*)
Resilience of tree species* (e.g based on indicators such as reproduction patterns and mortality from natural causes)	African rosewood tree species • Plant Resources of Tropical Africa (PROTA) https://prota.prota4u.org/search.asp (for *Dalbergia baronii,Pterocarpus soyauxii, Afzelia Africana, Khaya ivorensis* and *Khaya senegalensis*) For species listed at CoP19 (see bold in Table 5.) • IUCN TRAFFIC Analysis of the Proposals for CoP19 (https://www.traffic.org/site/assets/files/19065/iucn-traffic-cop19-full-analyses-1.pdf) • Global status of Dalbergia and Pterocarpus rosewood (https://www.blackwoodconservation.org/wp-content/uploads/2019/07/Global-Status-of-Dalbergia-and-Pterocarpus-Rosewood-CITES-2017-.pdf) (for *Pterocarpus* species only) • Agroforestree Database https://apps.worldagroforestry.org/treedb2/speciesprofile.php?Spid=18116 • FAO Global Agro-Ecological Zones dataportal (provides species summaries and data sheets) https://gaez.fao.org/pages/ecocrop-find-plant (for *Pterocarpus angolensis, Afzelia Africana* and *Khaya senegalensis*) For *Dalbergia baronii* and *Guibourtia demeusei* • UNEP-WCMC Review of selected *Dalbergia species* and *Guibourtia demeusei* https://www.blackwoodconservation.org/wp-content/uploads/2019/07/UNEP-WCMC_Review-of-selected-Dalbergia-species-and-Guibourtia-demeusei.pdf
B. Species range	
Global/geographic distribution	All *Dalbergia* species • The CITES *Dalbergia* checklist https://www.kew.org/sites/default/files/2022-05/CITES%20Dalbergia%20Checklist%202022%20%28EN%29%20%28PDF%29.pdf (data specifically habitat types and altitudinal ranges) All other species • CITES checklist https://checklist.cites.org/#/en • GEOCAT (to import species occurrences from various databases) https://geocat.iucnredlist.org/editor
D. Threats	
Global	All species: • Recent IUCN Red List Assessments https://www.iucnredlist.org/ (e.g., conducted from 2018 onwards) available for all medium priority species apart from Pterocarpus soyauxii (not assessed), and three species (*Dalbergia baronii, Khaya ivorensis* and *Khaya senegalensis*) assessed in 1998) • Listing proposals (available for all species at https://speciesplus.net/)
E. Historical and current species-specific levels and patterns of harvest and mortality	

Global legal/illegal trade	All species • CITES Trade Database https://trade.cites.org/ (with the exception of those listed at CoP19) • CITES Illegal Trade Database https://dmpone.unodc.org/ • Overviews provided in CITES and Timber: A guide to CITES-listed tree species (https://cites.org/eng/node/133876) For *Dalbergia congestiflora* and *Pterocarpus soyauxii* • TRAFFIC report on rosewood market survey in China https://www.traffic.org/site/assets/files/19229/rosewood_market_full_report_final.pdf
Known uses	All species • Overviews provided in CITES and Timber: A guide to CITES-listed tree species (https://cites.org/eng/node/133876) • Recent IUCN Red List Assessments https://www.iucnredlist.org/ (e.g., conducted from 2018 onwards) available for all medium priority species apart from Pterocarpus soyauxii (not assessed), and three species (*Dalbergia baronii, Khaya ivorensis* and *Khaya senegalensis*) assessed in 1998) • Listing proposals (available for all species at https://speciesplus.net/) All *Dalbergia* species • The CITES *Dalbergia* checklist https://www.kew.org/sites/default/files/2022-05/CITES%20Dalbergia%20Checklist%202022%20%28EN%29%20%28PDF%29.pdf (data specifically on maximum heights, habitat types and altitudinal ranges)
F. Management measures	
Capacity for regeneration	All species • See sources under section A (**Species biology and life-history characteristics)**
Minimum felling diameter/rotation cycle*	All species • These may be available in species/genus listing proposals (available for all species at https://speciesplus.net/)
Conversion factors*	All *Dalbergia* species • Conversion factors used by UNODC for estimates of the conversion of mass in trade to the number of logs for *Dalbergia* species are 125 kg of timber: 1 log (see https://www.unodc.org/documents/wwcr/Rosewood.pdf) Generic guidelines (all species) • US Department of Agriculture CITES I, II and III timber species manual https://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/cites.pdf • FAO Forest product conversion factors (https://www.fao.org/3/ca7952en/CA7952EN.pdf) • Mexico's Forest product conversion factors https://www.gob.mx/cms/uploads/attachment/file/644969/CONVERSIONES_FORESTALES_CONAFOR_2021B__3_.pdf

H. Conservation status	
Global Red List assessment	All species: • Recent IUCN Red List Assessments https://www.iucnredlist.org/ (e.g., conducted from 2018 onwards) available for all medium priority species apart from *Pterocarpus soyauxii* (not assessed)

2.2.1 Overview of sources and production systems for rosewood tree specimens in international trade

This subsection had two key research questions:

- Which are the main sources of all CITES-listed rosewood tree species reported in imports between 2017-2021?

- What are the top species reported in imports for each of the prominent sources identified?

To answer these questions, CITES trade data were downloaded in September 2023, for the families *Lauraceae, Leguminosae* and *Meliaceae* (e.g., incorporating all CITES-listed timber species identified as traded under 'rosewood') with the following criteria:

- All exporters and importers
- All sources
- Commercial purposes
- All terms
- Years 2012-2021

Only direct exports (e.g., where the origin country was the same as the exporter) were included. Only species identified as tree producing rosewood specimens (see Table 2) were included. Importer-reported data were used throughout the analysis as some Parties may report quantities of commodities in export permits issued (e.g not quantities actually exported), so importer-reported data are more likely to reflect the quantities of commodities traded.

Terms were categorised in two broad groups for effective comparison between quantities of commodities per species in direct exports:

- 'raw wood and raw timber' for any specimens which were not substantially processed (logs, plywood, sawn wood, timber, timber pieces, transformed wood, veneer,); and,
- 'wood and timber products' for specimens that were substantially processed (carvings, jewellery, piano keys, wood products)

Non-wood and non-timber commodities (bark, chips, cosmetics, derivatives, extract, leaves, live, medicine, powder, oil, roots, seeds, specimens) were excluded from the analysis.

For the overview of sources for all CITES-listed rosewood tree species, only trade data from 2017-2021 were included to enable reliable comparison between species, with close to a third of CITES-listed species identified as rosewood tree species listed for the first time in 2017. Total quantities of raw wood and raw timber/wood and timber products traded by volume in m^3, mass in kg, and number of specimens for each source were calculated. Records reported in cm^3 were converted into volume in m^3 and records reported in grams and tonnes converted into mass in kg.. A relatively small quantity (~ 19,500 m^2) of timber commodities were reported by length and excluded from the analysis. [11]

[11] It should be noted when interpreting the data for each unit (number, kg and m^3) that Parties did not always report timber/wood products according to preferred units as outlined in the CITES guidelines for the preparation and submission of CITES annual reports . For example logs were often reported as mass in kg, although the preferred unit recommended for logs in the CITES guidelines is m^3.

a) Raw wood and raw timber

The prominent source for raw wood and timber specimens (logs, plywood, sawn wood, timber, transformed wood, veneer) from CITES-listed rosewood tree species reported imported between 2017-2021 varies according to region (Figure 3). In Africa, North America, and Central and South America and the Caribbean the prominent source of raw wood and raw timber' is wild whereas in Asia the prominent sources are previously seized and confiscated specimens and artificial propagation. Raw wood and raw timber specimens reported in imports between 2017 and 2021 were mostly from logs and sawn wood, with smaller quantities of specimens from plywood, timber, transformed wood and veneer.

Close to 100% of raw wood and raw timber specimens from artificially propagated specimens were reported to be from the Asian rosewood species *Dalbergia latifolia*, (Figure 4). Most wild-sourced imports of raw wood and raw timber from CITES-listed rosewood tree species were from the African rosewood species *Pterocarpus erinaceus*, with the remaining mainly from *Dalbergia latifolia.*

Almost all imports from previously seized and confiscated specimens were from Asian rosewood tree species *Pterocarpus santalinus*, with negligible quantities from other species.

Smaller amounts of imports were reported to be from pre-convention specimens than other sources: around 215,000 kg, 140,000 m^3 and 710 specimens. These were from a mixture of African and Asian rosewood species, with the largest quantities of imports reported to be from *Dalbergia latifolia*, *Pterocarpus tinctorius*, and *Guibourtia tessmannii.*

b) Wood and timber products

Most wood and timber products (carvings, jewellery, piano keys, wood products) from CITES-listed rosewood tree species were reported imported from Asia, with smaller quantities reported imported from Africa and negligible quantities from North America and Central and South America and the Caribbean. These products were mostly from carvings and wood products, with only around 1200 specimens of jewellery reported imported between 2017 and 2021.

In Asia, importers reported the main source for wood and timber products from CITES-listed rosewood species are specimens from artificial propagation, followed by pre-convention specimens, whilst in Africa most are reported to be from previously seized and confiscated specimens, followed by wild sourced (Figure 3). Certain species are prominent in imports reported from each of these sources. Close to 100% of wood and timber products from artificially propagated species were reported to be from Asian rosewood species *Dalbergia sissoo* and *Dalbergia latifolia* (Figure 4). Most pre-convention and wild-sourced imports of wood and timber products from CITES-listed rosewood tree species are also from these two species, although a notable proportion of wild sourced imports of wood and timber products are also from African rosewood species *Pterocarpus erinaceus* and *Dalbergia melanoxylon.*

Smaller amounts of imports were reported to be from previously seized and confiscated specimens than other sources: around 552,000 kg, 903 m^3 and 1,700 specimens. These were almost entirely from African rosewood species *Guibourtia tessmannii*, with very small quantities from Asian rosewood species *Dalbergia latifolia* and *Pterocarpus santalinus*.

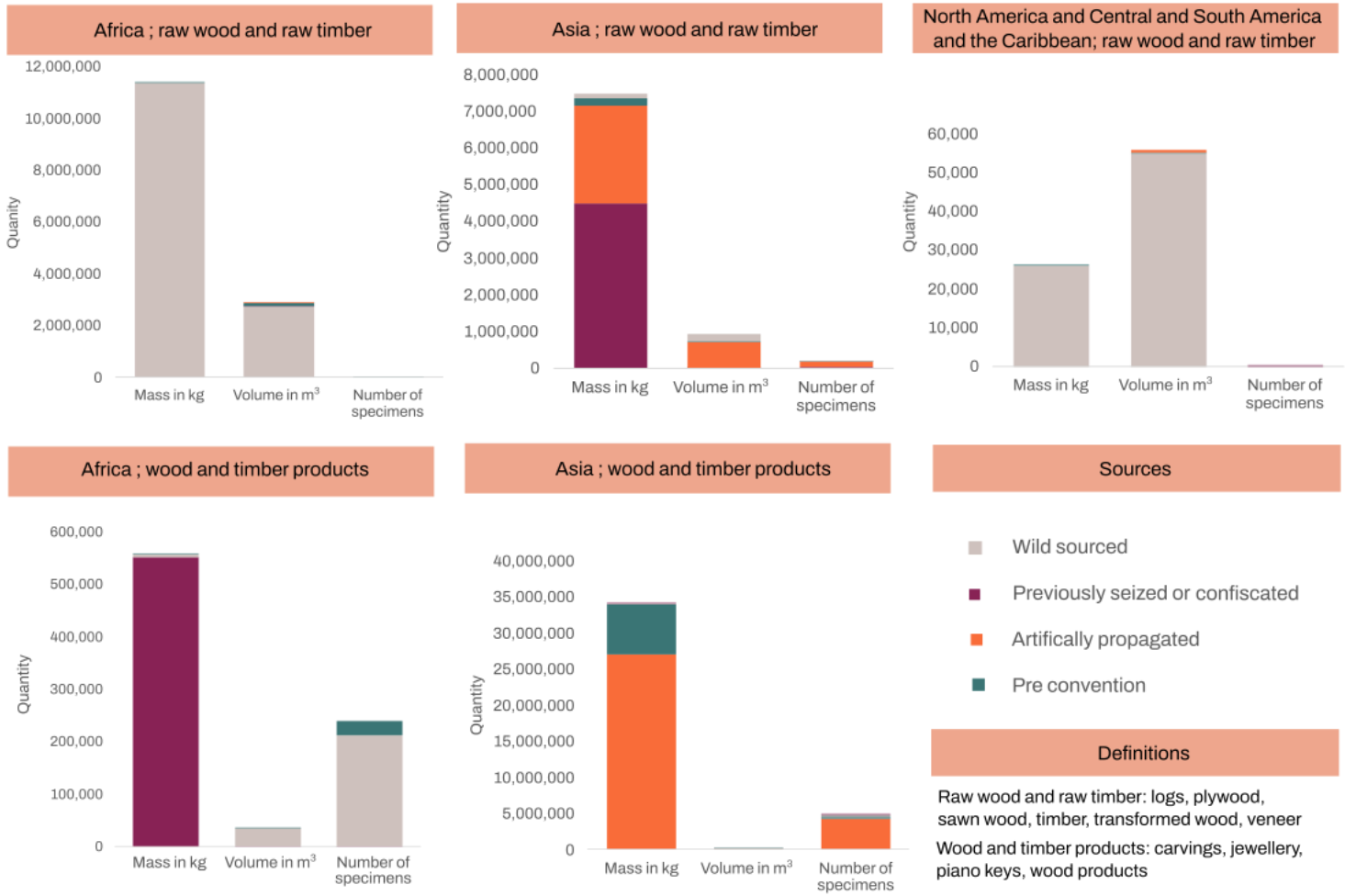


Figure 3. Sources of rosewood raw wood and raw timber specimens (logs, plywood, sawn wood, timber, transformed wood, veneer) and rosewood wood and timber products (carvings, jewellery, piano keys, wood products) from CITES-listed rosewood tree species reported in direct imports from each region for commercial purposes between 2017-2021. Source: CITES Trade Database.

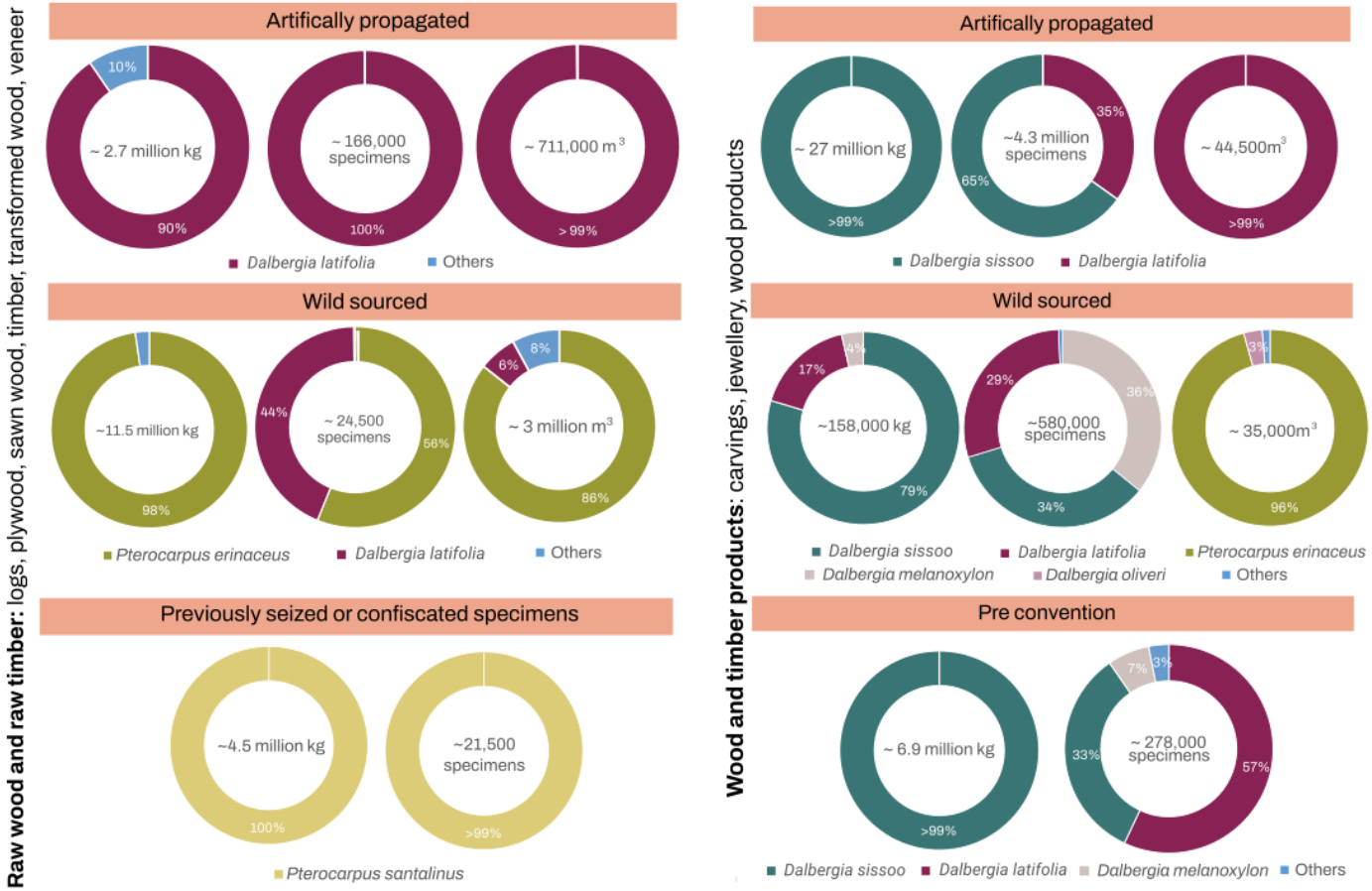


Figure 4. Top species for prominent sources of rosewood raw wood and raw timber specimens (logs, plywood, sawn wood, timber, transformed wood, veneer) and rosewood wood and timber products (carvings, jewellery, piano keys, wood products) from CITES-listed rosewood tree species reported in direct imports for commercial purposes between 2017-2021. Source: CITES Trade Database.

2.2.2 A regional analysis into sources and production systems for high priority CITES-listed rosewood tree species

The aim of this subsection was to identify prominent sources and any evidence of production systems for each CITES-listed rosewood species identified as high priority for the purposes of this study.

For each high priority species, the prominent source of specimens reported in imports was identified for all trade data (raw wood and timber and wood and timber products) available between 2012 and 2021. Data for each year were reviewed to identify any marked changes in source code within the ten-year period between 2012-2021 (noting some species were only listed in 2017 or later and had less data) with this noted in summary paragraphs for each species.

When compiling factsheet information for each high priority species during the literature review in section 2.1, any reference to sources of high priority species in trade, or management systems (e.g. plantations, or plantation types) were recorded and referred to in summary paragraphs, along with any information related to source and management systems provided by Parties in Notifications No 2020/023 and No 2023/107.

In interpreting this information, it should be noted that there is currently no internationally recognised definition of the term plantation (see PC24 Doc 16.2), nor is there a definition of plantation in the CITES glossary. Therefore, the intended meaning of the term plantation in the literature referenced to each high prioirty species may vary. Additionally, it is important to note the dates of any sources referenced when referring to evidence of plantations for each high priority species, as some information may now be outdated and require further verification.

Overview

Table 7 provides an overview of quantities of specimens in trade from each source for each high priority rosewood tree species, and prominent sources for each, reported by importers in CITES Trade Data between 2012 and 2021.

Most imports of high priority rosewood tree species were reported as predominantly from wild-sourced specimens with little to none reported from artificial propagation. Only one species classified as high priority, *Dalbergia latifolia*, was reported to be sourced predominantly from artificial propagation by importers.

For one species - *Pterocarpus santalinus* – previously seized or confiscated specimens were reported to be the predominant source of specimens imported. A large proportion of specimens from *Guibourtia tessmannii* were also from previously seized or confiscated specimens. For one species – *Dalbergia granadillo* – most imports were reported to be from pre-convention specimens.

Further information on sources and production systems detailed in the literature are outlined below for each high priority rosewood tree species.

Table 7. Total quantity and source of specimens from high priority rosewood tree species reported in direct imports for commercial purposes between 2012 and 2021. Source: CITES Trade Database. A: Artificial propagation; W: wild sourced; I: Previously seized or confiscated; O: Pre-convention

Region	Species	Raw timber			Timber products		
		Mass in kg: source (s) (%)	Volume in m^3: source (s) (%)	Number of specimens: source (s) (%)	Mass in kg: source (s) (%)	Volume in m^3: source (s) (%)	Number of specimens: source (s) (%)
Africa	*Pterocarpus erinaceus*	~ 14 million: W (100)	~ 2.8 million: W (99); O (1), A (<1)	~ 13,800: W (100)	-	~33,400: W (100)	3,500: W (100)
	Pterocarpus tinctorius	24,800: O (100)	~ 65,500: O (72); W (27); A (<1)	-	-	-	-
	Guibourtia pellegriniana	-	~ 1,600: W (100)	-	-	-	-
	Guibourtia tessmannii	-	~ 106,000: W (58); O (41); I (<1)	320: O (100)	~ 550,000: I (100)	910: I (>99); O (<1)	~6,500: O (86); A (8); I (6)
	Dalbergia melanoxylon	~107,000: W (100)	~ 63,500: W (>99); 0(<1)	120: O (100)	~5,900: W (>99); O (<1)	~150: W (100)	~226,000: W (92); O (8)
Asia	*Dalbergia cochinchinensis*	-	~83,000: W (93); O (6); A (<1)	~ 335: W (73); O (27)	-	-	-
	Dalbergia latifolia	~ 2.8 million: A (89); O (6); W(5)	~ 909,000: A (78); W (21); O (1)	~ 177,000: A (94); W (6); O)<1)	~124,000: A (77); W (21); O(2)	~45,000: A (>99); O (<1), W (<1)	~3.1 million: A (89); O (5); W(5); I(<1)
	Dalbergia oliveri	-	~ 10,700: W (93); O (7)	-	-	~1,200: W (91); O (9)	-
	Pterocarpus santalinus	~ 7.8 million: I (96); A (3); A (<1)	~ 320: I (100)	~21,500: I (100)	980: I (100)	-	-
Central and South America and the Caribbean	*Dalbergia retusa*	~146,000: O (82); W (18)	~80,000 (W: >99); O (<1)	248: W (87); O (6); A (4); I (2)	-	-	~ 170: W (88); O (12)
North America	*Dalbergia granadillo*	~ 53,000: O (100)	~2,400: W (71); A (27); O (<1)	-	-	-	-
North America and Central and South America and the Caribbean	*Dalbergia stevensonii*	-	~ 1,900: W (69); O (24); A (6) I (1)	~ 145: 0 (88); W (12)	-	-	-
	Dalbergia tucurensis	-	~6,300: W (98); O (2)	-	-	-	-

a) African rosewood tree species

A guide to CITES-listed tree species, last updated in 2023, states that there does not appear to be any known large-scale commercial plantations of *Pterocarpus* species, so all products from this genus in trade (e.g., including those in Africa) are assumed to be wild in origin (Groves and Rutherford, 2023). The guide also states that support programs for regeneration of *Guibourtia tessmannii* and *Guibourtia pellegriniana* have been in place for several years in several certified Forest Stewardship Council (FSC) forest concessions in Gabon and Cameroon but does not refer to evidence of plantations for either species. The authors state that *Dalbergia melanoxylon* is widely coppiced, with field plantations and seedling nurseries in existence and replanting in place, particularly in Tanzania (around Mount Kilimanjaro), and that FSC-certified timber for *Dalbergia melanoxylon* is in trade.

Some further references to sources and management systems for each high priority African rosewood tree species are outlined below.

Dalbergia melanoxylon

A 2016 trade study of *D. melanoxylon* (and *Afzelia quanzensis* and *Pterocarpus angolensis*) published by the Federal Agency for Nature Conservation in Germany (BfN) stated there is evidence that all three species can be successfully planted from plantation trials, but that the economic risks associated with plantations of slow growing species is a barrier to extensive plantations in the species (Cunningham, 2016).

A 2012 report stated seven FSC-certified forest areas in Tanzania are listed as having the potential to supply FSC (or controlled wood) from *D. melanoxylon* (Jenkins et al., 2012). The FSC states a 'pioneer' and still existing FSC certificate was issued to the Mpingo Conservation and Development Initiative (MCDI) group certification scheme in Tanzania in 2009 for a community-managed natural forest dominated by *D. melanoxylon* (FSC, 2023), although the MCDI platform currently does not refer to the species amongst those sustainably harvested and sold by the communities involved in the initiative (MCDI, 2023).

Most imports from the species reported in CITES Trade Data between 2017 (when it was first listed in CITES Appendix II) and 2021 are in wild specimens, with the remaining pre-convention. Most pre-convention specimens were reported imported between 2017 and 2019. Only one specimen (a wood product) from artificially propagated *D. melanoxylon* is reported imported between 2017 and 2021.

Guibourtia pellegriniana

The 2021 IUCN Red List assessment for *G. pellegriniana* states the species occurs in certified forests where populations are sustainably managed, and regeneration is supported (Barstow et al., 2021a). The CoP17 proposal to list *Guibourtia pellegriniana* (alongside *G. tessmannii* and *G. demeusei*) in Appendix II states that recommendations for minimum tree densities for the exploitation of tree species in Central African countries have been implemented in some FSC certified concessions (e.g. where the species is present) (CoP17 Proposal 56, 2016).

A report on the start of progress of research related to *Guibourtia* species in Gabon produced under the CTSP states programmes to aid regeneration of Bubinga species including *G. pellegriniana* (and *G. tessmannii*) in Gabon were undertaken in FSC-certified forest concessions but did not provide conclusive results, with 'numerous' technical and operational problems (Midoko Iponga et al., 2020). The report states there is a need to relaunch initiatives

to overcome low populations of these species. Although now outdated, a 2012 report produced for the International Tropical Timber Organization (ITTO) states Bubinga tree species (including *G. pellegriniana*) had not been planted in forest plantations in Cameroon according to a 2004 source (Betti, 2012)

Only small quantities of the species have been reported imported in CITES Trade Data since its listing in CITES Appendix II in 2017 (Table 7), with all of these reported to be from wild sourced specimens.

Guibourtia tessmannii

Like *G. pellegriniana, the* 2021 IUCN Red List assessment for *G. tessmannii* states the species occurs in certified forests where populations are sustainably managed, and regeneration is supported. The authors also state that Gabon and Cameroon are working with the EU Forest Law Enforcement Governance and Trade Action Plan to improve the governance and transparency of their timber trade to reduce illegal logging (Barstow et al, 2021b). The CoP17 proposal to list *Guibourtia pellegriniana* (alongside *G. tessmannii* and *G. demeusei*) in Appendix II states that recommendations for minimum tree densities for exploitation of tree species in Central African countries have been implemented in in some FSC certified concessions (e.g. where the species is present) (CoP17 Proposal 56, 2016).

Again, similar to *G. pellegriniana*, the report on the start of progress of research related to *Guibourtia* species in Gabon produced under the CTSP states programmes to aid regeneration of Bubinga species including *G. tessmannii* in Gabon were undertaken in FSC-certified forest concessions but did not provide conclusive results, with 'numerous' technical and operational problems, and a need to relaunch initiatives to overcome low populations of these species. (Midoko Iponga et al., 2020). The 2012 report produced for the International Tropical Timber Organization (ITTO) states Bubinga tree species (including *G. tessmannii*) had not been planted in forest plantations in Cameroon according to a 2004 source (Betti, 2012).

A large quantity of imports from *G. tessmannii* reported imported in CITES Trade Data between 2017 (when it was listed in CITES Appendix II) and 2021 are from previously seized or confiscated specimens (Table 7), with most of these reported imported in 2020. The remaining are mostly from wild sourced or pre-convention specimens, with most pre-convention specimens reported imported between 2017-2018. Only very small quantities of imports are reported to be from artificially propagated specimens: between 2017 and 2021, 533 specimens from wood and timber products were reported imported from Indonesia and China. Given a lack of evidence for plantations in the species – and no reference in the IUCN Red List assessment to its' introduction in these countries- is it not clear if these reports are an error.

Pterocarpus erinaceus

The CoP17 proposal to transfer *P. erinaceus* from Appendix III to Appendix II in 2016 states that all harvesting of the species is from wild specimens, although the proposal also states there was some indication of small-scale planting in Ghana and Senegal in the past (CoP17 Prop. 57, 2016).

Imports from *P. erinaceus* reported in CITES Trade data between 2016 (when it was first listed in Appendix III by Senegal) and 2021 are reported to be almost entirely from wild sourced specimens (Table 7). Small quantities of pre-convention specimens of *Pterocarpus erinaceus* were reported imported between 2016-2019, with most of these between 2018 and 2019. Only very small quantities are reported imported from artificially propagated specimens: in 2017, 204 m^3 raw wood and raw timber specimens are reported imported from Nigeria, and in 2021,

19 m^3 from Sierra Leone. Given a lack of evidence for commercial plantations in the species, is it not clear if these reports are an error.

Pterocarpus tinctorius

The CoP18 proposal to list *Pterocarpus tinctorius* in CITES Appendix II stated that at present (e.g in 2019) all harvest appeared to be from wild sources (CoP18 Proposal 54, 2019). The 2018 Red List Assessment for the species stated that the species was not considered to be under sustainable management, with some forests well managed and others not (Barstow, 2018). A 2017 TRAFFIC and WWF report stated the species had been studied insufficiently, and that it was difficult to determine its prospects as a commercial tree under sustainable management (Lukumbuzya and Sianga, 2017).

Since its' listing in Appendix II in 2019, most imports from *P. tinctorius* are reported to be from pre-convention specimens (all between 2020 and 2021), with the remaining mostly from wild specimens. Only very small quantities of imports are reported to be from artificially propagated specimens: in 2021, 120 m^3 raw wood and raw timber specimens are reported imported from United Republic of Tanzania. Similar to *P. erinaceus*, given a lack of evidence for plantations in the species, is it not clear if these reports are an error.

b) Asian rosewood tree species

The 2023 guide to CITES-listed tree species states that no commercial plantations exist for most Asian *Dalbergia* species, with most trade therefore assumed to be wild in origin (Groves and Rutherford, 2023). Like the issues raised by Cunningham (2016) relating to the economic viability of African rosewood tree species *D. melanoxylon*, the authors point out it would take many years to produce timber from *Dalbergia* species of a size large enough to export. The exceptions pointed out by Groves and Rutherford are *Dalbergia sissoo* (assigned low priority in this study) and *Dalbergia latifolia* (assigned high priority).

The authors state that *Dalbergia sissoo* is widely cultivated, with plantations in India, Pakistan and other regions in the subtropics and tropics, including areas within Africa, North America, and Central and South America and the Caribbean, Australia, French Polynesia, and New Caledonia, whilst *D. latifolia* is grown in plantations in India and Indonesia (Java). The guide does not refer to evidence of commercial plantations for other Asian high priority rosewood *Dalbergia* species; *D. cochinchinensis* or *D. oliveri*. It is worth noting that India currently has a reservation in place for all *Dalbergia* species (UNEP,2023).

The guide also refers to commercial plantations for the remaining Asian high priority rosewood tree species *Pterocarpus santalinus* in India, comprising of around 3,000 hectares in two states (Andhra Pradesh and Tamil Nadu). The authors state there is evidence of cultivation on farmland but no formal inventory for this production mode (Groves and Rutherford, 2023).

Some further references to sources and management systems for high priority Asian rosewood tree species are outlined below.

Dalbergia cochinchinensis

The IUCN Red List assessment for the species states that trial plantations for the species were established in one province in Cambodia in 2004 (Barstow et al., 2022). In 2013, the proposal to list the species in CITES Appendix II stated few efforts had been made for commercial plantations, so all timbers exported were sourced from wild populations (CoP16 Proposal 60, 2013).

A 2022 NDF for the species in Viet Nam stated several small populations remained in plantations but did not survey these (Center for Nature Conservation and Development, 2022), whilst a 2022 NDF for the species in Lao PDR stated plantations for the species exist in the country, but that documentation on the magnitude or location is sparse (NAFRI, 2022). It is not clear if plantations in either country are for commercial purposes.

A 2021 NDF for the species in Cambodia stated 84,000 seedlings of the species had been distributed to local villagers, monks, and public institutions to plant on their lands, or had been planted in forest plantations, since 2013. Observations in 2020 indicated that only around 7-17% of planted trees had survived, with survival rates thought to be low in both plantations and natural habitats in part due to planting under unsuitable conditions (Forestry Administration, 2021). A 2022 paper stated the species was amongst the most planted tree species in Cambodia (Gaisberger et al. 2022). In a response to a second Notification to the Parties on CITES-listed rosewood tree species in 2023 (No 2023/107), Cambodia stated the species occurs in three private forest plantations (in quantities not stated) and that the species also occurs in tree plantations established by the Forestry Administration of Cambodia, which are scattered in many provinces. The Party stated data on these tree plantations is unavailable.

Most imports from the species reported in CITES Trade Data between 2013 (when it was first listed in CITES Appendix II) and 2021 are reported to be from wild sourced specimens, with the remaining mostly pre-convention and wild, and negligible quantities form artificially propagated specimens. All pre-convention specimens were reported imported between 2013-2014.

Dalbergia latifolia

The 2020 IUCN Red List assessment for the species states *D. latifolia* is grown in commercial plantations but points out the slow growth and long rotation period required can make it challenging for plantations to meet the demand for the timber (Lakhey et al., 2020). The assessment also states the species is grown in community forests in Nepal.

An NDF for the species in Indonesia states the population of this species in Indonesia can be found in artificial plantations and may be grown as monoculture stands or in mixed plantations with minimal human intervention (Yulita et al., 2022). The authors state the mixed plantations are owned by both a state-owned forestry company and community-owned lands, with specimens grown under these meeting criteria for export under code Y (assisted production). In their response to No 2023/107, Indonesia states the harvest regime of rosewood in Indonesia covers non-wild populations only.

Most imports from the species reported in CITES Trade Data between 2017 (when it was first listed in CITES Appendix II) and 2021 are in artificially propagated specimens, with some pre-convention and wild.

Dalbergia oliveri

Field visits to six provinces in Viet Nam conducted as part of a review of the taxonomy, biology, and ecology of *D. oliveri* found nursery systems for the species were not established in the region (Nguyen et al., 2019). A 2022 NDF for the species in Lao PDR stated an experimental plantation for the species exists but that it was generally not planted in the country due to limited access to seeds and seedlings (NAFRI, 2022). In Cambodia, it is thought that around 3,000 seedlings of the species have been planted in one district (Forestry Administration, 2021). No mention of commercial plantations for *D. oliveri* were identified in the literature review.

Most imports from the species reported in CITES Trade Data between 2017 (when it was first listed in CITES Appendix II) and 2021 are in wild sourced specimens, with some pre-convention (mostly reported imported in 2021) and none from artificial propagation.

Pterocarpus santalinus

A 2019 NDF for the species in India (where the species is endemic) states most exports from India are in previously seized or confiscated specimens, with wild harvested species protected and not permitted for export. Since 2018, India has also had stricter domestic measures with a ban on export of all wild sourced specimens of species in CITES Appendices I, II and III. Export of artificially propagated specimens is however allowed, with around 14,000 hectares of land used for cultivation of *P. santalinus* species in India (Ahmedullah et al., 2019).

The IUCN Red List assessment states that the species is cultivated in Kerala, Maharashtra, Gujarat, Karnataka, Telangana, Tamil Nadu, Odisha and West Bengal within India, and also in

Sri Lanka and China. The author states however that due to long generation lengths in the species, cultivated stock cannot meet demand and opportunities to increase the harvest and trade in cultivated stock need to be further investigated (Ahmedullah, 2021).

Almost all imports from the species reported in CITES Trade Data between 2012 and 2021 are in previously seized or confiscated specimens (numbering ~ 7.5 million kg and ~ 21,500 specimens). A relatively small quantity of wild specimens (~49,000 kg) were reported imported in 2016 only. Raw wood and raw timber from artificial propagation (~ 255,000 kg) was reported only recently, in the years 2020-2021.

c) North American, and Central and South America and the Caribbean rosewood tree species

The 2023 guide to CITES-listed tree species states export of *Dalbergia* species from the Americas and the Caribbean are mostly wild sourced (Groves and Rutherford, 2023). The exceptions pointed out by the authors are *Dalbergia stevensonii* (which has planting schemes in Belize), and *Dalbergia retusa* and *Dalbergia granadillo*, both of which have plantations in Costa Rica and Nicaragua, although most wood from these species is reported to come from privately owned land with specimens planted 80-100 years ago. The authors state that *Dalbergia* species in this region have been used in sustainable forest management in Central America, with the species grown in mixed cultivation with plants such as plantain, cocoa and coffee, but do not specify which *Dalbergia* species this applies to.

Some further references to sources and management systems for high priority North American, and Central and South America and the Caribbean rosewood tree species are outlined below.

Dalbergia granadillo

As reported in the 2023 guide to CITES-listed tree species, plantations for this species are maintained in Costa Rica and Nicaragua but most still comes from privately owned fincas (rural or agricultural land) planted 80-100 years ago (Groves and Rutherford, 2023). In their response to No 2023/107, Mexico stated since the listing of the species in Appendix II, all exports of this species from Mexico (which it is endemic to) are from timber felled by hurricanes.

Most imports from the species reported in CITES Trade Data between 2013 (when it was first listed) and 2021 are in pre-convention specimens, with the remaining mostly wild-sourced specimens. All pre-convention specimens were reported imported between 2013- 2014, with negligible quantities since 2017. Imports of raw wood and raw timber from artificial propagation is reported in small quantities in 2020 only.

A 2015 workshop in Mexico held by Conabio concluded that *Dalbergia retusa* is not native to Mexico (CEC,2017) with this later confirmed in Cervantes et al., (2019). Direct imports of *Dalbergia retusa* from Mexico reported in CITES Trade Data are therefore likely to be in *Dalbergia granadillo* instead (Camarena Osorno, in litt., in CEC, 2017). Importers report only ~ 250 m^3 of (wild-sourced) *Dalbergia retusa* (i.e., *D. granadillo*) specimens imported from Mexico between 2012 and 2021.

Dalbergia retusa

The 2020 IUCN Red List assessment for *D. retusa* states most international trade in this species is now reported to come from plantations due to the scarcity of populations in the wild

(Barstow and Linares, 2020). The proposal to list all *Dalbergia* species in Appendix II in 2016 states Guatemala has registers of plantations of *D. retusa* and also states that the species was included in plantation trials of native precious wood species in Costa Rica which started in 1992 (Cop17 Prop 55, 2016). As reported in the 2023 guide to CITES-listed tree species, plantations for the species are maintained in Costa Rica and Nicaragua but most comes from privately owned fincas (rural or agricultural land) planted 80-100 years ago (Groves and Rutherford, 2023). A 2010 NDF for *D. retusa* in Costa Rica states there were three plantations, each with more than 20 trees, but that they were not necessarily considered for forestry use (Rivera-Luther and Víquez-Mora, 2010).

Most imports from the species reported in CITES Trade Data between 2012 and 2021 are in pre-convention or wild-sourced specimens. Most pre-convention specimens were reported imported in 2012, with negligible quantities since 2017. Close to 90% of wild-sourced specimens were also reported imported between 2012 and 2017 with relatively small quantities since. Raw wood and raw timber from artificial propagation is reported in negligible quantities.

As previously mentioned, a 2015 workshop in Mexico held by Conabio concluded that *Dalbergia retusa* is not native to Mexico (CEC,2017) with this later confirmed in Cervantes et al., (2019). Direct imports of *Dalbergia retusa* from Mexico reported in CITES Trade Data are therefore likely to be in *Dalbergia granadillo* instead (Camarena Osorno, in litt., in CEC, 2017).

Dalbergia stevensonii

The proposal to list all *Dalbergia* species in Appendix II in 2016 states Guatemala has registers of plantations of *D. stevensonii* and lists *D. stevensonii* as an example of a *Dalbergia* species that responds well to coppicing (Cop17 Prop 55, 2016). This conflicts with other sources; although outdated, a 2012 report states *D. stevensonii* is not believed to be grown commercially in plantations but has been in at least one tree-planting scheme in Belize. Jenkins et al (2012) and the 2021 IUCN Red List assessment for the species state all harvest of this species is from the wild, as there are no plantations (Martínez Salas et al., 2021).

Most imports from the species reported in CITES Trade Data between 2012 and 2021 are in wild sourced specimens, with the remaining mostly pre-convention (almost all of which was reported imported between 2013-2015). Only a very small quantity of raw wood and raw timber from artificial propagation is reported imported: ~ 105 m^3 from Guatemala, with over half of this in 2016 and the remaining between 2020 and 2021.

Dalbergia tucurensis

The 2020 IUCN Red List assessment for the species states there are no plantations known for this species, with all trade from wild harvested individuals (Linares and Martínez Salas, 2020).

Almost all imports from the species reported in CITES Trade Data between 2014 (when it was listed in Appendix III by Nicaragua) and 2021 are in wild-sourced specimens, with a very small quantity from pre-convention specimens and none from artificial propagation.

2.3 Challenges and opportunities (e.g from a management perspective) with a focus on *Pterocarpus erinaceus* country combinations in Stage 2 (from cases for rosewood species in the RST, or those with a recommendation to suspend trade)

To identify management challenges and opportunities for rosewood tree species in the RST, or with a recommendation to suspend trade, relevant documents on the CITES website were reviewed, with a focus on those related to CITES-listed rosewood tree species currently undergoing compliance procedures (see Table 5 below). Documents reviewed consisted of Plants Committee and Standing Committee meetings and any documents related to compliance procedures. It was noted from this review whether Parties had NDFs published and if any Party had submitted a voluntary zero export quota, to provide an overall summary of current progress made by those Parties subject to compliance process for CITES-listed rosewood tree species. These data, alongside the review of relevant documents, were used to identify common challenges and opportunities for improved management and potential collaborations between Parties that could support implementation of CITES for these rosewood tree species.

A more detailed analysis was conducted for *Pterocarpus erinaceus*, for which all Parties that are range States are currently included in Article XIII as an exceptional case. There were five NDFs for *P. erinaceus* that were found to be publicly available as of October 2023; two from the CTSP website (Benin, Côte d'Ivoire) two from PC26 documents (Ghana and Mali) and one from an SC77 document (Sierra Leone). Each NDF was reviewed against recommended information requirements from criteria paragraphs A-H from Resolution Conf. 16.7 (Rev. CoP17) to identify common strengths or gaps. The subheadings under each criterion developed in section 2.1 (see Figure 2) were used to guide this review; for example for management criteria under paragraph F in Resolution Conf. 16.7 (Rev. CoP17), the NDFs were reviewed for content relevant to the principles of forest management from Chapter 3 of the Guidelines for the Management of Tropical Forests (FAO, 1998) such as the calculation of recovery rates to inform rotation cycles and minimum felling diameters. A summary of strengths and gaps under each NDF criterion A-H is provided and can with reflections that can be used towards recommendations for knowledge sharing and collaborations between Parties that are range States of *P. erinaceus*.

2.3.1. Overview of common challenges and opportunities for CITES-listed tree rosewood species

Table 8 below provides a summary for all species/taxa-country combinations subject to compliance procedures prior to the 77th meeting of the CITES Standing Committee (SC77, November 2023), with current measures taken by Parties (e.g. submission of export quotas or NDFs). Prior to SC77, 29 CITES-listed rosewood species/taxa country combinations were subject to compliance procedures (e.g Article XIII, RST, or a recommendation to suspend trade). For Congo, *Guibourtia demeusei* is mentioned as an update on their progress in implementing recommendations related to Article XIII but was not the reason for Congo's inclusion in Article XIII, so it was excluded from Table 8.

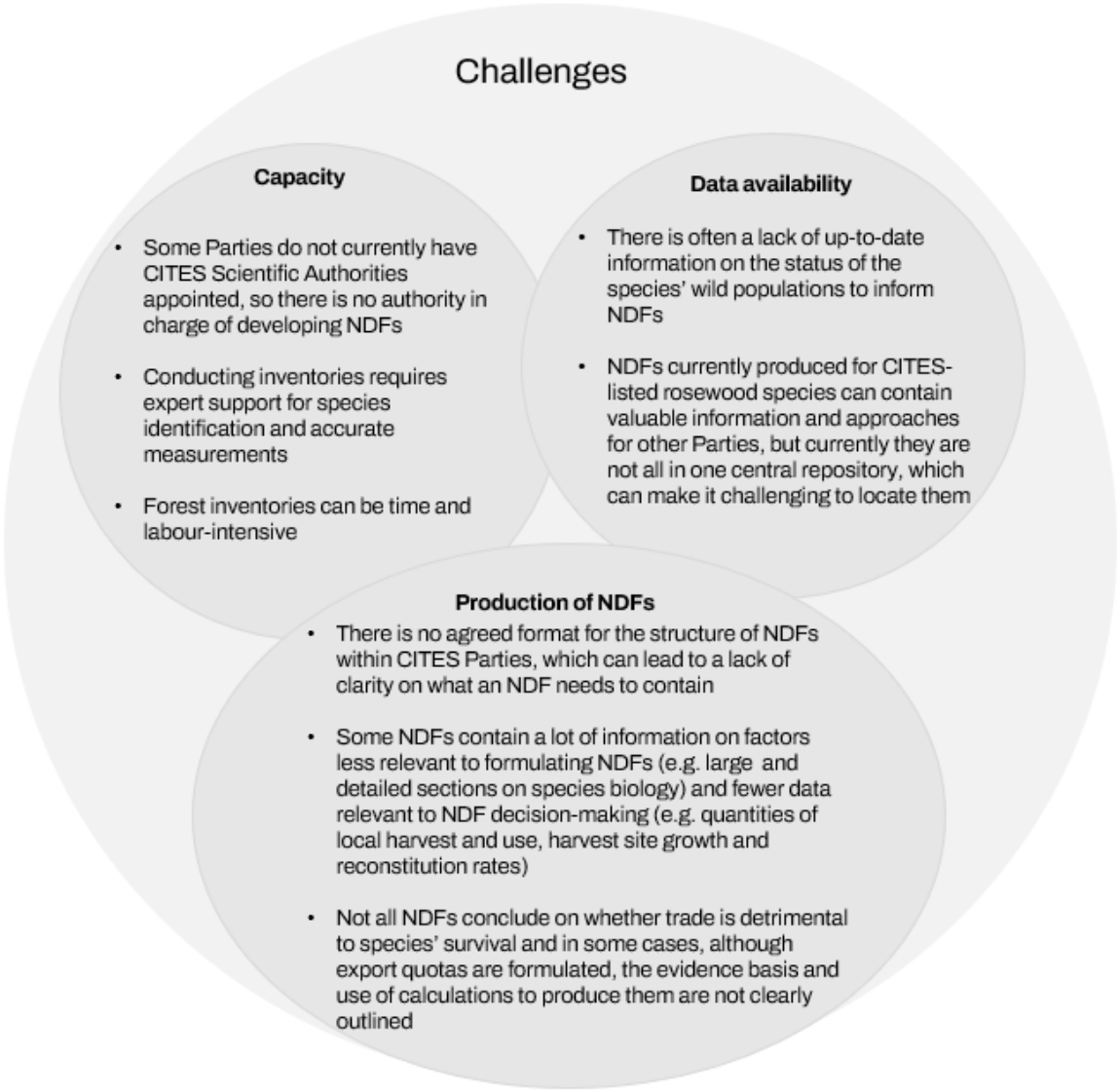
Of these, close to 40% of Parties (11 out of 29) had established voluntary zero export quotas, and around a third (34%; 10 out of 29) had published NDFs. As of October 2023, two NDFs had been approved by the Plants Committee, but it should be noted that several NDFs were yet to be published at the last Plants Committee meeting PC26 in June 2023. During the 77th meeting of the Standing Committee, two species country combinations (*Dalbergia retusa* and Panama, and *Pterocarpus santalinus* and India), were removed from the RST process.

Table 8 CITES-listed rosewood tree species/taxa-country combinations subject to compliance procedures before the 77th meeting of the CITES Standing Committee.

Species	**Party**	**Article XIII**	**RST**	**Recommendation to suspend trade**	**Voluntary zero export quota**	**NDF (publicly) available**
Pterocarpus erinaceus	Nigeria	Yes	Yes	Yes	No	No
Pterocarpus erinaceus	The Gambia	Yes	Yes	Yes	No	No
Pterocarpus erinaceus	Guinea Bissau	Yes	Yes	Yes	No	No
Pterocarpus erinaceus	Mali	Yes	Yes	Yes	No	Yes
Pterocarpus erinaceus	Cameroon	Yes	No	Yes	No	No
Pterocarpus erinaceus	Central African Republic	Yes	No	Yes	No	No
Pterocarpus erinaceus	Chad	Yes	No	Yes	No	No
Pterocarpus erinaceus	Togo	Yes	No	Yes	No	No
Pterocarpus erinaceus	Benin	Yes	Yes	No	Yes	Yes
Pterocarpus erinaceus	Burkina Faso	Yes	Yes	No	Yes	No
Pterocarpus erinaceus	Ghana	Yes	Yes	No	Yes	Yes
Pterocarpus erinaceus	Sierra Leone	Yes	Yes	No	Yes	Yes
Pterocarpus erinaceus	Cote de Ivoire	Yes	No	No	Yes	Yes
Pterocarpus erinaceus	Niger	Yes	No	No	Yes	No
Pterocarpus erinaceus	Senegal	Yes	No	No	Yes	No
Dalbergia cochinchinensis	Lao People's Democratic Republic	Yes	No	Yes	Yes	Yes
Dalbergia oliveri	Lao People's Democratic Republic	Yes	No	Yes	Yes	Yes
Dalbergia spp.	Madagascar	Yes	Yes	Yes	No	No

Species	Party	Article XIII	RST	Recommendation to suspend trade	Voluntary zero export quota	NDF (publicly) available
Dalbergia retusa	Nicaragua	No	Yes	No	No	Yes
Dalbergia retusa	Panama	No	Yes	No	Yes	Yes
Pterocarpus santalinus	India	No	Yes	No	Yes (until 2026, wild specimens only)	Yes
Dalbergia melanoxylon	Mozambique	No	Yes	No	No	No
Dalbergia melanoxylon	United Rep. of Tanzania	No	Yes	No	No	No
Dalbergia melanoxylon	Uganda	No	Yes	No	No	No
Dalbergia melanoxylon	Kenya	No	Yes	No	No	No
Dalbergia tucurensis	Nicaragua	No	Yes	No	No	No
Guibourtia tessmannii	Equatorial Guinea	No	Yes	No	No	No
Guibourtia tessmannii	Gabon	No	Yes	No	No	No
Guibourtia tessmannii	Cameroon	No	Yes	No	No	No

An overview of common challenges and corresponding opportunities identified in the review of documents related to compliance procedures for rosewood tree species is presented in Figure 5. These can be broadly grouped into themes related to data availability, capacity of Parties, and the production of NDFs.


Challenges
Capacity
Some Parties do not currently have CITES Scientific Authorities appointed, so there is no authority in charge of developing NDFs
Conducting inventories requires expert support for species identification and accurate measurements
Forest inventories can be time and labour-intensive
Data availability
There is often a lack of up-to-date information on the status of the species' wild populations to inform NDFs
NDFs currently produced for CITES-listed rosewood species can contain valuable information and approaches for other Parties, but currently they are not all in one central repository, which can make it challenging to locate them
Production of NDFs
There is no agreed format for the structure of NDFs within CITES Parties, which can lead to a lack of clarity on what an NDF needs to contain
Some NDFs contain a lot of information on factors less relevant to formulating NDFs (e.g. large and detailed sections on species biology) and fewer data relevant to NDF decision-making (e.g. quantities of local harvest and use, harvest site growth and reconstitution rates)
Not all NDFs conclude on whether trade is detrimental to species' survival and in some cases, although export quotas are formulated, the evidence basis and use of calculations to produce them are not clearly outlined

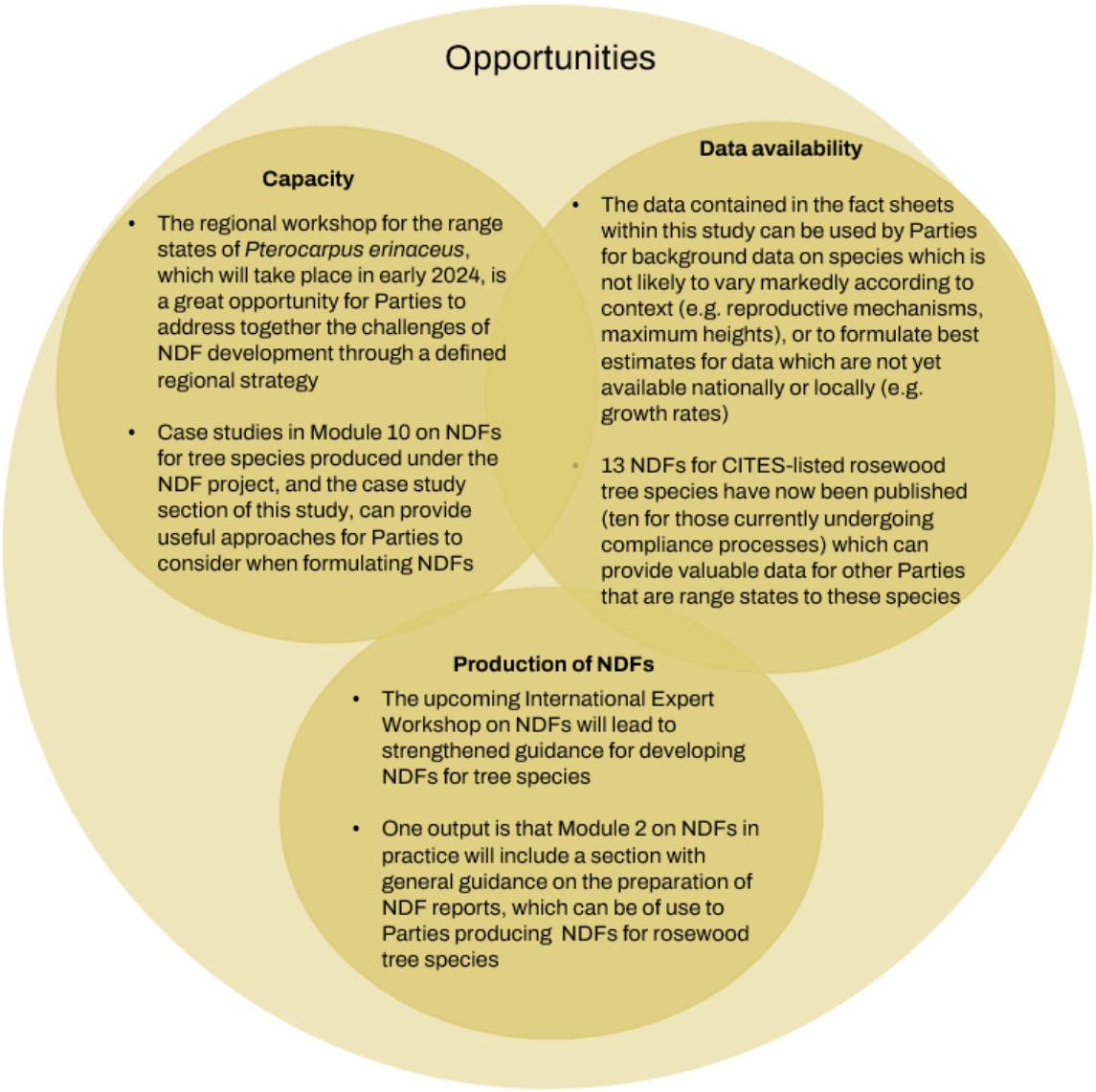


Figure 5. A summary of challenges and opportunities relating to implementation of CITES identified in the review of CITES documents for CITES-listed rosewood tree species currently undergoing compliance procedures.

The following reflections on any future recommendations detailed below could support decision-making processes for the CITES community, including the Secretariat, the Plants Committee, the Standing Committee, CITES Authorities, and other stakeholders in the international trade of CITES-listed rosewood tree species.

Reflections on use of the study by Parties

- Parties could utilise the data and resources provided in the factsheets of this study as background information for NDFs of CITES-listed rosewood tree species assigned to categories of high and medium priority before conducting a shorter literature review to supplement any gaps remaining and obtain more up to date data on factors such as trade patterns

- Where necessary, data from these factsheets on existing minimum felling diameters and known growth rates could be used by Parties as best estimates if they do not yet have data for this nationally; if these are used, a precautionary approach is recommended until data specific to harvested areas can be collected
- Parties can use the information provided on sources and production systems for CITES-listed rosewood species identified ad high priority in this study to identify any potential opportunities to share best practices in their management

Reflections on Capacity building

Training related to NDFs

- In any training or capacity building sessions for Parties, the Secretariat and Plants Committee could focus on ensuring Parties compile and generate the most relevant information for NDF development;
- In training and capacity building sessions, Parties could be reminded that the primary aim of the NDF is to determine the sustainability of timber for export, e.g., not necessarily to develop a management plan at the national level.
- If capacity for conducting inventories is low, Parties could establish temporary voluntary zero export quotas, or very conservative quotas based on available information, until data can be collected
- Although national inventories are valuable if capacity allows, Parties are encouraged to prioritise sampling areas where the species may be harvested from
- When formulating NDFs, Parties may find it useful to consider the forest management unit (s) where harvesting is permitted and any quantities previously exported, with the NDF conducted to verify if these quantities are sustainable and to adjust quantities where needed. This would help to ensure the NDF focuses on collecting the data most relevant to this decision
- Parties could make use of tools and guidance developed to support them with NDF formulation (e.g., outcomes from the International NDF expert workshop), and can use existing tools outlined in Module 10 on NDFs for tree species formed under the NDF Project and other resources such as the 9-step process for producing NDFs for timber/tree species (Wolf et al., 2018).

Collaboration with other relevant experts

- Parties could benefit from strengthened collaborations between CITES Authorities and Forestry departments to align Forestry Management Plans with NDFs for timber species
- Parties under compliance procedures or with voluntary zero export quotas for the same species due to lack of information, could consider a regional collaborative approach for the formulation of non-detriment findings by sharing relevant data and management approaches

Reflections on data availability

Access to existing NDFs

- The Secretariat could consider improving Parties' access to relevant documents available on the CITES website, for example through the production of a webpage dedicated to rosewood tree species like those already in place for CITES and Forests and for Medicinal Plants

- The Secretariat could compile all available NDFs for each CITES-listed rosewood tree species in one place/central repository (e.g., the CITES NDF database, or the webpage referred to above)
- If possible, the Secretairat could seek funding for translating all available NDFs for each CITES-listed rosewood tree species into the three languages of the Convention

Reflections on collaboration with relevant stakeholders

- Parties could benefit from strengthened collaborations with Authorities involved in forestry management (e.g any authorities already mandated to conduct forest inventories) as well as the users of resources (e.g., Indigenous Peoples and Local Communities) to conduct periodic field sampling as part of a monitoring plan with standardized methods
- Where certification schemes exist for forests containing CITES-listed rosewood tree species, Parties could, where possible, use data collected under these schemes for the formulation of NDFs and refer to existing management measures in place when developing a forest management plan for these areas

Reflections on production of NDFs

Outcomes from the international workshop on NDFs in December 2023

- In addition to using the specific guidance provided in Module 10 on tree species, Parties subject to compliance procedures could refer to Module 2 on Practical considerations for making NDFs. Module 2 includes a section on the preparation of a NDF Report, which is a useful source of general guidance for the types of information required in NDFs
- Parties are encouraged to review case studies provided in both this study and in Module 10 on NDFs for tree species produced under the NDF project to identify approaches that can be used when producing NDFs for tree species, and to select approaches that best suit their national context

Support for Parties formulating NDFs

- For species subject to compliance procedures, the Plants Committee could produce a model NDF for CITES-listed rosewood tree species to assist Parties in following best practices.
- It would be useful to ensure that any funded projects to support Parties with NDFs focus on
  a) the collection of data and information most relevant for NDF development and the estimation of non-detrimental harvest/export quotas, with a focus on forest management units where harvest is permitted.
  b) the development of a monitoring plan for forests with standardised field methods to identify population trends and update harvest/export quotas through adaptive management.

2.3.2. A closer look at existing NDFs for *Pterocarpus erinaceus* as a reference point towards the implementation of ongoing compliance recommendations

Overall, the review identified that there is often detailed information available on key biological characteristics of *Pterocarus erinaceus* and a good knowledge of the overall distribution range of the *Pterocarus erinaceus* within the range States.

What was often lacking is data on threats, mortality rates, local uses, roles in ecosystems, and growth rates specific to forest management units. Some of these parameters (e.g mortality and growth rates) would require repeat inventories in the same site and may be included in management plans for the species.

The biological basis for minimum felling diameters in NDFs is also often not explicitly outlined. Conversion factors, where used, are often generic and not based on harvesting techniques or the wood products derived from the logs. These may not be accurate for estimating volumes of timber that can be harvested and exported from known estimates of exploitable growing stock. Generally, in the absence of these data Parties either establish zero export quotas, or conservative quotas.

Strengths, gaps, and reflections on each aspect of NDFs identified in the review of existing NDFs for *Pterocarpus erinaceus* are outlined below. The Secretariat could conisder the reflections on any future recommendations outlined below for each aspect of NDFs when formulating any future recommendations to Parties that are range States of *P. erinaceus*, and for the conceptualization of the regional workshop.

A. On species biology and life history characteristics (e.g habitat, growth, mortality rates, characteristics of timber, role of species in the ecosystem, and resilience of tree species)

Strengths

- Overall, the NDFs have a lot of information on habitats in which the species grows, which provides good environmental context
- They also have a good level of detail on the general resilience and characteristics of the tree species.

Gaps

- The specific role of *P. erinaceus* in the ecosystems the species inhabits within each country is often lacking due to insufficient evidence and studies
- Inventory data are usually a one-off sample, or do not use repeat methodologies at sites previously inventoried, so cannot be reliably used to calculate annual growth increments for the species
- For the same reason, data on resilience of the tree species within ecosystems sampled is lacking

Reflections [towards any future recommendations]

- Repeat inventories of forest management units in the same area with the same methodology, or using methods and areas that replicate prior inventories, could enable a better understanding of the resilience of the tree species.
- Permanent sampling plots within forest management units (which are a recommendation in all NDFs), would enable estimates of growth rates for the species in different habitat types and climatic conditions.
- When and where permanent sampling plots are established, it would be beneficial for Parties to share data on factors such as growth rates specific to different

habitats and climatic characteristics to support those Parties that do not currently have the capacity to establish these
- Where possible Parties can encourage research by relevant institutions into the role of the species within forest management units/areas intended for harvest

B. On species range

Strengths

- There is generally a lot of data on geographic distribution of the species, and to a large extent this is at a national and sub national levels

Gaps

- These data often come from a range of sources (e.g. herbarium specimens, anecdotal evidence, literature reviews, previous inventories) and are not the result of national large scale systematic surveys

Reflections [towards any future recommendations]

- Parties are encouraged, where possible, to collaborate with relevant agencies mandated to conduct forest inventories (e.g. forestry departments or forest owners within forest concession agreements) to access data on species' distribution
- Where capacity is low, it is beneficial to prioirtise inventories of forest management units over large scale national forest inventories

C. On population structure, status and trends

Strengths

- All NDFs use inventories conducted to summarise population structure and abundance/density in the areas surveyed
- Some compare this with data from previous years to estimate population trends
- Data on trends is in part extrapolated from population structures; for example, a lack of mature individuals is used to conclude there has likely been over exploitation

Gaps

- In most cases, trends in populations cannot be identified as inventories are not repeated in the same area with the same methodology
- In some cases, this is done for one area, or a small number of areas, which are extrapolated to estimate the potential national status and population structure of the species

Reflections [towards any future recommendations]

- Where possible, it is recommended Parties ensure methodologies are clear to follow and replicable to enable repeat inventories in the same area and with the same methodology. This can enable a better understanding of trends in abundance and changes to population structure as a result of harvest, or conservation measures implemented
- Some Parties in their management plans recommend a 'zoning' approach with some areas designated for protection of the species and others for harvest; this approach could enable a more targeted approach towards which areas to inventory, with repeat inventories used to monitor the impact of conservation measures (for protection areas) /exploitation (for areas harvested) over time

- Where possible, Parties are encouraged to collaborate with agencies already responsible for conducting forest inventories to collect data to avoid the time and cost burden of inventories

D. On threats

Strengths

- There is generally good availability of information on general threats to the species (e.g illegal trade, habitat loss)

Gaps

- There is often a lack of data on threats specific to areas inventoried.
- These threats are rarely integrated into the calculation of recovery rates and harvest quotas

Reflections [towards any future recommendations]

- Parties are encouraged to collect data on threats specific to areas where they intend to harvest from; this could be from interviews with local communities or with forestry agencies in those localities, observations during inventories (e.g evidence of disease, wildfires)
- Where possible, estimates of loss from these factors should be factored into harvest quotas; for example, if 20% of the stock is estimated to be impacted by threats, harvest quotas could be calculated from the remaining 80%
- Precautionary measures are recommended where there is a lack of data on local threats

E. On historical and current species-specific levels and patterns of harvest and mortality (e.g domestic use, legal trade, illegal trade and mortality rates)

Strengths

- Most NDFs report on known domestic uses of the species
- Data on legal trade (e.g from CITES Trade Databases and harvest permits) is also available for Parties where harvest has been permitted
- One NDF also uses port data to estimate exports for the species, although it states this is likely mixed with the export of specimens from other neighbouring range States
- One NDF factors in a proportion of stock from population inventories for local use in fuelwood production when formulating harvest quotas
- One NDF interviews local communities when conducting forest inventories to better understand which parts of the trees are used locally and in which quantities, with this recorded for each area sampled

Gaps

- As inventories conducted are mostly one off inventories, data on mortality rates within forest management units are lacking
- There is rarely quantitative data on domestic use of the species, for example, volumes used and processing methods, to inform upon estimates of the impact of domestic use on populations

- Data on illegal trade that could better inform the quantity of timber lost to this threat is limited and often restricted to evidence from literature or sporadic reports that may now be outdated

Reflections [towards any future recommendations]

- Parties are encouraged to collaborate with relevant authorities to prioritise regular reporting and recording of illegal trade in the species, and to gain access to any data already recorded
- Where possible, Parties can work with relevant authorities to ensure illegal trade data is recorded in a format that enables estimates of stock lost (e.g specifying quantities of specimens seized)
- Parties may be able to use observations during inventories to identify evidence of illegal trade (e.g stumps or evidence of selective felling in areas where harvest bans currently exist)
- Where possible, the collection of inventory data could be combined with interviews with local communities to better understand local use patterns and quantities.
- Where possible, it is reccomended data on estimated quantities of stock in illegal trade and quantities/parts of the trees used locally are factored into formulation of harvest quotas, with a precautionary approach to harvest for export taken if these data are not available

F. On management measures currently in place and proposed, including adaptive management strategies and consideration of levels of compliance (e.g forest management plans, forest inventory protocols, calculation of recovery rates, minimum felling diameters and rotation cycles, silviculture and harvest techniques, conversion formulas and calculation of harvest and export quotas)

Strengths

- The NDFs summarise methodologies followed in forest inventories and often include diagrams of sampling techniques and relevant formulas used
- Inventories are used to generate classifications of species by size classes according to diameter at breast height, and often also by height
- Most NDFs also collect data on regenerative capacity by recording the quantity of seedlings, saplings, or coppicing stumps
- Parties that intend to export specimens provide information on minimum felling diameters and rotation cycles
- Some NDFs appear to have adjusted minimum felling diameters based on inventory data but the method for calculating these is not clear
- Where harvest/export quotas are determined, they are mostly conservative and based on precautionary principles
- Some NDFs provide detailed management plans that provide actions with timelines, estimated budgets, and actors responsible
- There is some information available and included in NDFs on silvicultural techniques

Gaps

- Harvest techniques are not detailed in any NDF, and silvicultural techniques are not yet clearly incorporated into management of forests where the species is intended to be harvested from
- Reconstitution rates are calculated in some NDFs based on inventory data, but without repeat inventories to inform upon parameters such as mortality rates, growth rates, and evidence for the proportion of stock lost to logging damage, estimates from previous studies appear to have been used which impacts upon the reliability of the recovery rates calculated
- It is often not easy to understand how formulas presented are used to estimate recovery rates or harvest quotas for forest management units
- Although minimum felling diameters and rotation cycles are outlined in the NDFs, it is often not clear how these were calculated, or whether they were informed by forest inventory data
- Some NDFs use formulas with conversion factors to calculate harvest volumes from exploitable growing stock volumes but these are mostly based on generic estimates and are not specific to harvest techniques and equipment used in forest management units for the species
- In many cases, management plans for forests (e.g future monitoring plans and adaptive management) are not clearly defined in the NDFs

Reflections [towards any future recommendations]

- Where possible, at least one worked example would be useful in NDFs when calculating harvest quotas for forest management units, and their conversion into quotas for various commodities to be exported (e.g the volume of logs that may be produced from a quantity/volume of trees to be harvested). This would help guide other Parties that may want to replicate methods
- Parties that intend to export the species are encouraged establish permanent sampling plots in forest management units, so that data on growth rates, recruitments into exploitable diameter classes, and mortality rates in areas they intend to harvest from can be used to inform accurate recovery rates and sustainable/informed harvest quotas in future calculations
- Parties are recommended to share the biological basis for establishment of minimum felling diameters in their NDFs, using guidance from Module 10 on NDFs for tree species produced under the NDF project
- Where these data are not available, Parties are encouraged to use precautionary measures of either the establishment of temporary zero export quotas while data are generated, or conservative harvest and export quotas based on large minimum felling diameters and long rotation cycles
- Parties are encouraged to include management plans for forests with clarity on measures that will be taken to monitor stock and adapt harvest and export quotas when necessary
- Parties are encouraged to use the principles of forest management from Chapter 3 of the Guidelines for the Management of Tropical Forests (FAO, 1998), which are summarised in Module 10 on NDFs for tree species formed under the NDF Project, for formulation of aspects of NDFs relating to forest management (e.g forest management plans, forest inventory protocols, calculation of recovery rates, minimum felling diameters and rotation cycles, silviculture and harvest techniques, conversion formulas and calculation of harvest and export quotas)

G. On population monitoring

Gaps

- Mechanisms for ongoing monitoring of populations are often not clearly referred to in the NDFs

Reflections [towards any future recommendations]

- Parties are encouraged to detail timelines and actors responsible for continued population monitoring for the purposes of either harvest or export

H. On conservation status

Strengths

- The NDFs often refer to various land use classifications (e.g. protected or production forests) in species distribution areas and relevant legislation relating to the species

Gaps

- There are no national red list assessments for this species available in the NDFs reviewed

Reflections [towards any future recommendations]

- Where possible, data collected for developing NDFs could be utilised for national red list assessments for the species

2.4 Case studies of different approaches to implementing CITES (with a focus on Article IV and non- detriment findings)

a) Method

In this section, we follow a similar approach to the case study chapter in Module 10 on NDFs for tree species formed under the NDF project. We showcase examples of different approaches used by Parties when developing NDFs for CITES-listed rosewood tree species. Given a variety of contexts in terms of funding and capacity available, the case studies are a series of example approaches.

Parties should note that the case studies contained in this section and referred to throughout the the study serve as illustrative examples of specific aspects of the implementation of the Convention for rosewood tree species. These cases are not endorsed by the CITES Secretariat, or the governing and scientific bodies of the Convention.

This chapter can be used in conjunction with Module 10: NDFs for Tree species, which further details approaches to forest management for a wide range of high value timber producing trees that may be transferable to CITES-listed rosewood tree species.

A full list of available NDFs for CITES-listed rosewood tree species was collated from a review of all available on the CITES NDF database[12] and the CTSP Website[13] in October 2023. This was supplemented with NDFs identified in the literature review of CITES documents for section 2.2, which included working documents and information documents for SC77. All NDFs identified in this review are summarised in Table 9: five were from Africa (all for *P.*

[12] https://cites.org/eng/virtual-college/ndf
[13] https://cites-tsp.org/

erinaceus) five from Asia (three for *Dalbergia oliveri* and *Dalbergia cochinchinensis,* one for *P. santalinus* and one *for D. latifolia)*, and three from Central and South America and the Caribbean (both for *D. retusa*)

To focus our review on examples of approaches that may be of must use to Parties currently developing NDFs, we prioritised first a review of approaches used in producing NDFs for *Pterocarous erinaceus*, given all range States are undergoing Article XIII compliance processes for this species. There were five NDFs publicly available as of October 2023; Benin, Côte d'Ivoire, Ghana, Mali and Sierra Leone.

We then prioritised a review of approaches to producing NDFs for CITES-listed rosewood tree species that were identified as sourced from mostly wild-sourced in chapter 2.1b (based on CITES Trade Data between 2017 and 2021). This excluded the following NDFs from our review

- India: *Pterocarpus santalinus* (this species is almost entirely sourced from non-wild sources, such as artificially propagated)
- Indonesia: *Dalbergia latifolia* (this species is mostly sourced from artificial propagation)

We also excluded an NDF for *Dalbergia retusa* from Nicaragua, as the Plants Committee have requested this be further developed by Nicaragua before approval (SC77 Doc. 35.3, 2023).

Table 9. All NDFs identified in the CITES NDF database, the CTSP website, and in CITES documents reviewed in section 2.2, with those in bold used to identify approaches to collecting data for NDFs

Region	Country	Species	Source
Africa	**Ghana**	***Pterocarpus erinaceus***	SC77 document
	Mali	***Pterocarpus erinaceus***	PC26 document
	Sierre Leone	***Pterocarpus erinaceus***	PC26 document
	Benin	***Pterocarpus erinaceus***	CTSP
	Côte d'Ivoire	***Pterocarpus erinaceus***	CTSP
Asia	**Cambodia**	***Dalbergia oliveri and Dalbergia cochinchinensis***	CTSP
	Lao PDR	***Dalbergia oliveri and Dalbergia cochinchinensis***	SC77 document
	Viet Nam	***Dalbergia oliveri and Dalbergia cochinchinensis***	CTSP
	India	*Pterocarpus santalinus*	NDF database
	Indonesia	*Dalbergia latifolia*	CTSP
Central and South America and the Caribbean	**Costa Rica**	***Dalbergia retusa***	NDF database
	Nicaragua	*Dalbergia retusa*	NDF database
	Panama	***Dalbergia retusa***	PC26 document

The NDFs remaining were for Asian CITES-listed rosewood species *Dalberigia oliveri* and *Dalbergia cochinchinensis* (Cambodia, Lao PDR, and Viet Nam) and Central and South America and the Caribbean *Dalbergia retusa* (Costa Rica) (see species in bold in Table 9). No NDFs for North America (e.g Mexico) were identified from the sources reviewed. However, Mexico has developed an "Informative guide for the management and sustainable harvest of mahogany under CITES provisions" (PC24 Inf. 3), that specifies the information used by the Scientific Authority for developing NDFs for this and other timber species such as *Dalbergia* spp. that may be useful for Parties to consider.

All NDFs selected were reviewed, with approaches to the collection of data needed to formulate NDFs summarised as a compendium in the sections below. To keep information consistent with other sections, headings and subheadings from Resolution Conf 16.7 (Rev. CoP17) developed in Chapter 1 (Figure 2) were used to categorise approaches. Like previous sections, aspects from Chapter 3 of the Guidelines for the Management of Tropical Forests (FAO, 1998) used in Module 10 on NDFs for timber producing tree species produced under the NDF project were used as guiding principles when summarising approaches to forest management (e.g. the formulation of harvest and export quotas, or forest inventories).

b) Results

The different approaches taken by Parties to develop NDFs were broadly grouped under five themes relevant to Resolution Conf. 16.7 (Rev. CoP17) on *Non-detriment findings*:

- Theme 1: Forest inventory protocols and determination of population structures
- Theme 2: Collection of historical and current species-specific data on levels and patterns of harvest and mortality
- Theme 3: Calculation of recovery rates and establishment of harvest quotas
- Theme 4: Forest management plans
- Theme 5: Collection of other data relevant to NDFs e.g national threats and species biology

Table 10 outlines approaches highlighted from each NDF included in the review.

A summary of the different approaches taken by Parties for each theme is provided in the format of case studies in the corresponding sections below. Where applicable, each case study provides a summary of the impact of the data collected on the NDF decision. Links to the NDFs are provided for Parties to access more detailed methodologies than those provided in the summaries.

Table 10. NDFs for CITES-listed rosewood tree species, with themes highlighted in case studies of approaches to formulating NDFs

Region	Country	Species	Theme highlighted in the case study of approaches to formulating NDFs				
			Theme 1 Forest inventory protocols and determination of population structures	Theme 2 Collecting historical and current species-specific data on levels and patterns of harvest and mortality:	Theme 3 Calculation of recovery rates and establishment of harvest quotas	Theme 4 Forest management plans	Theme 5 Collection of other data relevant to NDFs e.g national threats and species biology
Africa	Ghana	*Pterocarpus erinaceus*	Y		Y	Y	
	Mali	*Pterocarpus erinaceus*	Y		Y		
	Sierra Leone	*Pterocarpus erinaceus*	Y	Y		Y	
	Benin	*Pterocarpus erinaceus*	Y	Y		Y	
	Cote D'Ivoire	*Pterocarpus erinaceus*	Y		Y	Y	
Asia	Cambodia	*Dalbergia oliveri* and *Dalbergia cochinchinensis*	Y				Y
	Lao PDR	*Dalbergia oliveri* and *Dalbergia cochinchinensis*	Y				
	Viet Nam	*Dalbergia oliveri* and *Dalbergia cochinchinensis*	Y			Y	
Central and South America and the Caribbean	Costa Rica	*Dalbergia retusa*	Y	Y			Y
	Panama	*Dalbergia retusa*		Y			

Theme one: Forest inventory protocols and determination of population structures: Benin, Côte d'Ivoire, Ghana, Mali, Sierra Leone and *Pterocarpus erinaceus,* and Cambodia and *D. cochinchinensis/D. oliveri*

The methodology used for population inventories can be broadly split into two key approaches:

- those that sample smaller areas of the country as indicators of national population status and population structures (Benin and Côte d'Ivoire for *P. erinaceus*, Cambodia and Lao PDR for *D. oliveri* and *D. cochinchinensis* and Costa Rica for *D. retusa*)
- those that aim to sample across the range of known distribution, or across potential harvesting areas, for the species (Ghana, Mali and Sierra Leone for *P. erinaceus* and Viet Nam for *D. oliveri* and *D. cochinchinensis*).

The latter approach appears more likely to be taken by countries with intent to export specimens from CITES-listed rosewood tree species (e.g Ghana, Mali, and Sierra Leone for *P. erinaceus*).

Benin's NDF demonstrates a practical approach to inventory that utilises less time and resources; they selected a sample area that is most representative of habitats in the North and South of the country and used this to gain data that may be nationally representative. Although they have legislation preventing the export of *P. erinaceus* since 2017, this inventory can be of use as baseline data to track the progress of any conservation measures in future assessments.

Côte d'Ivoire and **Costa Rica** both used known occurrences of the species from existing data sources (literature and herbarium specimens for Côte d'Ivoire and forestry authorities and institutions such as universities and museums for Costa Rica) to determine areas to survey, with both Parties conducting sampling across the range of known distribution for the species.

Two NDFs (**Mali** and **Ghana**) utilised collaborations with other organisations to collect data for inventories. Mali used data from inventories conducted by forest concessionaires, whilst Ghana worked with forestry departments within their Forestry Commission, including the Resource Management Support Centre of the Forestry Commission, whose mandate is to conduct forest inventories to complete their NDF. This approach to collecting data may also depend on national structures and policies for whose mandate it to conduct forest inventories. It is not clear if other countries could have used similar collaborations to collect data for CITES-listed rosewood tree species, but where possible this approach of utilising existing forestry structures that may be mandated to collect inventory data could be a useful approach. Use of collaborations was recommended in **Benin's** forest management plan. The authors stated that the inventory currently conducted in one area could be extended with the facilitation of forest inventory operations underway in classified forests of Benin, using any data for *P. erinaceus* from the plots inventoried to map the national distribution of the species.

Ghana and **Cambodia** both used previous inventory data to assess trends in populations of CITES-listed rosewood tree species with similar survey areas and methodologies used where possible to enable comparison over time.

Lao PDR also used data from previous inventories to indicate which areas to sample, in addition to a review of literature and interviews with provincial and district level forestry officers. **Viet Nam** also interviewed local experts (in this case rangers of protected areas) to prioritise areas to sample in their inventory and reduce the time required to survey large areas, as well as using interviews with relevant authorities (in combination with data from literature and field visits) to provide evidence on the presence or absence of *Dalbergia oliveri* and *Dalbergia cochinchinensis* across all provinces.

Lao PDR was the only Party to summarise data on specimens according to source types (e.g wild, artificially propagated, and assisted production).

NDF: *Pterocarpus erinaceus* in Benin

Link: https://www.cites-tsp.org/sites/default/files/project_files/202301/Doc_ACNP_PErinaceus_Benin_02092022.pdf

Inventory

Selection of sampling area

The researchers identified five forests within five protected areas with natural occurrences of the species, based on data from previous inventories and research (see 1 in figure below). Of the five forests, they selected one in the centre of the country, which constituted ecosystems representative of northern and southern formations and is exposed to degradation factors typical of the other forests. This forest was therefore thought likely to be representative of the population structure and abundance for the species at a national level (see 1 and 2 in figure below)

Sampling methods

The species is found in various land use types, so stratified sampling (e.g representative of each land use type) was used. The species is not thought to be present in two land use types (crops and fallows and forest and fruit plantations) so only three were selected for sampling: gallery forest, tree/shrub savannah, clear forest/wooded savannah.

The number of sampling plots to be completed was determined based on a coefficient of variation of the basal area of trees of the species from previous research (see p.53 of NDF in link), which determined that a minimum of 257 plots be sampled. This number was increased to 270 to account for different strata within forests.

Sampling plots were randomly distributed amongst the three land use types. Square plots measuring 50 m x 50m were used in clear forest and wooded savannah and tree and shrub savannah, with rectangular dimensions of 250 m x 10 m deemed more suitable for gallery forest and riparian formations. Within each plot, 5 x 5m quadrats were placed, with one each in the four corners, and one in the centre (see 2 in figure below)

Data collected and calculations

Data on the diameter of trees was collected at 1.3 m (e.g., diameter at breast height). They collected data on the number of stems per hectare, basal area (used to indicate total biomass) and population structure (e.g. % of trees in four classes of DBH and ten classes of height). To measure the regeneration density they also collected data on the number of trees with diameters of 5 cm and lower. Data were collected for all species including *P. erinaecus.*

Density and basal area

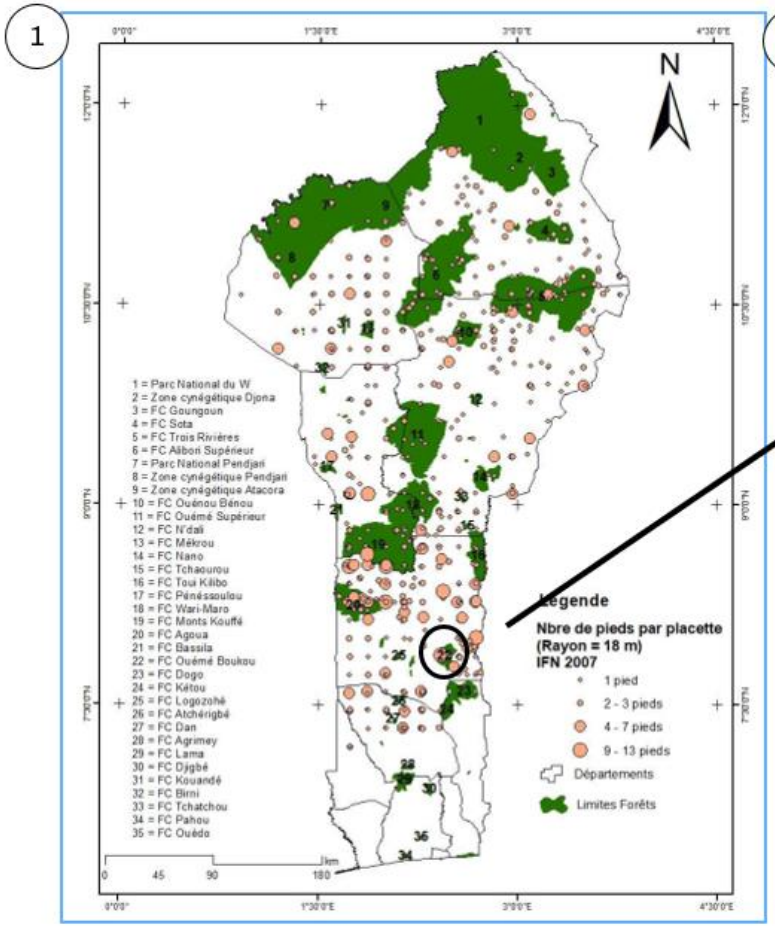
The authors noted the highest density of *P. erinaceus* trees in clear forest/wooded savannah (4 plants/hectare) and tree/shrub savannah (~6 plants/hectare) with only 2 trees/hectare in gallery forest. They found the tree's overall contribution to the basal area of the stand (assumedly meaning all three land use types) was low, at around 7% of all trees present.

Population structure

The authors plotted the % frequency of stems in each diameter class to identify if the population followed the reverse J curve expected in a stable population distribution. They concluded the population did not, with 'right asymmetry' and the largest population of individuals in diameter classes of 15-25 cm DBH. There was overall a rarity of trees with diameters greater than 20 cm DBH. For height classes, there was an asymmetry to the left, with most trees in height classes of 9-11 m and 11-13 m (see 3 in figure below)

The authors calculated the regeneration density (e.g., the number of trees with diameters of 5cm or lower per hectare) for each land use type. The regeneration density of *P. erinaceus* was highest in clear forest/wooded savannah (320 plants/ha) and very low in tree/shrub savannah (~5 plants/ ha) with none in gallery forest. They also point out that the absence of larger trees, noted in the analysis of size class distributions, can limit the natural regeneration of the species due to a lack of seed-bearing trees.

Impact on NDF opinion: Benin issued a decree in 2017 prohibiting the exploitation and export of raw wood from Benin's natural forests., with laws since 2018 also specifically prohibiting the exploitation and marking of *P. erinaceus.* They report the findings of the inventory presented in this case study show a lack of significant improvement in the forest potential of the species, concluding that exploitation and trade would be detrimental to the survival of the species and that conservation measures must be implemented, and a new assessment taken at a future date, before a positive NDF opinion can be made.



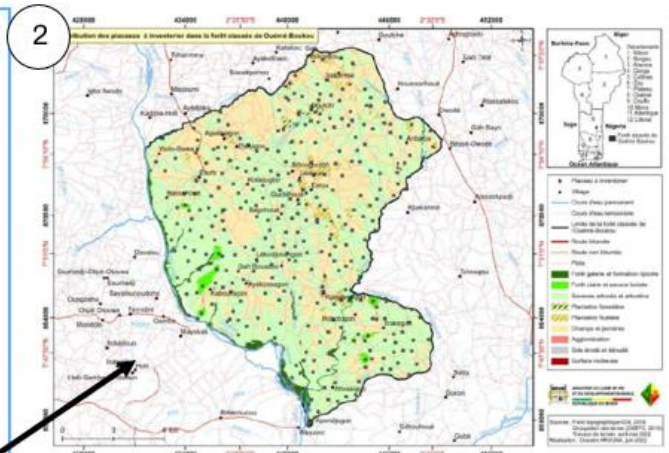
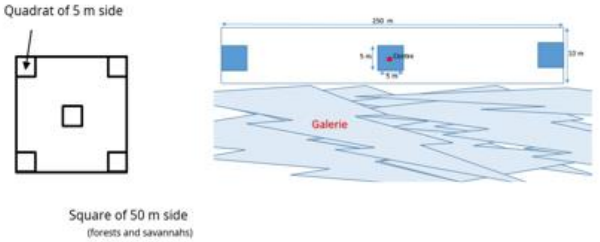
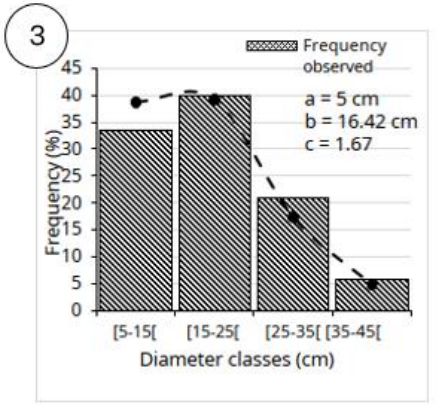


Figure 10. Map of the distribution of inventory plots in the Ouémé-Boukou classified forest





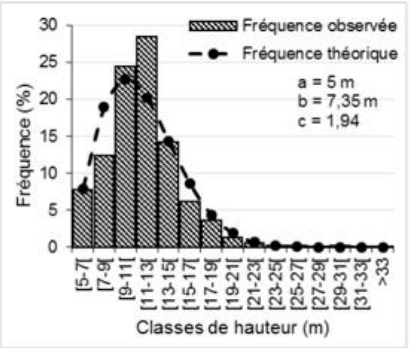


Figure 8. Distribution map of *P. erinaceus* in Benin

NDF: *Pterocarpus erinaceus* in Côte d'Ivoire

Link: https://cites-tsp.org/sites/default/files/project_files/2023-01/ACNP-CITES_2022-Bois_de_vene_vf_compressed.pdf (NDF) and https://cites-tsp.org/sites/default/files/project_files/2023-01/Rapport-Inventaire-Assamela-et-Vene_SIREC-280222-cites-ctsp.pdf (detailed inventory methodology for NDF)

Selection of sampling area

The researchers produced a distribution map using herbarium collections (e.g. data on areas where the presence of the species has been reported) and information collated from relevant literature (e.g collection of evidence of where the species has been encountered or introduced). Observation information was converted into geographic coordinates, with the geolocation of harvesting sites mentioned (assumedly in the literature) where possible. In cases where harvesting sites were referred to by their distance from a locality, that locality was used as a best estimate. This resulted in a total of 152 occurrences: 82 from herbarium specimens and 70 from the literature, 125 of which could be geolocated and were used to produce a distribution map for the species (see 1 in Figure below). Preliminary inventories were carried out to confirm or refute the presence of the species in these habitats identified through the desk-based review. This led to the selection of five sites in the distribution area of the species for the inventory (see 2 in Figure below), covering 25 hectares in total, or 2% of the total 1,000-hectare sampling site. The researchers categorised each sampling site according to land use type (e.g., food crops, tree savannah, gallery forest).

Sampling methods

The method used for inventorying the species was prepared in accordance with an operational guide relating to the development standards of the forest management inventory sampling plan (assumedly a national document for forest inventories). The sampling was carried out in areas of 1,000 hectares, with five transect lines each measuring 25 m wide and 2,000 m in length and 1 km spaces between each (see 2 in Figure below). All trees within the location of the paths were included in the inventory.

Data collected and calculations

Data on the diameter at breast height and height (defined as the vertical distance from ground level to the terminal bud of the tree) of each tree was collected. Individuals with diameters of 5 cm or less were classified as regeneration stock, and researchers noted the diameter of trees next to which seedlings were recorded. They also coded the health of trees or seedlings to determine the number of healthy individuals to inform stock management: 1 healthy, 2 affected, 3 dead/tree stumps. They calculated the density of individuals (e.g number of stems per hectare), diversity index (using the number of each species and their relative abundunce), average tree height, basal area, and the number of individuals in each diameter and height class. They also characterised the spatial distribution of the species by using the 'nearest neighbour' approach, which calculates a ratio of average observed differences to average expected distances between individuals. An index lower than 1 indicates aggregation and greater than 1 dispersion. Researchers also interviewed locals in each area surveyed to identify the use patterns of the species.

Density and basal area

The researchers noted the density of *P. erinaceus* trees varied according to site, with a maximum of ~13 individuals per hectare and a minimum of ~ 3 individuals per hectare. The basal area of the trees varied from a maximum of 0.24 m^2 per hectare to a minimum of 0.12 m^2 per hectare

Population structure

The researchers summarise size class distributions for both DBH and height for each site sampled. They conclude that overall, close to 50% of individuals were in smaller diameter classes of between 10- 25cm DBH, with large diameter individuals generally absent in most areas (see 3 in figure below). Across all sites, most individuals were in height classes of 3-4 metres. They used interview results to help understand the population structures in areas sampled; for example in rural areas, large-diameter individuals are killed as the roots are harmful to yam crops, making individuals of this size rarer. They note that the regeneration capacity of the population in two sites (Bondoukou and Dimbokro) is good, but in other sites it is weak.

The authors state that tree regeneration by natural sowing was most observed with less stump regeneration and sucker regeneration very rare. They noted most seedlings were observed next to individuals with diameters of 21- 50 cm DBH, with two instances of seedlings occurring next to trees of diameters between 7-12 cm DBH (lower than those previously documented as average fruiting size – 15-25 cm - in the literature)

Impact on NDF opinion: The authors point out that current conservation measures including the ban on harvesting of rosewood have helped to improve the recovery of the species. However, they point out that with coverage of only around 2% of the distribution of the species in this inventory, the zero-export quota should be maintained before a more in depth national study can be conducted.

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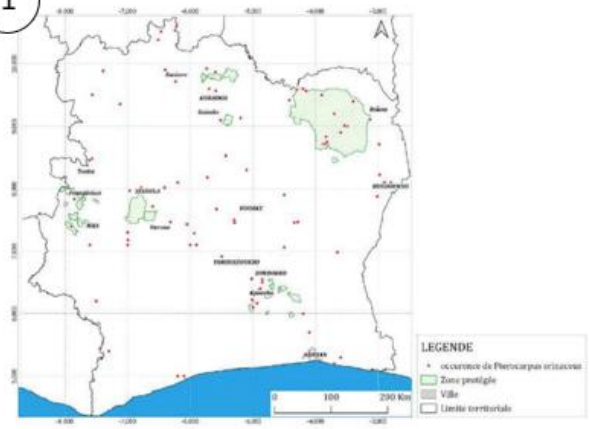
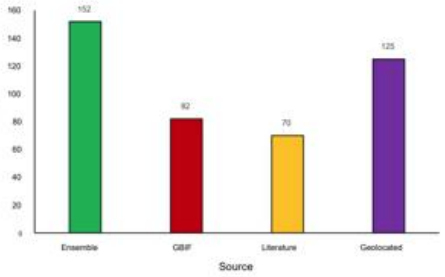


Figure 14: Distribution of sites of occurrence of *Pterocarpus erinaceus* in Ivory Coast



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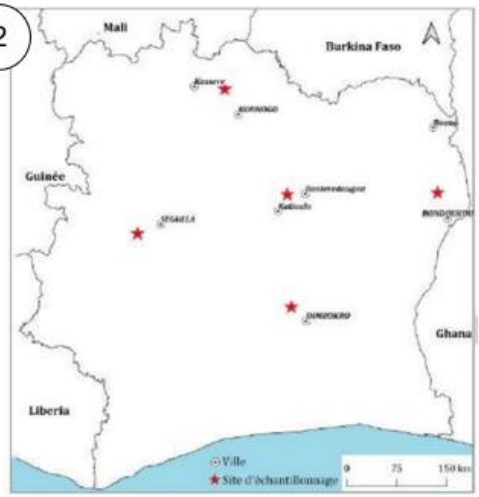

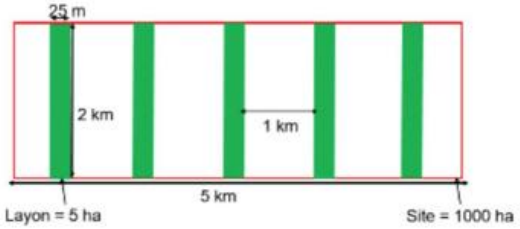

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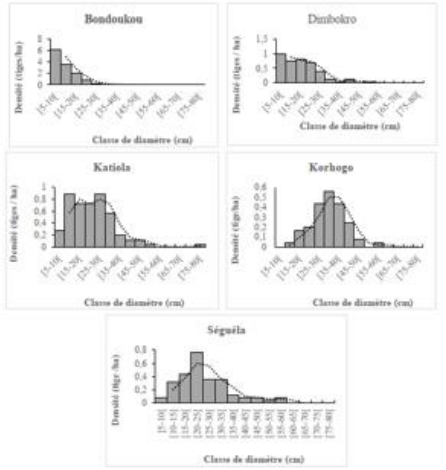

Figure 36 : Structure en diamètre de *Pterocarpus erinaceus* des différentes zones d'étude

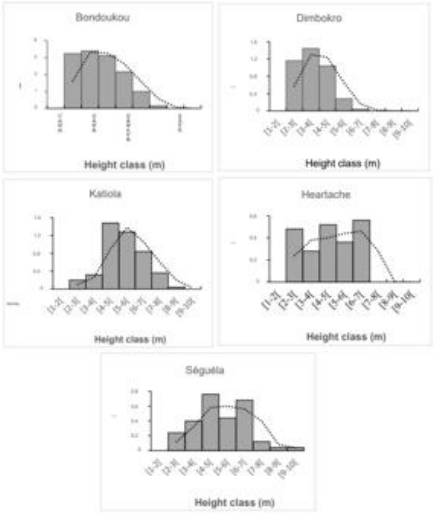

Figure 37: Height structure of *Pterocarpus erinaceus* in the study areas

NDF: *Pterocarpus erinaceus* in Ghana

Link: https://cites.org/sites/default/files/documents/E-SC77-Inf-06.pdf

To produce this NDF, the CITES Scientific Authority in Ghana collaborated with several forestry departments:

- Resource Management Support Centre of the Forestry Commission (RMSC; the technical wing of the forestry commission which conducts inventories for all species across their distribution range as part of their mandate)
- Wildlife Division of the Forestry Commission (WD; also CITES Management authority in Ghana)
- Forest Services Division of the Forestry Commission (FSD; in charge of policies/regulations relating to forest resources)

Selection of sampling area

The researchers selected 26 political districts for the field assessment, based on past inventories and interviews with district forestry staff to determine where the species occurred in relatively substantial quantities. The districts were mapped to guide field teams when distributing sampling plots (see 1 in figure below)

Sampling methods

The researchers reviewed methods used in previous (2013 and 2017) forest inventories to guide sampling methods for this inventory. Long sampling plots (40 m x 1,000 m) were used in each district to capture various land use types, with each sampling plot divided into 10 quadrats each of 40 m x 100 m in size. Forest districts are made up of a number of political districts, so three to five plots were laid in each forest district to enable coverage of different political districts in each site (see 1 in figure below)

Data collected and calculations

Field researchers collected data on the major land use type and terrain condition in each quadrat sampled. All trees greater than 10 cm (assumedly DBH but not stated) were identified and their DBH was measured and recorded. Mean stem numbers per hectare were summarised, and volume per hectare was calculated using an existing equation (source not referenced)

$V= 0.0004634(d^{2.201})$ Where: V= tree volume, d= diameter at breast height

The minimum felling diameter in Ghana is 20 cm DBH, so trees with stems between 10-19.9 cm DBH were classified as advanced regeneration and averaged to indicate the recovery capacity of the species.

Population structure

The authors present data on population structure using four diameter classes with the mean number of stems per km^2 across all forest districts as an indicator of population structure (see 2 in figure below). They point out that in most districts, trees were below 40 cm DBH, but that the structure generally follows the negative exponential curve typical of natural stands. Regeneration (indicated by the number of stems between 10-19.9 cm DBH) in most districts is reported to be generally good, whilst in five it was particularly high, and in four poor (< 70 stems per km^2).

Trends in population size and structure

They compare the number of stems greater than 20 cm DBH (e.g above the felling limit) per km^2 for data from this inventory with that from an inventory in 2021, with data categorised for six regions across Ghana to identify trends, and do the same for corresponding volumes. These data show a decline in rosewood stocks in all but one region (see 4 in figure below), which the authors report indicates existing regulatory mechanisms aimed at restocking of the species have not been largely effective.

Impact on NDF opinion:

The authors do not directly refer to population structures and trends in their conclusion to the NDF, but they do select a conservative felling cycle of 50 years for the export of the species (see case study section on 'calculation of recovery rates and establishment of sustainable harvest quotas')

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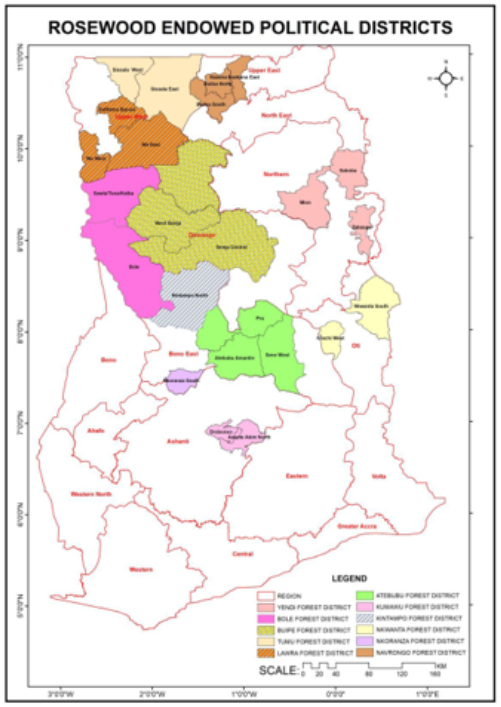

Figure 5 Spatial distribution of rosewood endemic districts

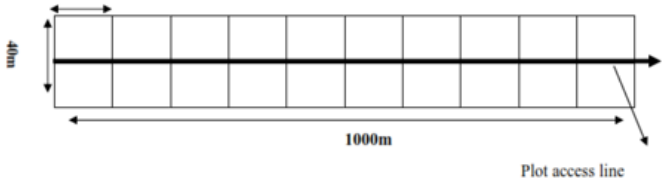

Figure 6 Sample plot layout

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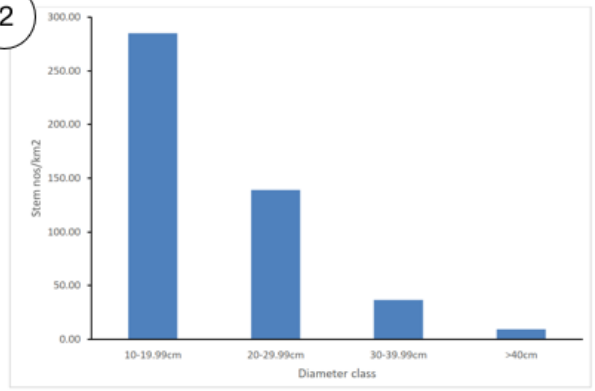

Figure 7 Mean stem number per km2 diameter class distribution for all the political

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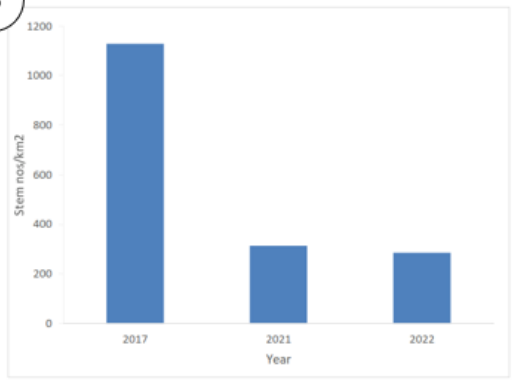


Figure 8 Natural regeneration per km2 across all the districts

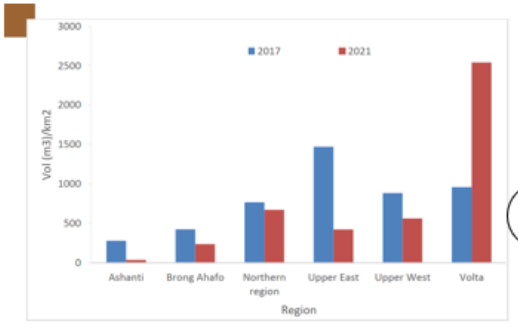


Figure 10 Comparison of volume per km2 of rosewood in 2017 and 2021 for six regions in Ghana

4

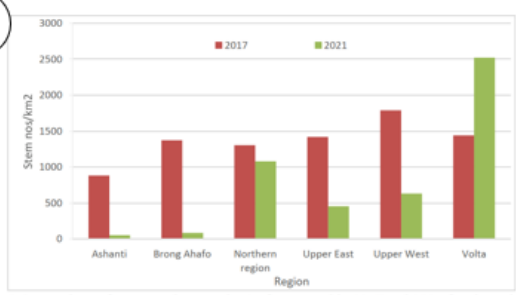


Figure 9 Comparison of stem numbers per km2 of rosewood in 2017 and 2021 for six regions in Ghana

NDF: *Pterocarpus erinaceus* in Mali

Link: https://cites.org/sites/default/files/documents/E-PC26-16-04_0.pdf

Selection of sampling area

Data collected in this NDF focus on 148 forest 'masifs', which are not defined but are assumedly forest management areas, or forest concessions.

Sampling methods

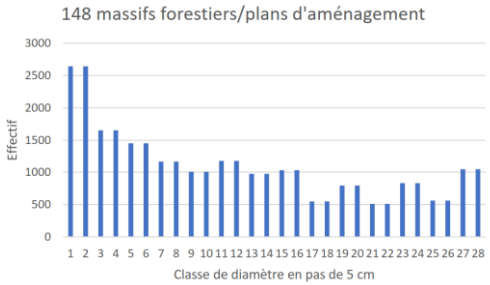
The method used for inventory is not detailed, but the data is supplied by each massif based on inventories conducted between 2020 and 2022 by 'forest concessionaires assisted by design offices'.

Data collected and calculations

Data is summarised in a supplementary excel document to include the total area in hectares of each forest masif surface sampled, and quantities in each diameter class for each masif

Population structure

The authors present data on population structure for the 148 forest masifs in the report and state overall these shows good potential for regeneration in the species (see example below).



Impact on NDF opinion: The authors go on to do further research on the recovery potential in each forest massif to determine if each one is suitable for harvest of the species, and in which quantities (see case study section on 'calculation of recovery rates and establishment of sustainable harvest quotas')

(Draft) NDF: *Pterocarpus erinaceus* in Sierre Leone

Link: https://cites.org/sites/default/files/documents/E-PC26-16-04_0.pdf

Selection of sampling area

The researchers selected eight districts encompassing 53 Chiefdoms, where woodlands dominated by the species occurs. The NDF does not detail how these areas where identified, but in the executive summary the authors state that the study was conducted in all regions, districts, and chiefdoms where the species occurs (see 1 in figure below). Another section states that there was no data on population size and distribution of the species in Sierra Leone (prior to the NDF) but that information from the field indicated areas where the species could be found. The authors state the species is found mostly in community forests, which are also called protected forests and located on Chiefdom lands. The community forests are managed by the Forestry Department in collaboration with the Chiefdom council, with revenue from their use paid to the Chiefdom where they are located.

Sampling methods

The sampling unit was a belt transect of 20 m x 50 m, separated by intervals of 50 m. GPS data were recorded for the centre and four corners of each belt. The survey coverage was proportional to the extent of the species' woodland in each chiefdom; for example, the larger the area of occurrence the greater the coverage and number of plots used in the survey (see 2 inf figure below). The authors state that sampling protocols ensured that statistically sound proportions of sites were sampled, but do not detail the calculations used. Drone data and GIS mapping tools were used to produce a map of vegetation in areas where the species occurs.

Data collected and calculations

The researchers collected data on counts, DBH, and heights of trees of all exploitable species (including *P. erinaceus*) above 10 cm DBH. They also collected data on the number of tree stumps to calculate the number of trees that had been cut, expressed as a proportion of the total number of trees in that location as an indication of logging intensity in each area. For these stumps, they noted whether they were regrowing or dead an indicator of reconstituion capacity. Data was also collected on the number and approximate height of saplings (< 10 cm DBH) and seedlings.

To supplement these data, the researchers documented noticeable threats in sites surveyed (e.g evidence of wildlife, farming, charcoal production), wastage (e.g waste from processed timber, the number of trees cut and not processed). They also documented any use of waste materials generated from processing by local communities, any restoration efforts (e.g replanting) and legal and regulatory mechanisms. They carried out a questionnaire survey that generated other socio-economic data, but do not detail the questions within the survey.

Population structure

The authors present data separately for each district, and additionally break this down according to chiefdoms within districts, with a summary of the number of trees per hectare in each diameter class for each Chiefdom, as well as the number of coppicing and dead stumps, and the number of seedlings and saplings (see 3 in figure below for example from Kono district). They use this to assess recovery capacity in each Chiefdom, and the quantity of commercially viable stock (e.g that with greater than 30 cm DBH). Overall, authors find that most remaining live tree stock are from younger individuals, with most belonging to diameter classes of 10-20 cm DBH, and 21-30 cm DBH, and only around 30% above 30 cm DBH. They conclude that commercially viable and exportable stock is generally low, but varies according to Chiefdom. They point out there is a high density of trees in one of the most remote districts in the country, which is naturally protected by inaccessible road networks/

Impact on NDF opinion: Sierra Leone states this is a draft NDF at present, which will be used as a basis for producing the final NDF and LAF review for the species The authors conclude that 22 (e.g 41.5%) of the 53 chiefdoms can be given a positive NDFs status (see 4 in Figure below for example of decisions for Kono district). It is not clear from the NDF what criteria were needed to reach a positive NDF decision and no quotas are designated for each Chiefdom yet. They state that no commercial harvesting should be allowed in Chiefdoms with negative NDFs over the next ten years to allow for regeneration of the populations.

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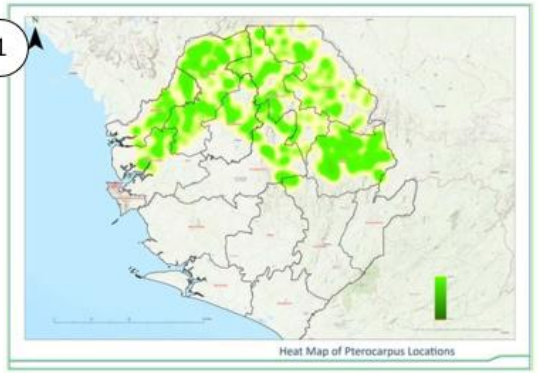

Figure 4.1 - Map of Sierra Leone indicating the spatial extent of *Pterocarpus erinaceus* woodland and the survey coverage.

2

Chiefdoms	No. of Plots	No. of live trees counted	Live trees per plot	Tree density per ha
Sandor	12	34	23	28
Fiama	18	189	11	105
Gbanekondor	28	62	2.2	22
Lei	19	332	18	175
Mafindor	12	49	4	41
Soa	21	91	4	43
Toli	7	33	5	47
TOTAL/AVERAGE	117	790	9	66

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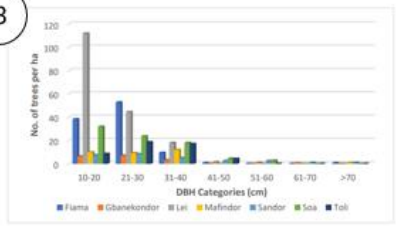

Figure 5.1.2 – Comparative distribution of tree size categories (DBH) per ha, among chiefdoms in the Kono District.

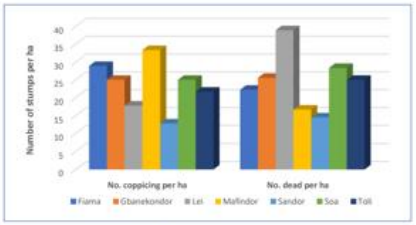

Figure 5.1.4 – Status and distribution of stumps of *Pterocarpus erinaceus* among Chiefdoms.

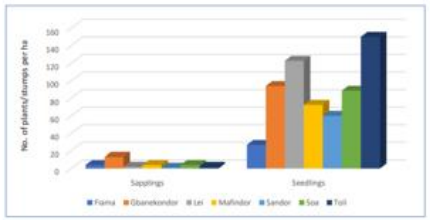

Figure 5.1.3 – Distribution of the regenerative potential *Pterocarpus erinaceus* among Chiefdoms in the Kono District.

4

Table 8.4.1 – Conclusion on the Status of The Non-Detriment Finding in the Study Areas.

PROVINCE	DISTRICT & NO. OF CHIEFDOM	CHIEFDOMS	CONCLUSION ON NDF
EASTERN PROVINCE	Kono District	Sandor	NEGATIVE
		Fiama	NEGATIVE
		Gbanekondor	NEGATIVE
		Lei	POSITIVE
		Mafindor	NEGATIVE
		Soa	POSITIVE
		Toli	POSITIVE

NDF: *Dalbergia oliveri and Dalbergia cochinchinensis* in Cambodia

Link: https://cites-tsp.org/sites/default/files/project_files/2023-01/CITES_KH_NDF_D_cochinchinensis_D_oliveri_20210923.pdf and detailed inventory method https://cites-tsp.org/sites/default/files/project_files/2023-01/CITES_KH_Systema_Inventory_D_Cochichinensis_D_Oliveri_Report_20210712.pdf

Inventory

Selection of sampling area

The researchers selected a pilot study area (Choam Ksant District) based on the known distribution of the two species. It is not clear from the NDF where data on known distribution was sourced from. The authors note this is an area where permits issued are restricted to domestic uses only, so impacts of harvest and trade on populations and establishment of quotas for harvest and export could not be determined in this pilot study. Data collected were used to better understand biological risks, habitat specificity and vulnerabilities of the species for both the NDF and to inform a pilot establishment of small scale plantations. The sampling area was representative of seven forest cover types.

Sampling methods

To reduce the time and costs associated with the inventory, the researchers first conducted preliminary spot checks in the study area to identify occurrences of the species. They then calculated the Normalized Difference Vegetation Index (NDVI) using satellite images. The higher the NDVI level, the denser the vegetation; by selecting a range of NDVI values, the researchers were able to reduce the number of sampling plots whilst still incorporating a variety of forest types (open dry deciduous forest, mixed deciduous forest, and semi-evergreen). This led to a selection of 86 sampling plots, with areas where the NDVI was greater than 0.7 or less than 0.4 excluded (see 1 in Figure below). Sampling plots were 30 m x 50 m but contained smaller sub plots within them; each sub plot was designated for the measurement of trees of particular sizes (see 2 in figure below). They reference a study that states this increases the accuracy of sampling, especially for larger trees, and allows for a more efficient use of time.

Data collected and calculations

The authors collected both local and scientific names of all tree species with a DBH of 5 cm or above. For trees with DBH of less than 5 cm, they only recorded data on *D. oliveri and D. cochinchinensis.* They defined seedlings as plants with a height of less than 1 m and DBH of less than 5 cm, and saplings as plants with heights and DBH greater than this. The authors calculate tree volumes based on equations developed by the Forestry Administration for different forest types and tree families (see 3 in Figure below). Data were also collected on density (trees/hectare) for individuals of different DBH, and statistical tests were used to assess if the relationship between diameter class distribution and population density fit classic growth and reverse J shape curves. The researchers also recorded locations of *D. oliveri and D. cochinchinensis* trees that had been previously planted along with their diameters.

Abundance and volume

Overall, *D. cochinchinensis* was reported in five out of 86 plots, and *D. oliveri* in seven. The authors note an absence of larger trees for both species: For *D. cochinchinensis,* there was an average of 2.6 plants per hectare with diameters of greater than 5 cm, and corresponding wood volumes of these larger trees were also very low (~0.1 m^3/hectare) (see 4 in Figure below). For *D.oliveri*, there was an average of only 0.8 plants/hectare with diameters greater than 5 cm, with the average wood volume low in both deciduous forests (~0.3 m^3/hectare) and semi-evergreen forests (~ 0.2 m^3/hectare).The authors attribute this to illegal logging over the last 15 years and note that large trees with diameters of 15-30 cm for both species were observed in two areas only: a Heritage Forest and gates of community houses close to the border with Thailand; it is thought that villagers in these areas maintain the larger trees in their gardens because they recognise their value and want to conserve the trees for their children. The authors note that since 2013 there have been ~84,000 seedlings of *D. cochinchinensis,* and an estimated 3,000 seedlings of *D.oliveri,* distributed in the district sampled, Observations from the inventory indicate an estimated 7-17% of ~29,000 seedlings planted prior to 2020 have survived.

Trends in population size

The authors also compare data from the systematic survey in this inventory (conducted in 2020) to previous forest inventories between 2014-2016 carried out in the forest concessions harvested areas. They note survey designs, locations, and methodologies in each case and present data for *D. cochinchinensis, D.oliveri* and other target (high value timber) species over time. Although the name of the area surveyed in this inventory differs to those inventoried in 2014-2016, there appears to be an overlap between the two areas (based on online map data). The authors note declines of about 6.4 times in population density and 2.0 times in wood volume for all species combined in 2020 (see 5 in figure below)

Population structure

The authors plot population density and diamter distribution for each species and state that it approximately follows a reverse J shaped curve indicating structural conditions conducive to reproductive sustainability, but also point out that the maximum DBH recorded for *D. cochinchinensis* was only 20 cm DBH (see 4 in Figure below). A similar trend is shown for *D. oliveri,* with a similar curve shape but also few larger trees (an average of less than one plant per hectare for trees with 20-30cm DBH and none larger. The authors point out the lack of mature trees with diameters of greater than 20 cm DBH could lead to sporadic reproduction, and limit recruitment and regeneration.

Impact on NDF opinion: The authors note these data, alongside other data collected in the study on reproductive strategies and other threats to the species, indicate a 2014 suspension on exports of products from luxury grade timber species (including from *Dalbergia* species), should remain in place. This ban applies irrespective of whether the specimens are from artificial propagation or from natural forests. See case study section on 'Collection of other data relevant to NDFs' for more detail on the scoring system used to inform this conclusion.

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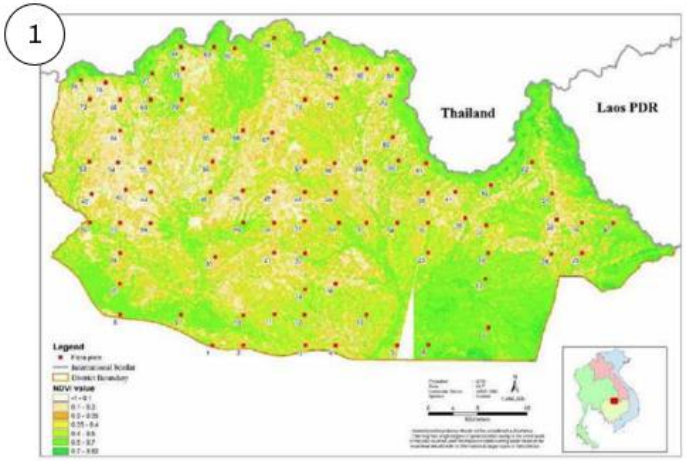

Figure 4. A map of systematic flora sampling plots based on NDVI ranks between 0.4-0.7.

2

Plot & Sub-plot	*Dimensions*	*Area (m^2)*	*DBH class*
Plot: Larger Trees	30 m × 50 m	1500	DBH ≥ 30 cm
Subplot 1: Medium Size Trees	30 m × 25 m	750	DBH ≥ 10 cm
Subplot 2: Small Trees	10 m × 10 m	100	DBH ≥ 5 cm
Subplot 3: Trees and saplings*	5 m × 5 m	25	Trees: 1cm ≤ DBH ≤ 5 cm; Height >1 m
Subplot 4: Trees and seedlings*	2 m × 2 m	4	Trees: DBH < 1cm; Height ≤ 1 m

Note: * Only *D. cochinchinensis* and *D.oliveri* were recorded in these 2 sub-plots.

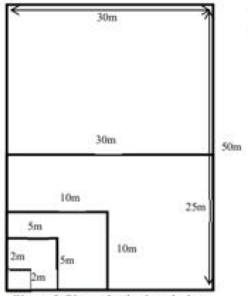

Figure 5. Plot and sub-plots design.

3

Table 3. Wood volume equations for different forest types.

Tree Family	*DBH*	*Forest types*	
		Semi-evergreen forest	Deciduous forest
Dipterocarp	< 15 cm	$V= 0.03+4.8*D^2$	$V= 0.00849+4.097*D^2$
	> 15 cm	$V= 0.0012+6.167*D^2$	$V= 0.051+5.864*D^2$
Non-Dipterocarp	>15 cm	$V= 0.0083+4.3*D^2$	$V= 0.03+3.3*D^2$
	15-30 cm	$V= 0.008+5.3*D^2$	$V= 0.03+3.55*D^2$
	> 30 cm	$V= 0.0083+6.081*D^2$	$V= -0.413+7.819*D^2$

Source: Forestry Administration, 2010.

Table 4. Population density of *D. oliveri* in natural forest habitats.

Forest Type	*Seedlings/ha*	*Saplings/ha*	*5-10 cm*	*10-15 cm*	*15-20 cm*	*20-30 cm*	*30-40 cm*	*40-50 cm*	*> 50 cm*	***Sub Total***	**Grand Total**
Average in DF	198.41	95.24	-	0.21	0.21	0.42	-	-	-	**0.85**	**294.50**
S.E.	*198.41*	*59.16*	-	*0.21*	*0.21*	*0.30*	-	-	-	0.72	**258.29**
Average in SF	-	*69.57*	-	-	-	0.58	-	-	-	0.58	**70.14**
S.E.	-	*0.14*	-	-	-	*0.58*	-	-	-	0.58	**0.72**
Overall Average	**145.35**	**88.37**	-	**0.16**	**0.16**	**0.47**	-	-	-	**0.78**	**234.50**
S.E.	**145.35**	**45.55**	-	**0.16**	**0.16**	**0.27**	-	-	-	**0.58**	**191.48**

Table 5. Volume of *D. oliveri* in natural forest habitats.

	Volume (m^3/ha)							
Forest Type	5-10 cm	10-15 cm	15-20 cm	20-30 cm	30-40 cm	40-50 cm	> 50 cm	**Total**
Average in DF	-	0.150	0.031	0.127	-	-	-	**0.308**
S.E.	-	*0.150*	*0.031*	*0.090*	-	-	-	*0.271*
Average in SF	-	-	-	0.197	-	-	-	**0.197**
S.E.	-	-	-	*0.197*	-	-	-	**0.197**
Overall Average	-	**0.015**	**0.022**	**0.146**	-	-	-	**0.183**
S.E.	-	*0.015*	*0.022*	*0.084*	-	-	-	**0.121**

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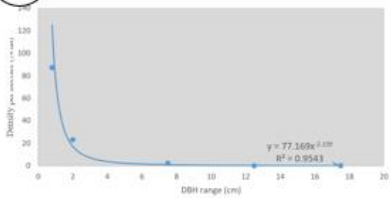

ure 6. The population density and diameter distribution represented in the reverse J-sha curve for *D. cochichinensis*.

5

Table 9. Forest Inventories conducted between 2014 and 2020 used to detect changes in population density and wood volume of target species.

Designed sampling & period	FA-ITTO[7]	Phoung Sopea[8]	Heng Soriya[9]	Chea Kearath[10]	ELC-CDP[11]	Average (2014-2016)	Systematic Survey[12]
Main purpose	Carbon Stock	Carbon Stock	Carbon Stock	Carbon Stock	ESIA		*Dalbergia* species
Period	2014-2015	2015	2015	2016	2015		2020
# plots sampled	89	33	12	20	36		86
Sampled plot shape	Rectangle	Rectangle	Circle	Circle	Rectangle		Rectangle
Sampled plot area (m^2)	1500	1500	314	314	1500		1500
Sampling method	Randomly	Randomly	Randomly	Randomly	Randomly		Systematic
Locations of sampled plots	PVPF*	PVPF*	PVPF*	PVPF*	ELC-CDP		Choam Ksant**
Results							
Semi-evergreen forest (SF)							
Density (trees/ha)	2,839	1,900	335	305	658	**1,207.4**	189.87
Wood volume (m^3/ha)	217.18	NA	NA	52.15	59.91	**109.75**	55.19
Target species group in SF							
Luxury Grade (trees/ha)	NA	117	NA	0	40.5	**52.5**	11.6
Luxury Grade (m^3/ha)	NA	6.02	NA	0	3.69	**3.24**	1.84
Deciduous forest (DF)							
Density (trees/ha)	764	764	225	279.6	434	**493.32**	165
Wood volume (m^3/ha)	169.92	NA	NA	19.4	48.29	**79.20**	32.199
Target species group in DF							
Luxury Grade (trees/ha)	NA	13	NA	12.7	26.7	**17.5**	16.4
Luxury Grade (m^3/ha)	NA	2.41	NA	0.49	2.97	**1.96**	0.81

Note: * PVPF = Preah Vihear Protected Forest (Chheb Wildlife Sanctuary); ** throughout Choam Ksant forestland

NDF: *Dalbergia oliveri and Dalbergia cochinchinensis* in Laos PDR

Link: https://cites.org/sites/default/files/documents/E-SC77-Inf-04.pdf

Inventory

Selection of sampling area

The researchers used data from previous inventories, technical reports, scientific papers, records type specimens, government documents from province and district levels, and interviews with representatives from key sectors within the forestry sectors (e.g. Province/district Agriculture and Forestry Offices) and land owners or other stakeholders involved in tree plantations to identify areas where the two species occurred (see 1 in Figure below).

These were categorised into the three CITES source codes of wild (W), artificially propagated (A) and assisted production (Y). The researchers prioritised sampling of areas where species from source codes A and Y occurred and for which there was limited knowledge, given that it has been previously acknowledged that there is a low wild population of the two species. Only plantations reported to have existed for 3+ years were surveyed. Overall, six provinces with 24 districts were surveyed.

Sampling methods

Sampling used data from interviews and other sources collated by the researchers to identify survey sites for each source type (see examples for each source 1 in figure below)

- For wild specimens (W) (17 sites): survey sites were selected based on areas that were reported to have the highest and lowest population densities. Transect lines were used to sample low density areas and square sample plots for high-density areas
- For plantations (A) (21 sites): survey sites were selected based on the largest and smallest plantation areas in each district, with all trees in the site included for small areas (less than 1 hectare), and at least 100-200 trees for larger areas (greater than 1 hectare)
- For assisted production specimens (Y): as many areas as resources allowed were surveyed

Data collected and calculations

Data from previous field surveys in two other provinces were combined with data from this inventory. Data on locations of species occurrences for each source type were recorded to produce a distribution map. Total counts of the species from each source, and counts for each diameter class, were recorded. In the annexes to the NDF, they also provide detailed data for each province surveyed, including distribution maps.

Abundance

There were around 7,000 specimens of *D. cochinchinensis,* mostly from source codes Y and A, and around 610 from *D.oliveri*, mostly from source W (see map for distribution, 2 in figure below). The authors conclude that overall, the wild populations of both species are extremely low. For specimens from source code A, they report that the full registry of tree plantations has not been effectively enforced throughout the country, so the data cannot be used to estimate total quantities of specimens from source code A for *D. cochinchinensis*, although they state that *D.oliveri* has not yet been planted in the country. The authors report that occurrence of specimens of *D. cochinchinensis* from source Y is widespread across central and southern parts of Laos PDR.

Population structure

The authors group the specimens into three diameter classes (a: greater than 20cm DBH, b: >10 to 20cm DBH and c: 5-10 cm DBH). Mature trees are classifed as those with 20cm DBH or greater. They present data for the numbers of individuals from each source in each category, and overall percentages across all sources (see 3 in figure below). They state that inventories of specimens of *D. cochinchinensis* from source code Y show healthy population structures.

Impact on NDF opinion:

The authors note that the findings from this study were limited to areas inventoried, with locations where inventories were conducted based on information gained from interviews and literature reviews. Their data is therefore based largely on general knowledge of provincial and district-level staff interviewed. They point out there is a need for a more systemic survey, but in the meantime state populations from both source code W and Y for both species are very low, and therefore as a precautionary approach harvest and commercial export should not be permitted. There is already a ban on commercial logging of natural forests in the country but the authors go on to note conditions for export from specimens of each species; for example export from pre-convention specimens is allowed once certain legal obligations are met, and artificially propagated specimens once information on founder stock can be provided, which requires establishment on a system to register this information (see 4 in Figure below). Several measures outlined in an action plan are designed to improve survey methodologies to enable exports to resume.

1

Table 2 Habitats of Source code W Dalbergia species as identified through interviews

Province	district	Area (ha)	Inventoried (yes/no) or observed*	Remarks
Borlikhamsay	Khamkuet	NA	Observation & Interview	Low occurrence and dispersed
Khammouan	Boualapha	NA	Yes	Observation, Low occurrence and dispersed
	Nakai		Yes	

Table 3 Locations of Source code A as identified through interviews

Province	District	Area (ha)	Inventoried (yes/no)	Planting regime
Vientiane capital	Sangthong	8	Inventoried (in past studies)	Single species
	Nasaythong	2	Inventoried (in past studies)	Single species
Borlikhamsay	Borlikhan	10	Yes	Mixed with other species
	Khamkuet	5	Yes	Mixed with other species
	Pakkading	5	Yes	Mixed with other species
	Paksan	5	Yes	Mixed with other species
	Thaphabath	9	Yes	

Table 4 Habitats of Source code Y (assisted production) as identified through interviews

Province	District	Area (ha)	Inventoried (yes/no) or Observed	Remarks
Borlikhamsay	Khamkuet	1,000 ha	Yes	High occurrence but dispersed
Khammouan	Boualapha	100	Yes	Low occurrence and dispersed
	Nakai	20	Yes	Low occurrence and dispersed
	Nong	1,000	Yes	High occurrence but dispersed

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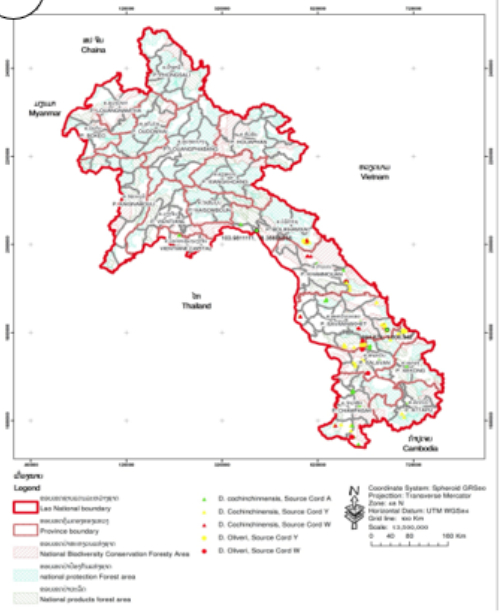

Figure 1 Map 09 Occurrence and distribution map of two Dalbergia species in central and southern Laos

3

Table 7 Population of D. cochinchinensis identified through the field plot inventory, by DBH

Source Code	*D. cochinchinensis*			Total
	a	b	c	
W	125	589	1.070	**1.784**
A	141	678	1.333	**2.152**
Y	2.027	412	322	**2.761**
Total	***2.293***	***1.679***	***2.725***	**6.697**
Percentage (%)	***34,2***	***25,1***	***40,7***	***100,0***

Table 8 Population of D. oliveri identified through the field plot inventory, by DBH

Source Code	*D. oliveri*			Total
	a	b	c	
W	51	79	361	**491**
A	4	1	2	**7**
Y	98	10	5	**113**
Total	***153***	***90***	***368***	**611**
Percentage (%)	***25,0***	***14,7***	***60,2***	***100,0***

4

Table 1 Sources of rosewood specimen for potential export and recommendations

	NDF requirement	Recommendations
Pre-convention specimens that were acquired before these two rosewood species were added to CITES Appendix II, which was on 2 January 2017 (Source code O)	No	Export can be permitted after due legal processes[3] are taken.
Specimens removed through the conversion of natural forests (for example, into infrastructure such as roads or other forms of mass transport) (under Source code W)	Yes	Export not permitted for the time-being, and until an NDF (completed to the satisfaction of the CITES Secretariat and in accordance with the applicable recommendation under CITES Article XIII process) can be issued based on the results of an updated survey.
Confiscated specimens (Source code I)	Yes	
Assisted production specimens (Source code Y)	Yes	
Artificially propagated plants (Source code A)	Yes: only for founder stock of plants used to establish the cultivated parental stock in the propagation system involved.	Export not permitted until an NDF can be issued based on information of the founder stock of plants used. Establishment of a system that registers such information to be considered.

NDF: *Dalbergia oliveri and Dalbergia cochinchinensis* in Viet Nam

Link: NDF here https://cites-tsp.org/sites/default/files/project_files/2023-01/Vietnam_NDF_report_for_D_cochinchinense_D_oliveri_CTSP-CITES-2022_compressed.pdf and inventory here https://cites-tsp.org/sites/default/files/project_files/2023-01/Report_on_systematic_survey_of_Dcochinchinensis_and_Doliveri_in_Vietnam.pdf with report with data on distributions from an initial review here for *D.oliveri* https://cites-tsp.org/sites/default/files/project_files/2023-01/Review-taxonomy...-of-Dalbergia-oliveri_compressed.pdf and here for *D. cochinchinensis* *https://cites-tsp.org/sites/default/files/project_files/2023-01/Review-taxonomy...-of-Dalbergia-cochinchinensis_revised_compressed.pdf*

Inventory

Selection of sampling area

The researchers aimed to carry out an initial inventory by sampling across the national population. This initial inventory focused on presence/absence of the species in each province based on data from literature, field visits, and interviews with relevant authorities. A more in-depth inventory (e.g inclusive of data on abundance and population structure) of four protected areas not covered in this initial review was subsequently completed. The authors state these four protected areas may be the key sites for the existence and restoration of the two species.

Sampling methods for in depth inventory

The survey team first interviewed tehnicial staff and forest rangers with many years of experience working in the protected areas, in addition to members of community based forest groups, to prioritise areas to sample based on known distibutions. Adaptive cluster sampling was used for larger protected areas, with random sampling used for one of the smaller protected areas. The authors note that adaptive cluster sampling is useful for rare species that tend to cluster in certain areas.

Data collected and calculations for in depth inventory

The survey team collected data on DBH of each tree, height, and GPS coordinates. All trees with heights of 6 cm DBH or larger were recorded in the survey. The basal area, stem volume of each tree, total forest stand volume and density were calculated, with formulas detailed on p.18 of the inventory report. They also recorded data on the number and type of regenerating plants, which included seedlings and coppicing plants.

Abundance

The initial inventory found that *D. oliveri* was present in 15 provinces and *D. cochinchinensis* in ten (see 1 in figure below), with *D. cochinchinensis* more sparsely distributed than *D. oliveri.* Total quantities or the abundance in each of these provinces are not clear. The in depth inventory conducted in the four protected areas found *D. cochinchinensis* present in two, with a maximum estimated total of 18,000 trees, and *D. cochinchinensis* in three, with a maximum estimated total of 300,000 trees.

Population structure

Data is not available on detailed age structures of populations from the initial inventory (e.g from literature, field visits, and interviews with relevant authorities), although the authors of the reviews state that there is evidence of over-exploitation with a reduction in larger individuals from both species. The review of the four protected areas provides in-depth data for each protected area on population structures and the distribution of seedlings/coppicing plants and mature individuals (see 3 in figure below for an example).

Impact on NDF opinion:

The authors use these data to conclude populations of both species, but particularly *D. cochinchinensis,* are small and fragmented. They evaluate this in the context of other known threats related to species biology, illegal logging, and habitat loss, to conclude that the NDF is negative and export would be detrimental to wild populations.

1

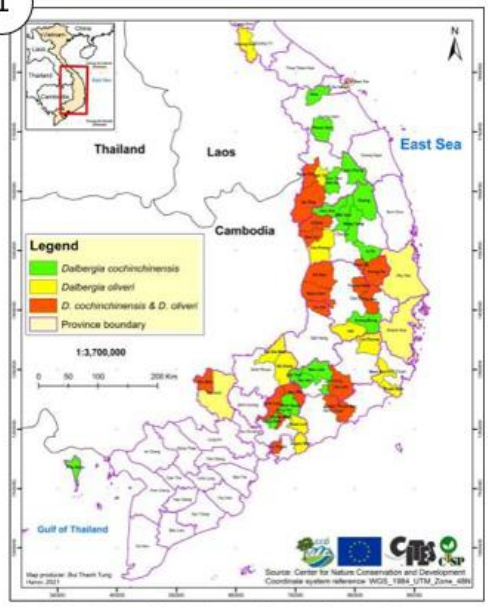

Figure 8. Map of distribution of *D. cochinchinensis* and *D. oliveri* in Vietnam by districts.

2

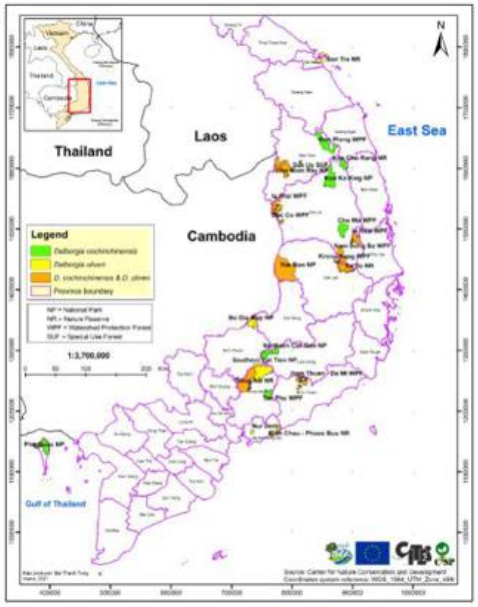

Figure 9. Map of distribution of *D. cochinchinensis* and *D. oliveri* in Vietnam by protected areas.

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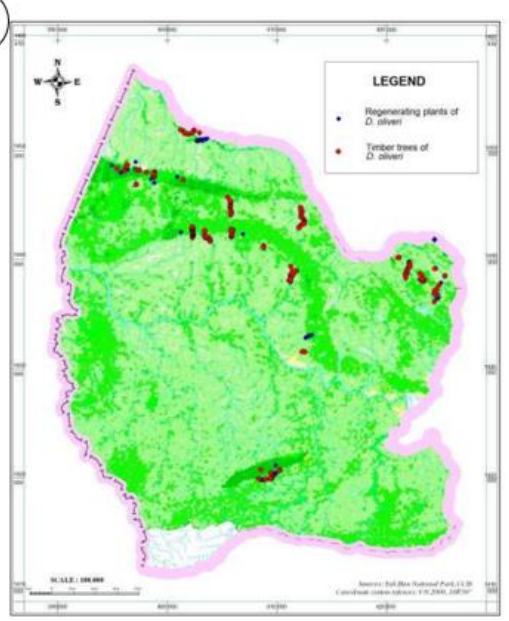


Figure 14. Distribution of *D. oliveri* in the Yok Don NP.

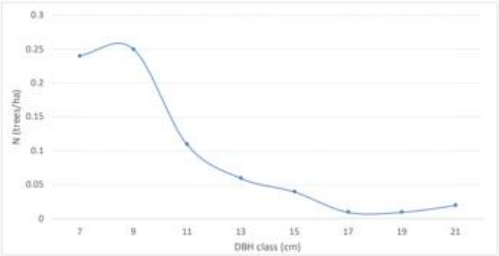


Figure 11. N-DBH distribution of *D. cochinchinensis* trees in the Yok Don NP.

NDF: *Dalbergia retusa* in Costa Rica (note; this is a population status and trade study produced prior to the species' listing in Appendix II but is now in the CITES NDF database and has useful approaches to highlight)

Link:
https://cites.org/sites/default/files/ndf_material/INFORME%20FINAL%20Estado%20Poblacional%20y%20Comercio%20de%20Cedrela%20odorata%20y%20Dalbergia%20restusa%2C%20%20para%20CR%202010.pdf

Inventory

Selection of sampling area

The researchers used information on the natural distribution area of the species, information provided by various forestry authorities, and data from various institutions (e.g National Museum of Costa Rica (MNCR), National Institute of Biodiversity and Universities) to identify where the species were known to occur. If species were not present in an area where they were thought to exist, local officials were contacted to ask about other possible locations. Sampling locations were identified throughout the national territory. Plantation areas were surveyed separately to natural habitats of the species.

Sampling methods

The researchers intended to establish abundance across the natural distribution area. They used random stratified sampling, with transects established where individuals of the species were found. Sampling continued along a transect until presence of the species decreased or became absent (e.g after either 30 minutes or 30 km of sampling), so the length of each transect varied. Habitat units in sampling areas were classified according to features; for example, wooded pastures were defined as areas with a high percentage of grass, and mature forests areas with trees aged between 40-80 years.

Data collected and calculations

Data was collected on trees with DBH greater than 10 cm. The DBH and height were recorded to enable data on population structures to be generated. The basal area was also estimated, as well as number of individuals, locations, relative dominance, relative abundance, and relative frequency. Population density was worked out according to the number of individuals within an area sampled. They also recorded GPS locations of each species to generate distribution maps. The researchers collected data to estimate regeneration capacity by reporting the life stage of the species based on established categories (seedling; from germination until leaves appear, saplings; plants with leaves between 0.3-1.5 m in height, latziale; individuals greater than 1.5m and DBH up to 9.9 cm, fustal; individuals with DBH above 9.9cm).

Density and basal area

Average density was 0.79 individuals per km, with a total of 1,213 individuals sampled. The researchers plotted a distribution map to show the relative density of the species across the national distribution, with the size of the circle corresponding to the number of individuals present (e.g up to 10 individuals was the smallest, and more than 50 the largest). Over 95% of individuals observed were in their natural distribution and not cultivated (see map and graph, number 1 in figure below).

Population structure

The authors plotted the number of individuals in each diameter class to identify if the population followed the reverse J curve expected in a stable population distribution(see 2 in the figure below). They concluded the population does follow the trend expected in stable populations, with a greater number of individuals in the lower classes, and around 36% of individuals in reproductive age classes of 20-40 cm DBH, which together indicate good regenerative capacity and the ability to recover from exploitation. They note that height classes do not follow the same trend, but also demonstrate a low correlation between height classes and DBH (see 2 in figure below).

The researchers note that the overall population was formed of 19% seedlings and 20% saplings. They map regeneration on a distribution map to identify distances between producing trees (e,g mature adults) and conclude that individuals in regeneration stages are most often between 10-19.9m away from the producing tree (41% of individuals) (see map and graph, number 3 in figure below).

Impact on conclusion of study

Although the researchers do not indicate that the number estimated in this study is the total population, they do point out the species appears to be largely restricted to tropical dry forest or in the transitional to dry humid forest based on sampling data. Despite age structures showing good regenerative capacity, they also not they cannot be sure of the abundance of the species, and with a small population sample, combined with research that suggests around 500-1,000 individuals of reproductive age are required for a population to be viable, they note that the species could be close to extinction and recommend a ban on extraction from its' natural distribution area, with harvest from plantations only, which should be promoted for the species.

1

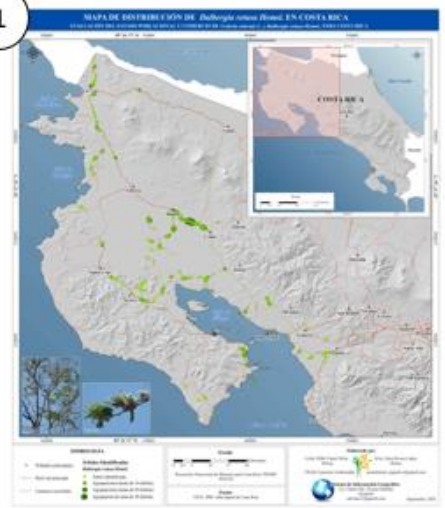
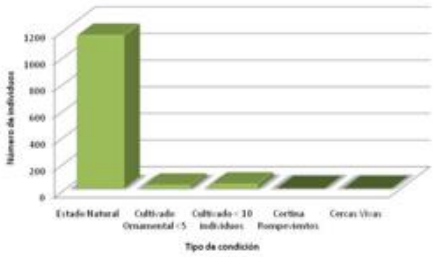


Figure 32. Distribution map of individuals of *Dalbergia retusa* Hemsl., in Costa Rica. 2010.
Prepared by: H. Viquez, D. Rivera and C. Alvarez. Photography on VEGAE Environmental Consulting map.



2

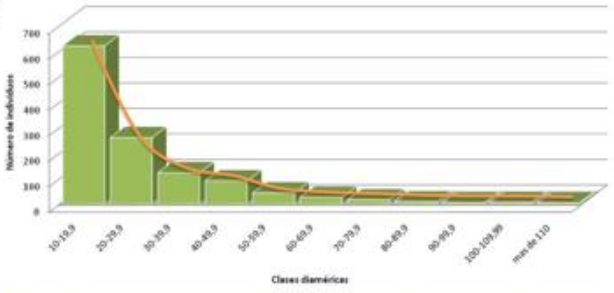


Figure 40. Distribution in diameter classes of individuals of *Dalbergia retusa* Hemsl., for Costa Rica. 2010.

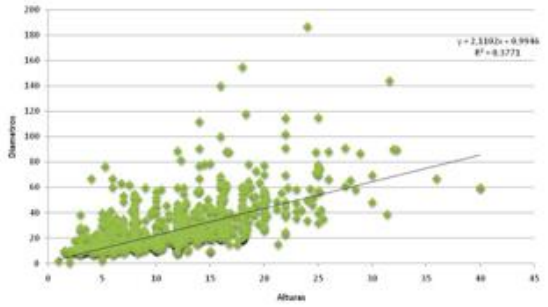


Figure 42. Relationship between height and diameter for individuals of *Dalbergia retusa* Hemsl., for Costa Rica. 2010.

3

Figure 45. Location map of different life stages of *Dalbergia retusa* Hemsl., in Costa Rica. 2010.
Prepared by: H. Viquez, D. Rivera and C. Alvarez. Photographs on map of VEGAE Environmental Consulting

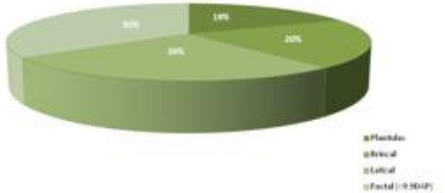


Figure 43. Percentages of regeneration of *Dalbergia retusa* Hemsl., for Costa Rica. 2010.

Theme two: Collecting historical and current species-specific levels and patterns of harvest and mortality: Benin, Sierra Leone and *Pterocarpus erinaceus,* Costa Rica and *Dalbergia retusa*

Four NDFs used approaches other than, or in addition to, CITES trade data when determining use and/or trade in the species.

Benin used official authorisation and harvest data from forestry administration annual reports, in addition to export data from a port, to identify trends in exports of *P. erinaceus*.

Sierra Leone used data collected from interviews/observations in each Chiefdom inventoried to document patterns of harvest and local/international use of *P. erinaceus*. Whilst their methodology in collecting this data was not provided in detail within the NDF, these data are important factors to be considered when formulating harvest quotas.

A survey on harvest and trade of *D. retusa* by **Costa Rica** available in the CITES NDF database used data on permits for harvest of the species, and interviews with local traders, to better understand patterns of use and trade in the species. These qualitative data from interviews helped to inform trade dynamics such as popularity of the species and origin of the wood/timber used in craft production, which were used to inform recommendations arising from the study.

Panama used a combination of CITES export data and evidence from a report that compiled seizure data from online media reports for *D. retusa* between 2011-2018 to conclude that illegal trade and harvesting of the species continues and that legal trade was reported in most years from 2012-2021. They also presented further evidence of more recent media reports of seizures in *D. retusa* since 2018. They stated these data show that there is evident demand for the species. Due to slow growth and regeneration rates for the species, its' national status as endangered, and a lack of plantations (meaning all exports are wild sourced), the authors concluded that the NDF is negative, and trade should be suspended in the short term.

These approaches highlight the use of both qualitative and quantitative data sources, as well as data from open-source media where government seizure data may be lacking, to understand patterns of harvest and trade in CITES-listed rosewood tree species.

NDF: *Pterocarpus erinaceus* in Benin

Link: https://www.cites-tsp.org/sites/default/files/project_files/202301/Doc_ACNP_PErinaceus_Benin_02092022.pdf

Benin compares data from the official authorisation/exploitation of the tree to export data from forestry administration annual reports in feet (see 'Nombre de pieds autorisés/exploités' in table below), with volume equivalents in metres cubed for official quantities of the timber exploited (see Exploitation m^3) to volumes in metres cubed reported in export data from the Autonomous Port of Cotonou between 2013 and 2016 (see Exportation m^3). They point out quantities from both have declined over the same time period. They point out the larger quantity exported than in official exploitation data is in part due to the re-export of timber from neighbouring countries Togo and Nigeria, but that there could also be clandestine exploitation not captured by forestry administration data.

Année	**Nombre de pieds autorisés**	**Nombre de pieds exploités**	**Exploitation (m^3)**	**Exportation (m^3)**
2013	682	682	7132	104.928
2014	655	655	5550	39.146
2015	505	505	3798.9	28.866
2016	172	172	3799	16.287
2017	-	-	-	22.996

(Draft) NDF: *Pterocarpus erinaceus* in Sierre Leone

Link: https://cites.org/sites/default/files/documents/E-PC26-16-04_0.pdf

To better understand use patterns specific to each Chiefdom where the species occurs, the researchers documented any use of wastage generated during processing of the tree by local communities, as well as noting use for charcoal production. They carried out a questionnaire survey that generated other socio-economic data, but do not detail questions included within the survey.

The researchers produced a summary document for each district (see below) concerning use of various parts of the tree (see example for one district below). There is not further detail in the methdology to inform how % off takes were determined.

Table 5.1.2 Summary of Harvest Regime for *Pterocarpus erinaceus* in the Kono District.

Species: *PTEROCARPUS ERINACEUS*	**Country (if applicable State or Province): SIERRA LEONE, EASTERN PROVINCE, KONO DISTRICT**
Date (of making Non-Detriment Finding): JUNE 2022	**Period to be covered by the finding: JUNE 2022 – MAY 2027**
Name: DR ABDUL BABATUNDE KARIM	**Position in Scientific Authority: HEAD**
Is the species endemic, found in a few countries only, or widespread? WIDESPREAD IN WEST AFRICA	
Conservation status of the species (if known): IUCN Global status:___ENDANGERED_____National status:__CITES APPENDIX II SPECIES___Other.....	

Type of harvest	Main Product	Degree of Control	Demographic segment of population harvested			Relative level of off-take (include number or quantity if known)				Reason for off-take and percentage (if known)			Commercial destination and percentage (if known)		
			Immature	Mature	Sex	Low	Medium	High	unknown	Subsistence	Commercial	Others	Local	National	International
1.1 Artificial propagation	*P. erinaceus*	Regulated													
		Unregulated													
1,2 Non-lethal harvesting of fruits/flowers/seeds/ leaves	*P. erinaceus*	Regulated													
		Unregulated		✓	na	✓				20%	5%			✓	✓
1.3 Non-lethal harvesting of bark/roots/ wood	*P. erinaceus*	Regulated	✓	✓											
		Unregulated		✓	na	✓			✓	10%	15%		✓	✓	
1.4 Removal of whole plant	*P. erinaceus*	Regulated		✓	na			✓			75%				✓
		Unregulated		✓	na		✓			5%	15%	10%	✓	✓	✓
1.5 Removal of whole bulb	*P. erinaceus*	Regulated													
		Unregulated													
1.6 Killing of individual by removal of seeds, leaves, bark, roots, wood	*P. erinaceus*	Regulated													
		Unregulated	✓	✓	na				✓	10%	0%		✓	✓	

Impact on NDF opinion: Whilst it is not clear from this (draft) NDF if this influenced positive or negative NDF decisions for Chiefdoms within the district, this data may be of use when determining harvest quotas for those with positive NDFs.

NDF: *Dalbergia retusa* in Costa Rica (note; this is a population status and trade study produced prior to the species' listing in Appendix II but is now in the CITES NDF database and has useful approaches to highlight)

Link:
https://cites.org/sites/default/files/ndf_material/INFORME%20FINAL%20Estado%20Poblacional%20y%20Comercio%20de%20Cedrela%20odorata%20y%20Dalbergia%20restusa%2C%20%20para%20CR%202010.pdf

To better understand trade in the species in Costa Rica, the researchers combined data from two main sources: data on permits issued and interviews with local artisans. See summary below

Source	Findings
Data on permits issued for felling of the species from a national database (limited to data from 2006-2007 only)	Only three permits were issued for felling of the species between 2006-2007 totalling 4 trees with a volume of 5 m^3
Interviews with 20 nationally renowned artisans, as the species is known to be used mainly for production of crafts	Around 69% of those interviewed stated they do not sell crafts from the species. Around a third (31%) stated they do not use the wood due to difficulties in obtaining it, with one group of artisans stating they had previously worked exclusively with the species but had to close their workshop and pursue other avenues due to scarcity and high prices for timber. Almost all interviewees (94%) stated the timber was sourced not from Costa Rica but from Nicaragua (illegally), and most reported that timber used comes from sources stored for many years as most timber from Nicaragua is now exported to China with less available for use (e.g nationaly or regionally). All interviewees stated the wood/timber is now difficult to obtain, with all stating they avoided it due to illegality. All also stated there is no market for the species, with no production systems established and slow growth, combined with the issue that it is very expensive to obtain, making it difficult to reach prices with adequate returns in national markets. In addition, they did not have the appropriate tools given how hard the wood is to work.

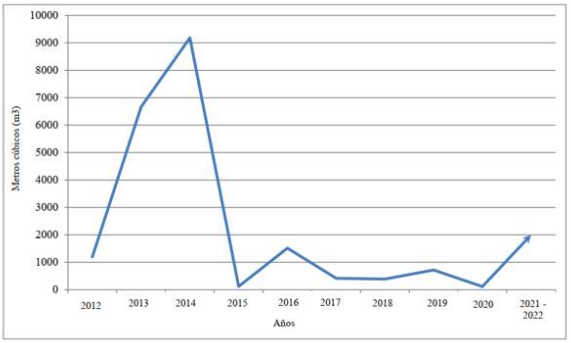
Impact on conclusions of study

The authors conclude that the species is not threatened by national or international trade but that better controls are needed to reduce illegal cross-border movement which may put populations in neighbouring countries at risk. They also recommend a need for a national registry of the origin of wood used nationally to establish the origin of extraction. Given a lack of species specific data on the national permit database prior to 2006, they also recommend a need to systemise national monitoring mechanisms to enable knowledge on the species harvested through exploitation permits.

NDF: *Dalbergia retusa* in Panama

Link: https://cites.org/sites/default/files/documents/E-PC26-16-02_1.pdf

Panama compiles CITES Trade data for the species in exports from 2012-2021 (graph below), with a summary of findings from a study of seizures from media reports between 2011-2018 (see top right below) and recent evidence of seizures for the species from media reports (see bottom right below) to evaluate legal and illegal trade in the species.



ILLEGAL TRAFFICKING FROM 2011-2018

During the period from 2011 to 2018, an analysis was carried out by Ella Vardeman and Julie Velásquez Runk on the status of illegal captures of *Dalbergia retusa* . In Panama. This document was based on national and international newspapers and news reports, which provided information on cocobolo captures, where most of these occurred in the provinces of Darién, Los Santos, Panama and the Emberá-Wounan region. This report indicates that the extraction was carried out mainly in the dry season, and also began in the central provinces and ended in Darién. Additionally, it is noted that the majority of the arrests were made in 2015, prior to the national elections.

Current situation

In the newspaper DIA A DIA, on October 24, 2018, the following news appeared: "More than 8 thousand cubic feet of cocobolo wood have been seized in Panama this year; But since saving this product is not an option, yesterday the Minister of Environment indicated that a program is being implemented to donate seized wood resulting from illegal logging to the Penitentiary System, since previously it was auctioned and returned to the market."

Impact on NDF opinion: The authors state that there is a high volume of international trade in the species (both legal and illegal) from Panama. They combine this data with evidence of slow growth rates and regeneration times, alongside its' current national assessment as endangered, to determine that a negative NDF decision is required as a short term precautionary measure for the species

Theme three: Calculation of recovery rates and establishment of harvest quotas: Côte d'Ivoire, Mali, Ghana and *Pterocarpus erinaceus*

As mentioned in the section on forest inventory protocols and determination of population structures: , the approaches taken by **Côte d'Ivoire** and **Mali** when collecting data to calculate harvest quotas differ: Côte d'Ivoire sampled five sites of the national population of the species, while Mali focused on forest concessions.

Both **Mali** and **Côte d'Ivoire** used the same formula from a forest management study in Eastern Cameroon (Madron, 1997, referred to by Module 10 on NDFs for timber-producing trees) to identify recovery rates for the populations of *P. erinaceus* inventoried. Both Parties also used similar values for mortality rate (set at 1% across all diameter classes), rate of logging damage (7% of the residual stand), and growth rate of the species (0.4 cm a year) in their calculations but differed on minimum felling diameters used (30-40 cm by Côte d'Ivoire and 50-65 cm by Mali) and rotation periods (25 years by Côte d'Ivoire and 12.5 years by Mali). Whilst it is not clear where either Party retrieved data on mortality, rate of logging damage, or growth rates for the species from, they are the same as those used in a 2008 NDF for *Pericopsis elata* in Cameroon (Betti, 2008).

A different approach is taken by **Ghana**; in their NDF, they didn't attempt to calculate the recovery rate for the populatons inventoried due to data on key parameters such as growth rate, recruitment, and mortality rates not being available for forest management units. Ghana didn't use estimates/proxy data for these parameters (which appears to have been the approach by Mali and Côte d'Ivoire**)**.

Ghana instead chose to formulate conservative/precautionary felling quotas based on felling cycles of 50 years, with minimum felling diameters of 20 cm DBH.

NDF: *Pterocarpus erinaceus* in Côte d'Ivoire

Link: https://cites-tsp.org/sites/default/files/project_files/2023-01/ACNP-CITES_2022-Bois_de_vene_vf_compressed.pdf

Calculation of regeneration (or recovery capacity)

The authors used data from five sites inventoried in 2021 to calculate recovery rates, using a formula derived from the literature:

$$\% Re = 100 [No (1- \Delta) (1- \alpha)] T/Np$$

Where:

Re = Percentage of recovery of the number of exploited stems

No = the number of individuals likely to pass to the minimum exploitable diameter after the rotation period, with an estimating annual diameter increase of 0.4 cm

Δ = The rate of logging damage (set at 7% of the residual stand)

α = is the mortality rate (ideally calculated according to each diameter class, but in this study set at 1% for all diameter classes combined

T = the rotation period, e.g., the space of time between two successive harvests in the same place. The researchers state this is generally 30 years for permanent domain forests and 25 years for community forests

Np = the initial number of exploitable species (e.g., in this case, the number of individuals between 30-40 cm DBH)

Establishment of harvest quotas

The authors do not detail the calculations made at each step to reach annual harvest quotas detailed below, but use data on regeneration rates ('D') alongside data obtained during forest inventories in each site to determine annual harvest quotas of ~177 stems for a minimum exploitable diameter (DME) of 30 cm and ~ 56 exploitable stems for a DME set at 40 cm. These data were calculated based on rotations of 25 years.

Table XI.Summary of the annual exploitation quota calculation and the characteristics of the population ofP. erinaceusaccording to the development diameter in five inventoried sites

Area	DME (cm)	D (%)	Nts	Ntes	Nt	Nte	PAT	QAE
BONDOUKOU	30	325.52	326	6	16091.36	296.16	643.65	11.85
	40	144.67	326	2	16091.36	98.72	643.65	3.95
DIMBOKRO	30	235.10	98	8	4711.84	384.64	188.47	15.39
	40	72.34	98	5	4711.84	240.4	188.47	9.62
KATIOLA	30	125.80	112	25	5600	1250	224.00	50.00
	40	343.60	112	6	5600	300	224.00	12.00
KORHOGO	30	69.56	55	34	2668.6	1649.68	106.74	65.99
	40	136.64	55	9	2668.6	436.68	106.74	17.47
SEGUELA	30	106.60	67	18	3173.12	852.48	126.92	34.10
	40	99.46	67	7	3173.12	331.52	126.92	13.26
Total/average	30	172.51	658	91	32244.92	4432.96	1289.80	177.32
	40	159.34	131.6	5.8	6448.984	281,464	257.96	56.29

DMA:Minimum usable diameter;D :Replenishment rate;Nts:Total workforce united;Ntes:Total exploitable workforce surveyed;Nt:Total workforce Nte:Total exploitable workforce;PAT:Total annual potential;QAE:Annual quota of exploitable stems.

Impact on NDF opinion: The authors conclude that there is potential for harvest of the species with satisfactory recovery rates but point out these data are based on 5 sites only, with a 2% coverage rate of each site, which cannot be extrapolated nationally. They state a more in-depth study of the national population status would be necessary prior to authorising exploitation, with a maintenance of a zero-export quota until this is conducted.

NDF: *Pterocarpus erinaceus* in Mali

Link: https://cites.org/sites/default/files/documents/E-PC26-16-04_0.pdf

Identification of minimum felling diameters

The authors of the NDF note the minimum regular fruiting diameter for the species ins around 25 cm, with the current minimum felling diameter in Mali of 25 cm for a rotation varying from 6-10 years. They point out this does not allow sufficient time for regeneration of the species after exploitation, so state the quotas will be calculated based on rotation times of 12.5 years and minimum felling diameters of above 50 cm. The exploitable stems are defined as those with diameters of above 50 cm, and those in the three diameter classes above this, with those of larger sizes than this not exploited to retain seed carriers

Calculation of regeneration (or recovery capacity)

The authors used the same formula as that used by Côte d'Ivoire

$$\% Re = 100 [No (1- \Delta) (1- \alpha)] T/Np$$

Where:

Re = Percentage of recovery of the number of exploited stems

No = the number of individuals below the minimum exploitable diameter and likely to pass to the minimum exploitable diameter after the rotation period, with an estimated annual diameter increase of 0.4 cm

Δ = The rate of logging damage (set at 7% of the residual stand)

α = is the mortality rate (1% for all diameters combined, the same as Côte d'Ivoire, although the authors note it is higher in young stems than old stems)

T = the rotation period, e.g., the space of time between two successive harvests in the same place. The researchers state this varies between 25-30 years for Congo Basin countries

Np = the initial number of exploitable species (e.g., in this case, the number of individuals of 50cm DBH, and in the three subsequent DBH classes above this)

Establishment of harvest quotas

The authors of the NDF supply an excel document that states the recovery rate for each forest massif. Only forests with recovery rates of greater than 50% after the second rotation will be retained for harvest of the species. To convert harvested volumes from the exploitable diameter classes in each forest massif, they use a conversion factor of one foot of timber to 0.72 m^3, using conversion factors from a global rate (the reference could not be found for this source). They also account for average yields of 80% from the harvestable timber into planks for export based on statements from dealers of the species in field visits.

They calculate that a total of 103 out of 148 forest masifs can be reconstituted at rates of over 50% after the 12.5 year rotation time, with a total harvestable volume of 65,302 m^3, and a total subsequent log export quota of 55,384 m^3 proposed from these forests. Some minimum export diameters have been increased to 65 cm in some forest masifs, assumedly to allow for adequate recovery percentages; this was an approach taken in an NDF for *Pericopsis elata* in Cameroon (Betti, 2008) (see p. 24 in https://cites.org/sites/default/files/ndf_material/WG1-CS2.pdf)

Impact on NDF opinion: The authors have submitted these proposed export quotas to CITES, and recommend these annual quotas are maintained, with rotation times of at least 12.5 years, and minimum felling diameters assigned, in each forest massif, adhered to. They also recommend conducting tree studies to better refine the development of parameters used in the study, and to monitor the effective implementation of management plans

NDF: *Pterocarpus erinaceus* in Ghana

Link: https://cites.org/sites/default/files/documents/E-SC77-Inf-06.pdf

Identification of minimum felling diameters

The authors of the NDF note minimum felling diameter is 20 cm DBH, but do not elaborate further on the rationale and scientific basis for this diameter

Establishment of harvest quotas

The authors calculate the total number of stems in each political district of Ghana based on inventory data across 26 forest districts. They use a formula to convert the stems into corresponding volumes based on their DBH:

$V= 0.0004634(d^{2.201})$ Where: V= tree volume, d= diameter at breast height

These calculations are made based on 40% of the populations of trees above 20 cm DBH (the minimum felling diameter), with 40% maintained for the purposes of conservation, destructions caused by wildfire, clearance for farming and domestic use, and 20% solely for use in charcoal production, with consideration given to the impact of the rosewood harvest bans on this previously.

They state that harvest quotas for each political district (derived from inventory data from forest districts) are based on several considerations, but do not explicitly state the calculations used to determine the harvest quotas. They give varying harvest quotas per district for felling cycles of 30 years (~38,680 m^3), 40 years (~29,010 m^3) and 50 years (~23,208 m^3). The harvest quotas are also based on off-reserve areas, with harvest not applicable to populations occurring in over 80 forest reserves and national parks.

The authors also estimate the volume of rosewood from submerged trees in the Volta Lake in Ghana, which is a unique situation given that they (alongside other submerged tree species) have been identified as a hazard and have been recommended to be removed as part of the management plan for the lake. There is a proposed annual felling quota of 40,000m^3 over a 16-year period (e.g., until stocks are depleted) for this population.

Impact on NDF opinion: The authors state they will use a precautionary approach given a lack of data on factors such as mortality rates, recruitment, and growth rates for the species, and elect to use the conservative 50-year felling cycle with a proposed (national) annual felling quota of 23,207.97m^3 based on a sum of harvest quotas for each political district. There is a separate annual export quota of 40,000m^3 over a 16 year period (e.g. until stocks are depleted) for submerged stocks under Lake Volta.

They provide in an Annex annual felling quotas for each district and also recommend a need for permanent sample plots of the species to be established in the savannah environment to gain a better understanding of missing population dynamics such as recruitment, mortality and growth, which can enable an informed review of current conservative harvest quotas in the future.

Theme four: Forest management plans: Benin, Côte d'Ivoire, Sierra Leone and *Pterocarpus erinaceus,* Viet Nam and *Dalbergia cochinchinensis* and *Dalbergia oliveri*

Module 10 on NDFs for tree species identifies some key elements of a forest management plan adapted from FAO (1998). One of these is a need for long term management objectives broken down into specific prescriptions and measures required to achieve these objectives.

Benin and **Côte d'Ivoire** have documents with detailed management plans available on the CTSP platform, which are additional to simpler management plans outlined in their NDFs (see case studies below for links to both). Management plans for both Parties included long-term objectives broken down into multiple activities which include time frames, actors responsible, and budgets. Côte d'Ivoire also prioritised actions, with some categorised as necessary for the completion of the management plans, and others as 'ideal', or only to be carried out if means and opportunities arose. Both management plans designate roles for different habitats or land types; for example, Benin prioritised protection in areas where the species plays an important ecological role, and restoration in other habitats, whilst Côte d'Ivoire designated nature parks and reserves for protection only, and rural estates for

'rational use', whilst classified forests were designated for both protection and rational use. **Viet Nam** also provided a detailed action plan with long term goals broken down into smaller objectives to reach each goal. For each objective there were a variety of activities required outlined with timelines for completion.

Benin and refered to a need for sampling plots/reference populations that can be used for long-term monitoring to inform upon key ecological characteristics for the species, such as growth rates, to provide a more scientific basis for factors such as minimum felling diameters. **Côte d'Ivoire** also recommended the need for a study to determine minimum felling diameters/minimum diameters of regular fruiting. The need for permanenent sampling/reference plots was also stated by **Ghana** and **Mali** in the context of a need for more accurate calculation of recovery rates for populations.

NDF: *Pterocarpus erinaceus* in Benin

Link: https://www.cites-tsp.org/sites/default/files/project_files/2023 01/Doc_ACNP_PErinaceus_Benin_02092022.pdf (NDF) and https://www.cites-tsp.org/sites/default/files/project_files/2023-01/Doc_plan_de_gestion_Benin_02092022.pdf (management plan)

Assessment of the forest resource

The NDF first concludes that a zero-export quota and a ban on exploitation of the species must be maintained in Benin, with conservation measures maintained to protect and restore populations of the species. This is based in part on inventory data for the species in the area sampled showing low average densities and basal area, and a rarity of individuals with diameters greater than 20 cm DBH. They state this must remain in place until a new assessment of the species is undertaken to assess the impact of actions recommended in the NDF and management document.

Long term management objectives

The overall vision in the management proposal is that 'By 2032, *P. erinaceus* is managed sustainably with the effective participation of organised communities'. The authors of the NDF state there is a need to focus on the protection of certain sites and intensive restoration of degraded populations. They state that the species is of higher ecological importance in light forest and wooded savannah, which can be prioritised for protection of the species, whereas in other habitats of shrub savannah and gallery forest, intensive ecological restoration should be prioritised with assisted regeneration/enrichment techniques.

The authors state there is a need for the involvement of local communities with significant ethnobotanical knowledge to be included in these conservation initiatives, with training on restoration and conservation techniques for both local communities and water, forestry and hunting officials. They also state a need to identify reference populations that can be utilised for long term ecological monitoring of populations to enable a more scientific basis for information such as minimum exploitable diameters. They suggest transplantation of plants from areas with strong natural regeneration to degraded areas, and university research into propogative techniques for the species.

Lastly the authors state that the inventory currently conducted in one area could be extended with the facilitation of forest inventory operations underway in classified forests of Benin, with extraction of data for *P. erinaceus* from national inventory plots to map the distribution of the species. This can be used to estimate density in each area and can be used in long term monitoring.

The authors go on to outline three strategic directions required to fulfil these goals, which include

1) Improving knowledge on the ecological, genetic, economic potential, silviculture and population dynamics of the species in Benin
2) Ecological restoration of the species in its habitat
3) Strengthening the capacities of stakeholders for the conservation and sustainable management of *P. erinaceus* and other valuable species threatened with extinction in Benin.

Specific prescriptions and measures

In a separate document, a detailed ten-year action plan for the years 2022-2032 is outlined, with activities, expected results, success indicators, stakeholders in charge and involved, time frames and budgets for each strategic direction (see example from table in figure below). The authors state there is a need to seek funding to achieve these goals, with the harvest and export of fast-growing species such as the baobab a potential opportunity for the generation of financial resources to enable conservation of species such as *P. erinaceus* that are threatened with extinction.

Table 4. Logical framework of a project for the conservation and sustainable management of *P. erinaceus* in Benin

Activities	Expected results	Indicators	Sources of verification	Managers	Partners	Period of Implementation	Estimated budget (FCFA)
Strategic axis 1: Improvement of knowledge on the ecological, genetic and economic potential, silviculture and the dynamics of populations of *P. erinaceus* At Benign							
A1. Carry out/update the forest inventory national in order to estimate the potential of *P. erinaceus*	**RA1.1.** THE data ecological updated are available on the species in Benin **RA1.2.** The potential availability (occurrence, volume, abundance) of *P. erinaceus* is known **RA1.3.** The data ecological and the potential of other valuable species is known	- Number of plots - Updated map potentialities of the species	- List of contact details of plot centers - Study reports / collection mission - Database	MCVDD/DGEFC	Universities / Laboratories	2022-2024	500 million
A2. Follow the dynamics of natural populations of the species (collection regular data within permanent plots, remote sensing)	**RA2.1.** Stands reference points are identified with the participation of local communities **RA2.2.** A network of permanent data collection units is installed and monitored in reference populations nationally. **RA2.3.** A system of information ecological and national forester on the species is established	- Cards of distribution of stands - Number of plots permanent	- Study reports - Database - Contact details plots permanent - Field reports / collection mission	MCVDD/DGEFC	- Universities / Laboratories - Communities local	2022-2032	100 million

NDF: *Pterocarpus erinaceus* in Côte d'Ivoire

Link: https://cites-tsp.org/sites/default/files/project_files/2023-01/ACNP-CITES_2022-Bois_de_vene_vf_compressed.pdf (NDF) and https://cites-tsp.org/sites/default/files/project_files/2023-01/Plan_Simple_de_Gestion_Pericopsis_Elata_version_Juin_2022.pdf (management plan)

Assessment of the forest resource

The NDF first concludes that a zero-export quota for the species must be maintained for the species in Côte d'Ivoire at present as a precautionary approach, given the low national coverage (an estimate 2% of the species distribution area) covered in the current inventory. They point out there is a need for a more complete inventory to be conducted, in addition to the study of growth rates and determination of minimum fruiting and exploitable diameters to better determine recovery rates. They also state there is a need to strengthen mechanisms for the application of regulations.

Long term management objectives

The authors of the NDF begin by stating their management strategy must consider rational use of resources, e.g that they cannot be protected to the detriment of local communities. They use inventory data to designate three zones where the species occurs: classified forests (66% of the population inventoried), rural estate (28%) and national parks (6%). Activities in each zone will differ with consideration given to both species conservation and interests of local communities

- Zone 1: classified forests; The heritage value of these forests is less strong, and various anthropogenic activites (e.g agriculture and livestock breeding) take place there. Although conservation issues are not a priority in these forests, the management plan should still aim to protect the natural populations of the species in these areas
- Zone 2: national parks: there is a strong heritage value in national parks, with conservation issues a priority. The management principle in these (and also in one nature reserve) is to contain any activity which could impact upon their habitats
- Zone 3: rural estate: This is where development activities may occur, but these should be based on agro-ecological approaches, with clear guidelines for the roles of all relevant stakeholders

Zones 2 (and partially zone 1) are priority areas for preservation, whereas zones 3 and 1 are areas for rational use.

The authors go on to outline five long term objectives required for these purposes, which include

a) Strengthening legal capacities (e.g consultations with all stakeholders to raise awareness of relevant regulations)
b) Strengthening capacities of stakeholders to ensure they have relevant technical and scientific knowledge
c) Development of conservation and security activities to protect populations
d) Promote rational management approaches with development of an integrated management approach that accounts for activities such as hunting, agriculture and livestock, and creation of incentives (such as a 'deposit') for the reforestation of 20,000 hectares of the species
e) Contribution to relevant regional and national development

Specific prescriptions and measures

In a separate document, the action plan it outlined in a table with the two general orientations identified in the long term plan (e.g preservation and rational use), which are broken down into the five long term objectives. Each long-term objective is broken down into operational goals and actionable activities. The table details actors involved for each activity, and deliverables/success indicators (see 1 in Figure below). Activities are prioritised as follows:

Priority 1+ = Operation to be carried out quickly because it is a pre-requisite to carrying out "priority 1" operations within the management plan (e.g. the development of protocols for collecting, processing data and monitoring populations)

- Priority 1= Operation that needs to be carried out as part of the management plan (e.g study on the determinations of the minimum exploitable diameter)

- Priority 2 = Operation that it would be ideal to carry out as part of the management plan (e.g training of ecoguards in methods of controlling and monitoring biodiversity in collaboration with managers, MINEF agents and NGOs)

- Priority 3 = Non-priority operation, to be carried out depending on means and opportunities (e.g introduction to in vitro culture)

1

ACTION PLAN MATRIX

Objectives to Long term	Influencing factors management	Goals operational	Results	Operations/Activity	Priority	Actors concerned	Deliverables and Indicators
General Orientation 1: Preservation of populations ofP. erinaceusand natural ecosystems							
OLT 1: Strengthen the abilities legal conservation and of use sustainableP. erinaceus	-Illiteracy -Failure to mobilize key players -The ignorance of the exhaustion of natural resources -Ignorance of the law	OO 1: Adapt the framework legal management requirements of conservation and of use sustainable resources natural	R1: Texts legal specific to setting work of the CITES available	Op 1:Adoption of the CITES implementing law and its regulatory texts	1+	National Committee and Authority scientist CITES, Equipped with Management. Ministries techniques, Managers areas of the area of distribution ofP. erinaceus, populations local; NGO	• Reports of monitoring and of inventories periodicals; • Translated texts • Attendance lists • Number of participants • Frequency of meetings
		OO 2: Popularize it forest code and his texts regulatory and train the actors on the related themes with CITES	R2: Texts legal relating to the forestry and CITES known and applied by all the categories of actors	Op 2:Sensi mobilization and strengthening abilities of the different categories of development actors on the application texts	1		
				Op 3:Translation of main texts into local languages	2		
				Op 4:Printing and popularization of legal texts	1		

2

Action planning

Long Goals Term	Operational objectives	Operations	Priority	Years									
				2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
OLT 1: Strengthen the abilities legal conservation and of use sustainableP. erinaceus	OO 1: Adapt the legal management framework to the requirements of conservation and durable use Resource natural	Op 1:Adoption of the CITES implementing law and its texts regulatory	1+	■	■								
	OO 2: Popularize the forest code and its regulatory texts and train stakeholders on themes related to CITES	Op 2:Raising awareness and strengthening the capacities of different categories of development actors on the application of texts	1	■	■	■							
		Op 3:Translation of main texts into local languages	2	■	■								
		Op 4:Printing and popularization of legal texts	1	■	■								
OLT 2: Strengthen the abilities institutional and techniques of parts stakeholders	OO 3: Strengthen technical capacities, scientists and institutional stakeholders in a partnership framework	Op 5:Creation and support for the functioning of village associations for sustainable management	2	■	■	■	■	■	■	■	■	■	■
		Op 6:Organization of periodic consultation meetings between management team and key players at local level	1	■	■	■	■	■	■	■	■	■	■
		Op 7:Definition and updating of animal transhumance routes with MIRAH	1	■		■		■		■		■	
		Op 8:Identification and geolocation of mining concessions	2	■		■		■		■		■	

3

Objectives to Long term	Operational objectives	Operations (Activities)	Priority	Estimated budget (in millions of CFA francs)									
				2023	2024	2025	2026	2027	2028	2029	20230	2031	2032	TOTAL
OLT 1: Strengthen the abilities legal conservation and of use sustainableP. erinaceus	OO 1: Adapt the legal management framework to the requirements of conservation and sustainable use of natural resources	Op 1:Adoption of the CITES implementing law and its regulatory texts	1+	10.0	10.0									20.0
	OO 2: Popularize the forest code and its texts regulations and train stakeholders on themes related to CITES	Op 2:Raising awareness and training of different categories of development actors on the application of texts	1	5.0	5.0	3.0								13.0
		Op 3:Translation of main texts into local languages	2	2.0	2.0									4.0
		Op 4:Printing and popularization of legal texts	1	5.0	5.0									10.0
OLT 2: Strengthen the abilities institutional and techniques Parties stakeholders	OO 3: Strengthen technical capacities, scientists and institutional arrangements of stakeholders in a partnership framework	Op 5:Creation and support for the functioning of village associations for sustainable management	2	3.0	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	23.0
		Op 6:Organization of periodic consultation meetings between management team and key players at local level	1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	10.0

NDF: *Pterocarpus erinaceus* in Sierra Leone

Link: https://cites.org/sites/default/files/documents/E-PC26-16-04_0.pdf

Assessment of the forest resource

The authors summarise data on regeneration capacity (e.g. coppicing stumps, number of seedling and saplings and population structures) and the number of exploitable individuals (e.g those with DBH greater than 30 cm) for 53 Chiefdoms. They conclude that 22 (41.5%) of the 53 chiefdoms can be given a positive NDFs status and state that no commercial harvesting should be allowed in Chiefdoms with negative NDFs over the next ten years to allow for regeneration of the populations. This is at present a draft NDF and the authors do not state harvest quotas for each Chiefdom.

Long term management objectives

The authors of the NDF do not detail management plans according to specific time frames and budgets, but list several measures in place for the species in Sierra Leone

- Appointment of a 'Sole Timber Export Agent' in 2018, responsible for facilitation of all timber exportation. They state this has had positive results with a well coordinated structure involving different stakeholders to prevent illegal trade along supply chains
- Nationwide bans on logging and timber transport for five months during the rainy season
- Restoration of degraded forest landscapes through a government-funded national tree planting project, which aims to increase forest cover by planting five million seedlings including *P. erinaceus* as a priority species
- Current stakeholder discussions to develop and implement a traceability system for timber export; for *P. erinaceus* specifically, this includes assessments of technological requirements, establishment of compliance standards, and the establishment of a national committee to implement the mechanisms with members from universities, other scientific communities with expertise in timber trade, and relevant environmental NGOs
- Local authorities in regions where the species is present are also encouraged to develop and enforce bylaws to control and reduce occurrences of wildfires

NDF: *Pterocarpus erinaceus* in Ghana

Link: https://cites.org/sites/default/files/documents/E-SC77-Inf-06.pdf

Assessment of the forest resource

The NDF shows regeneration stock (indicated by the number of stems between 10-19.9 cm DBH) across most forest districts inventoried is good based on data from forest concessionaries but concludes that they will use a precautionary approach given a lack of data on factors such as mortality rates, recruitment, and growth rates for the species. They elect to allow export of the species (40% of the population above exploitable diameters of 20cm DBH), but use a conservative 50-year felling cycle with an annual (national) felling quota of around 23,200m^3 from 26 forest districts, with a separate annual felling quota of 40,000m^3 over a 16 year period (e.g. until stocks are depleted) for submerged stocks of the species under Lake Volta.

Long term management objectives

The authors of the NDF do not detail management plans according to specific time frames and budgets, but list several actions required – alongside adherence to the felling quotas outlined in the NDF- to ensure sustainable management of the species in Ghana, with most detailing actors responsible:

- Use of a surveillance and tracking system to be put in place by the Forestry Commission at local and national levels to ensure adherence to annual felling quotas
- Establishment of additional permanent sample plots (with trials already started in three ecological zones across over 250 hectares) to study population dynamics (e,g recruitment, mortality and growth), and assess the feasibility of large-scale commercial plantations
- Increase the species population through extensive restoration programmes
- Felling quotas for each political district are to be administered by district offices of the Forest Services Division, and monitored by the Resource Management Support Centre (the organisation mandated to conduct population inventories for all species across Ghana and to implement and monitor effective forest management systems)
- Harvesting of the species to be integrated into existing wood tracking systems in Ghana, which has been put in place in collaboration with the EU for other species over the last five years
- Increase wildfire education /awareness-raising measures (e.g training of volunteer fire squads) to reduce their frequency and severity
- Promote the establishment of more efficient technologies for charcoal production, and alternative species that can be used, to meet the energy needs of local communities

Management plan: *Dalbergia oliveri and Dalbergia cochinchinensis* in Viet Nam

Link: https://cites-tsp.org/sites/default/files/project_files/2023-01/Vietname_Management-and-conservation-plan-April-2022.pdf

Assessment of the forest resource

The NDF concludes that due to sparse populations, and multiple threats facing both species, harvest and export would be detrimental to the species.

Long term management objectives

The authors first identify an overarching goal of 'Improved long-term management and conservation of *D. cochinchinensis* and *D. oliveri* through effective protection and restoration of the existing wild populations and afforestation of *D. cochinchinensis* and *D. oliveri* for the colonization in the historical distribution areas.'

This is broken down into seven objectives, each with outputs and detailed activities (see below). Final dates for activities to be completed are assigned according to urgency, with urgent from 2022-2027, medium-term from 2022 to 2030, and long term from 2022-2035.

A later section details actors responsible for broad themes within the management plan (for example, the Ministry of Agriculture and Rural Development (MARD) is responsible for directing and guiding localities to implement the plan for the management and conservation of *D. cochinchinensis, D. oliveri*, and other *Dalbergia* species in the whole country until 2035).

3.3. Specific objectives

1. Important wild populations of *D. cochinchinensis* and *D. oliveri* identified for appropriate management and protection measures by 2025.

Objective 1. Important wild populations of *D. cochinchinensis* and *D. oliveri* identified for appropriate management and protection measures by 2025.

Output 1.1. All potential distribution areas of *D. cochinchinensis* and *D. oliveri* surveyed.

- Activity 1.1.1. Conduct scoping visits to all potential distribution areas of *D. cochinchinensis* and *D. oliveri* to verify the existence of *D. cochinchinensis* and *D. oliveri* and identify key areas for further surveys before 2025.
- Activity 1.1.2. Design and carry out field surveys to stocktake important wild populations by measuring all identified trees with DBH greater than 10 cm and recording potential mother trees for providing seeds, and collecting information on threats and conservation practices by 2025.
- Activity 1.1.3. Produce maps of all important populations of *D. cochinchinensis* and *D. oliveri* in the wild by 2026.
- Activity 1.1.4. Digitize collected data and maps, and develop a database for long-term management and monitoring by 2026.

Output 1.2. Management and monitoring programs for key populations of *D. cochinchinensis* and *D. oliveri* developed and implemented.

- Activity 1.2.1. Develop management and monitoring programs for key populations of *D. cochinchinensis* and *D. oliveri* by 2026.
- Activity 1.2.2. Label, get GPS coordinates of and map all trees of *D. cochinchinensis* and *D. oliveri* with DBH from 20 cm in key populations for long-term management and monitoring.

Theme five: Collection of other data relevant to NDFs e.g national threats and species biology): Cambodia and *Dalbergia cochinchinensis/D.oliveri*, Costa Rica and *Dalbergia retusa*

When conducting their forest inventory, **Cambodia** also collected a wide range of data to inform not only upon evidence of illegal selective logging of *D. cochinchinensis* and *D.oliveri* in the area surveyed as part of their inventory, but also on biological factors relevant to NDFs

such as features of habitats in which the species occurs, and anecdotal evidence of reproduction and regenerative capacity. They used these data to inform upon their final NDF decision through a scoring system that collated the severity of impact of all factors relevant to NDFs, with the species scoring poorly on many biological factors.

In **Costa Rica**, the researchers also recorded observations on many relevant biological factors for *D.retusa* such as reproductive timing and evidence of regenerative techniques and requirements whilst completing their inventory. They also used GPS to map locations of individuals sampled and produce maps overlaying distribution areas with features such an average annual rainfall, forest type, and elevation, to better inform upon habitat specificity for the species.

Whilst these approaches are intensive in terms of time, capacity, and funding, they demonstrate that inventories can be an opportunity to advance understanding of not only use and harvest (e.g see case study section on historical and current species-specific levels and patterns of harvest and for Sierra Leone and Costa Rica), but also for collecting useful data on the biology of species nationally to better inform understanding of its adaptability, likely distribution range, localised threats, and reproductive patterns.

NDF: *Dalbergia oliveri and Dalbergia cochinchinensis* in Cambodia

Link: https://cites-tsp.org/sites/default/files/project_files/2023-01/CITES_KH_NDF_D_cochinchinensis_D_oliveri_20210923.pdf and detailed inventory method https://cites-tsp.org/sites/default/files/project_files/2023-01/CITES_KH_Systema_Inventory_D_Cochichinensis_D_Oliveri_Report_20210712.pdf

Whilst conducting their systematic survey for the NDF in 2020, researchers collected a wide range data on factors including

- **Threats in the survey area** (evidence of natural or human-induced disturbances)
- **Habitat specificity** (using statistical tests to assess factors that influence species occurrence including elevation, vegetation density, slope, and forest type)
- **Evidence of selective logging** (e.g based on any stumps from trees with larger diameters)
- **Fruiting and reproductive patterns** (using interviews with local communities in the areas where the tree grows)

Their results were used to identify

- **Threats;** for example, the researchers found that forest fires occur troughour the district sampled during the dry season. At least 60% of the 86 plots sampled were reported to be completely burned as a result of long droughts, with another 30% partially burned. They also noted there was clearing of forestland for agriculture and residential purposes
- **Habitat characteristics** for each; for example, *D. cochinchinensis* was found to occur mostly along streams and gentle slopes with well-drained soils at elevations > 70 m asl, in mixed deciduous or dry deciduous forests). The authors conclude from a range of data that both species appear to have relatively low adaptability in terms of habitat preference
- **Selective logging**; the researchers found that 45 out of 86 plots (52%) had been selectivity logged, although this data refers to all target species (e.g all high value timbers in the survey area). They note this also occurred in plots containing *D. cochinchinensis* however, with evidence that even remaining roots may eventually be harvested due to their high commercial value
- **Fruiting and reproductive patterns**; the authors noted that based on anecdotal evidence from local communities, it appears flowering of *D. cochinchinensis* could occur in early maturity (classified as individuals of 15-30 cm DBH) every year in natural forests in the study area, with regenerative capacity of seedlings grown from stumps good (e.g based on fast growth), whereas *D.oliveri* appear to flower and fruit only every other year after its' initial flowering period, with a low regenerative capacity

They use these data, alongside that from the 2020 inventory (see Forest inventory protocols and determination of size class distribution of trees) to complete the IUCN checklist for NDFs and assign scores to each category. This begins with selection of suitable criteria from a checklist for each parameter (see 1 in Figure below for an example related to species biology), with a more detailed justification of the selection of scores for each species (see 2), and a final summary of scores for all parameters (see 3)

Impact on NDF opinion: The authors note these data, alongside other data collected in the study on reproductive strategies and other threats to the species, indicate a 2014 suspension on exports of products from luxury grade timber species (including from *Dalbergia* species), should remain in place. They note both species generally score between 1-3 in most parameters, indicating a relative severity across all assessments relative to NDFs (see 3 in Figure below). This ban applies irrespective of whether the specimens are from artificial propagation or from natural forests.

Annex 1 - Guidelines for factors affecting management of the harvesting regime.

1

The NDF study on *D. cochinchinensis* and *D. oliveri* systematically followed the IUCN Checklist of NDFs (Rosser and Heywood, 2002). Most of the short descriptions of each parameter related to species characteristics that were used in the scoring system followed the Indonesian Guidelines for Non-Detrimental Finding Assessment of Ramin *Gonystylus* spp. (2010). Each parameter has a score from 1 (the lowest) to 5 (the highest).

Factor	Species Characteristics and status under study	Score	A	B
1. Biological Characteristics				
1.1 Adaptability: How is the adaptability of the species under study to the variety of habitats?	Easy to grow and adapt to all types of habitats and all types of forest succession	5		
	Easy to grow and adapt to some types of habitats and several types of forest succession	4		
	Relatively low adaptability, grows in certain habitats and certain succession types	3		*
	Grows only in certain habitat with high site requirements (edaphic, temperature, and elevation)	2	√	
	No information available related to adaptability	1		
1.2 Regeneration capacity: How is the regeneration capacity of the species?	Regeneration could be through vegetative propagation, fast	5		
	Regeneration could be through vegetative propagation, relatively slow	4		
	Regeneration relatively fast, with seed/stump	3	√	
	Regeneration slow, irregular, with seeds or stumps	2		*
	No information available on this aspect	1		
1.3 Dispersal efficiency: How efficient is the species' dispersal mechanism?	Very efficient: seed dispersed to distant area	5		
	Efficient: seeds dispersed to surrounding fruiting trees	4		
	Moderate: seeds dispersed under the fruiting tree	3		
	Bad: seeds undispersed due to natural barriers (i.e. ecological range, seed dispersers, water barrier, predation)	2	√	*
	Uncertain	1		
1.4 Habitat: What is the habitat preference of the species?	Shrub or disturbed open	5		
	Secondary forests	4		
	Logged-over area	3		
	Climax forest	2	√	*
	No information available	1		

2

A.1 Biological Characteristics

- Adaptability: *D. cochinchinensis* grows only in certain habitats with high site requirements (edaphic, temperature, and elevation) **(2)**, while *D. oliveri* has relatively low adaptability and grows in specific habitats and succession types **(3)**;
- Regeneration capacity: regeneration of *D. cochinchinensis* is relatively fast from seeds or stump **(3)**, while regeneration of *D. oliveri* is slow and irregular with seeds or stumps **(2)**;
- Dispersal efficiency: the seeds of both *Dalbergia* species are undispersed due to natural barriers (i.e., natural ranges, seed dispersers, water barriers, predation) **(2)**;
- Habitat: both *D. cochinchinensis* and *D. oliveri* prefer climax forests (undisturbed mature forests) to over logged-over areas or other types **(2)**.

Table 13. Parameter scores of *D. cochinchinensis* and *D. oliveri*.

3

No.	Factors	Parameters	Response (A)	Response (B)
1.1	Biology	Adaptability	2	3
1.2		Regeneration capacity	3	2
1.3		Dispersal efficiency	2	2
1.4		Habitat	2	2
2.1	Status	Distribution	2	3
2.2		District abundance	3	3
2.3		District population trend	2	2
2.4		Quality of information	4	4
2.5		Major threats	3	3
3.1	Management	Illegal harvest or trade	2	3
3.2		Management history	3	3
3.3		Management plan	3	3
3.4		Aim of harvest in management plan	3	3
3.5		Quotas or area to be harvested annually	1	1
4.1	Control	Harvest in authorized concessions	4	4
4.2		Harvest in conservation and Protected Areas	2	3
4.3		Harvest in Production Forests	2	2
4.4		Confidence in harvest management	2	2
5.1	Monitoring	Methods to monitor the harvest	2	2
5.2		Confidence in harvest monitoring	1	1
6.1	Logging Impact	Benefit to environment	3	3
6.2		Logging impact to environment damages	3	3
6.3		Environment recovery	2	2
7.1	Protection	Protection Percentage	1	1
7.2		Protection effectiveness	2	2
7.3		Harvest control	3	3

Note: A refers to *D. cochinchinensis* and B refers to *D. oliveri*.

NDF: *Dalbergia retusa* in Costa Rica (note; this is a population status and trade study produced prior to the species' listing in Appendix II but is now in the CITES NDF database and has useful approaches to highlight)

Link:
https://cites.org/sites/default/files/ndf_material/INFORME%20FINAL%20Estado%20Poblacional%20y%20Comercio%20de%20Cedrela%20odorata%20y%20Dalbergia%20restusa%2C%20%20para%20CR%202010.pdf

Whilst conducting their systematic survey for the 2010 study, researchers collected a wide range data on factors relating to biology of the species including

- **Geographical locations** using GPS (used in conjunction with digital databases to identify climatic factors such altitude, precipitation in areas the species was located)
- **Data on fruiting and reproductive patterns** (e.g presence of foliage or leaves, flowers, fruits, seeds and buds)
- **Other species associated** in a radius of 20 metres around individuals sampled (researchers randomly selected 25 individuals and used this to calculative relative frequency of appearance)

Their results were used to identify

- **Forest areas;** the researchers mapped the distribution according to different habitat types (see 1 in Figure below) and concluded the greatest presence of individuals was in the tropical dry forest, and the tropical dry forest transition to humid forest.
- **Habitat type:** It was found that a large proportion of individuals (30%) are found in the areas of anthropic use, such as edges of streets and roads, with the next most common habitat type wooded pastures (25%) (see 2 in Figure below)
- **Climate characteristics:** The habitat types where the species were most present were characterised by very hot and humid/subhumid climates, with little water and minimum temperatures of around 23 °C, and a maximum of greater than 27°C. The researchers found that around 60% of individuals overall were present in areas with annual precipitation of 2,000-2,500 mm with most of the remaining in areas with 0-1,500mm annual precipitation (see 3 in Figure below)
- **Altitude:** the researchers found ~ 77% of individuals were located at altitudes of 0-100 m above sea level, with very few above 200 m (see 4 in Figure below)
- **Fruiting and reproductive patterns**; the researchers found evidence of mass flowering in their observations (see 5 in Figure below). They noted the species flowers between March and April and fruits between April and July, although fruiting was most abundant from mid-April to June. They also note instances of the species regenerating from roots and stumps and conclude it regenerates well in open clearings with adequate light requirements (see 5 in Figure below).
- **Other species associated**: Species present in close proximity to *D.retusa* in almost 80% of areas sampled were *Bursera simarouba, Cochlospermum vitifolium, Cordia alliodora* and *Tabebuia ochracea,*

Impact on conclusions of the study

The researchers use these data to note some general requirements for the species, such as precipitation (<2000mm), temperatures between 25°C and 35°C, high levels of light and adequate drainage and pointed out a lack of these characteristics may limit establishment of the species. They also note however that this species is reportedly a generalist species, so may be able to adapt to varying conditions if at least one of these features are present. They do not directly link this data to their decision to recommend no harvest of the species from its' natural distribution areas.

1

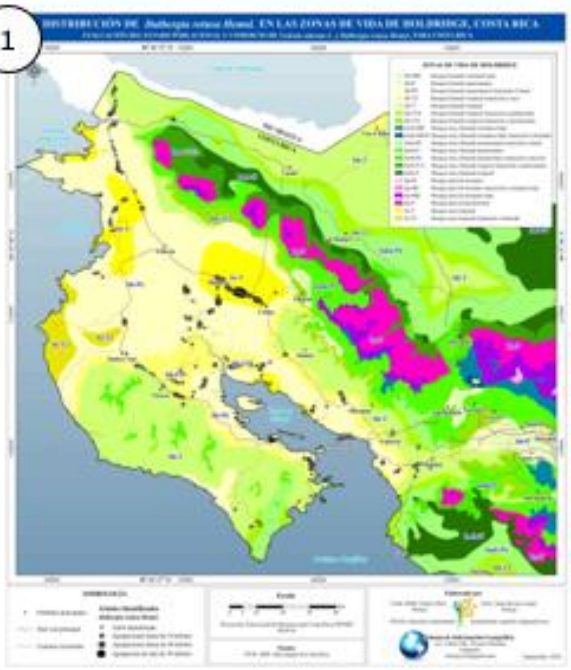


Figure 33. Distribution map of *Dalbergia retusa* Hemsl., by Life Zone, in Coast

2

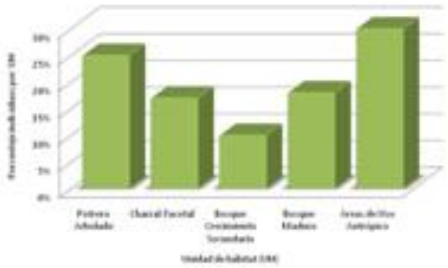


Figure 54. Habitat Units used by *Dalbergia retusa* Hemsl., for Costa Rica. 2010.

3

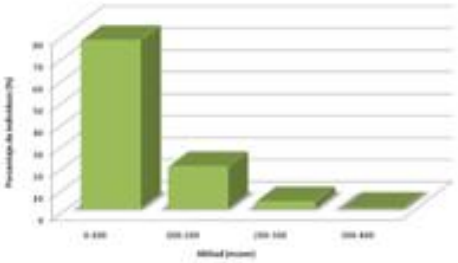


Figure 36. Altitudinal levels (masl) and percentages (%) of individuals in which presents *Dalbergia retusa* Hemsl., in Costa Rica. 2010.

2.5 Feedback from the International Expert Workshop on CITES NDFs (2023)

Between 4th-8th December 2024, the CITES Secretariat hosted an International Expert Workshop on CITES NDFs in Nairobi, Kenya. The workshop was held in the context of Decision 19.312 on Non Detriment Findings, which directs the Secretariat to address priorities for capacity building in relation to NDFs (see 19.132 to 19.134 Non-detriment findings). Eleven modules covering taxa or thematic specific NDF guidance were developed prior to the workshop and refined over the course of the week, with feedback received during this time being used to further refine the guidance in each module before final drafts are submitted in January 2024.

The results of this study were presented to the working group tasked with improving Module 10 on NDFs for tree species (see CITES TRAFFIC Rosewood Study 2023) during the workshop. The presentation provided an overview of the purpose and results of the study, with a request for feedback focusing on the prioritisation exercise and on whether the study was consistent with the guidance developed in Module 10 for Tree species. The study was generally well received by both Parties and observer organisations, who commented particularly on the utility of the factsheets as a basis for developing background data required for NDFs.

The feedback from the workshop focused on the following elements:

- clarity on the use of language and terms used in the study;
- further elaboration of the method used in the prioritisation exercise to ensure transparency;
- some changes to the reflections toward recommendations provided from the review of common information gaps in publicly available NDFs for *Pterocarpus erinaceus*;
- general/conceptual alignment with Module 10 on on NDFs for tree species, e.g. in approaches to the introduction of the case studies.

All there recommendations have been incoprporated where appropriate throughout the present report.

Chapter 3: Overview of findings

3.1 Updated and prioritised list of CITES-listed rosewood tree species

This study identified 55 CITES-listed tree species commercially traded under the name rosewood based on feedback from Parties in Notifications to the Parties issued between 2020 and 2023 (No. 2020/023 and No. 2023/107) and a further two mentioned in a World Wildlife Crime Report report by UNODC (2020). Five of these were species listed at CoP19 (i.e., *Pterocarpus angolensis, Pterocarpus soyauxii, Afzelia Africana, Khaya ivorensis,* and *Khaya senegalensis).*

A further 20 species from African populations of species in genera likely to be traded as rosewoods (*Pterocarpus, Afzelia,* and *Khaya*) and listed at CoP19 were added to this list of CITES-listed rosewood tree species until more data is received to confirm if they are known to be commercially traded under the term rosewood.

From these 77 species, a decision tree was developed to assign species categories of 'high, 'medium' or 'low' priority for the purposes of this study, based on factors such as high trade volumes from wild sources, inclusion in compliance procedures, global threat status from recent IUCN Red List assessments, and feedback from Parties. Thirteen high priority CITES-listed rosewood tree species and 14 medium priority species were identified. Most high priority species were included in this category due to ther inclusion in compliance procedures, or a combination of factors including:

- Parties stating they were highly to moderately affected by international trade
- Those considered to have high trade volumes of wood/timber from wild sources reported in CITES trade data between 2017 and 2021
- An assessment as globally threatened on the IUCN Red List assessment between 2019 and 2023.

Nine 'medium priority' species were included in this category primarily because one or more Parties stated they were highly to moderately affected by by international trade (but without high volumes of trade from wild sources reported in CITES trade data between 2017 and 2021). Five species listed at CoP19 and identified by one or more Parties as being commercially traded under the term rosewood were included in this category as a precautionary measure given there is currently no CITES trade data reported for these species.

A total of 50 CITES-listed rosewood tree species were identified as low priority for the purposes of this study, based on factors such as no trade or very low volumes of trade from wild sources, no feedback from Parties stating species were highly to moderately affected by international trade, or a recent IUCN Red List assessment of 'Least Concern'.. These low priority species also included the 20 species from African populations of *Pterocarpus, Afzelia,* and *Khaya* listed at CoP19 which are yet to be identified as traded under the commercial term rosewood by one or more Parties.

3.2 Report on the conservation and trade in CITES-listed rosewood tree species

a) Factsheets with information most relevant to NDFs

A literature review that encompassed a range of academic and grey literature sources was used to identify information that could be used by all Parties in developing NDFs for high priority CITES-listed rosewood tree species, with Resolution Conf. 16.7 (Rev. CoP17) on *Non-detriment findings* used as an overarching guidance for the types of information needed in NDFs.

This review focused on background information such as global threats and distribution, biological characteristics (e.g reproductive strategies, habitat types) and known global uses, that were relevant for Parties making NDFs regardless of national context. For some characteristics, such as growth rate, it was acknowledged that Parties need to collect data in the harvesting areas for tree species, but a range of known estimates were provided to help inform Parties of a range of possible values if national data are lacking at present. A list of sources identified in the review that may help Parties compile national level data are also provided at the end of each factsheet, such as example approaches to inventories, existing NDFs for the species, or reports with recent country specific legal or illegal trade dynamics. For all medium priority species, a factsheet with a list of sources that can support Parties with background data in NDFs was generated with sources most relevant for these species identified during the literature review.

There have been recent IUCN Red List assessments conducted for all high priority CITES-listed rosewood tree species, and for most there is also a wide range of other literature available. As a result, all high priority species had good data available on factors such as general habitat characteristics, tree and timber characteristics, general resilience of tree species, known roles in their ecosystems, global threats and global conservation status. Recent IUCN Red List assessments are also available for most medium priority species and are a useful collation of most background information required for producing NDFs.

b) Overview of sources and production systems

An overview of sources for all CITES-listed rosewood tree species using CITES trade data from 2017-2021 identified most imports of specimens from African and North American, Central and South America and the Caribbean regions were from wild sourced specimens, whereas most from Asia were from artificial propagation or pre-convention specimens. No specimens from CITES-listed rosewood trees were reported imported under source code Y (assisted production) between 2017 and 2021.

Commercial plantations in CITES-listed rosewood tree species are reported for some *Dalbergia* species: *Dalbergia sissoo* (India, Pakistan and other regions in the subtropics and tropics), *Dalbergia latifolia* (mostly Indonesia), *Dalbergia retusa* and *Dalbergia granadillo* (Costa Rica and Nicaragua) and *Pterocarpus santalinus* (a relatively small area within India). The size and scale of these plantations referenced in the literature may vary as interpretations of the term 'plantation' may differ (see PC24 Doc 16.2). Of these species, only *D. latifolia* and *D. sissoo* are reported imported in notable quantities from artificially propagated specimens between 2017 and 2021.

A commonly reported challenge to successful commercial plantations identified in the literature review is their economic viability. Given the slow growth of CITES-listed rosewood tree species, it can take many years for trees to reach a size large enough to harvest and export. Data collected for some factsheets indicated that some species may grow faster under cultivation (e.g *D. latifolia*), but growth in plantations has been documented to reduce the quality of the heartwood; this was reported to be the case for *D. melanoxylon* and *P. santalinus,*

with *D. melanoxylon* grown in plantations said not to be considered sufficiently high quality, and heartwood from *P. santalinus* reported to be paler than that from wild grown specimens, with plantation specimens also containing a higher proportion of sapwood than wild specimens.

Ongoing research is needed to identify best practices in plantations for CITES-listed rosewood tree species, which balance a need for adequate growth rates with the quality of heartwood produced.

c) Challenges and opportunities with a focus on Pterocarpus erinaceus *country combinations in Stage 2*

Documents related to compliance procedures for CITES-listed rosewood tree species available on the CITES website were reviewed alongside the RST database and information on Parties subject to Article XIII to generate a list of all known species/taxa country combinations currently undergoing compliance procedures. A total of 29 CITES-listed rosewood species/taxa country combinations were subject to compliance procedures prior to SC77, of which close to 40% had submitted voluntary zero export quotas and around a third had published NDFs.

Five countries (Ghana, Mali, Sierra Leone, Benin and Côte d'Ivoire) had published NDFs for *Pterocarus erinaceus* prior to SC77, and these were reviewed against recommendations for the types of information needed in NDFs for tree species from Resolution Conf. 16.7 (Rev. CoP17), Module 10 and the 9-step guidance to assess common strengths and gaps.

Common challenges identified included:

- a lack of capacity and/or funding, with associated challenges in collecting inventory data for species
- difficulty in finding publicly available NDFs which may be published in Plant Committee documents and are not yet all available in a central repository which can prevent access to data and approaches
- A lack of data on the aspects most required to formulate NDF, such as harvest site specific growth rates, mortality rates, and conversion factors). These data are needed to inform upon accurate recovery rates and minimum felling diameters, which can subsequently inform upon sustainable harvest and export quotas

d) Reflections toward future recommendations for CITES-listed rosewood tree species

Figures 6 and 7 detail reflections towards recommendations to improve implementation of CITES for all rosewood tree species and specifically for *Pterocarpus erinaceus* based on NDFs reviewed, respectively.

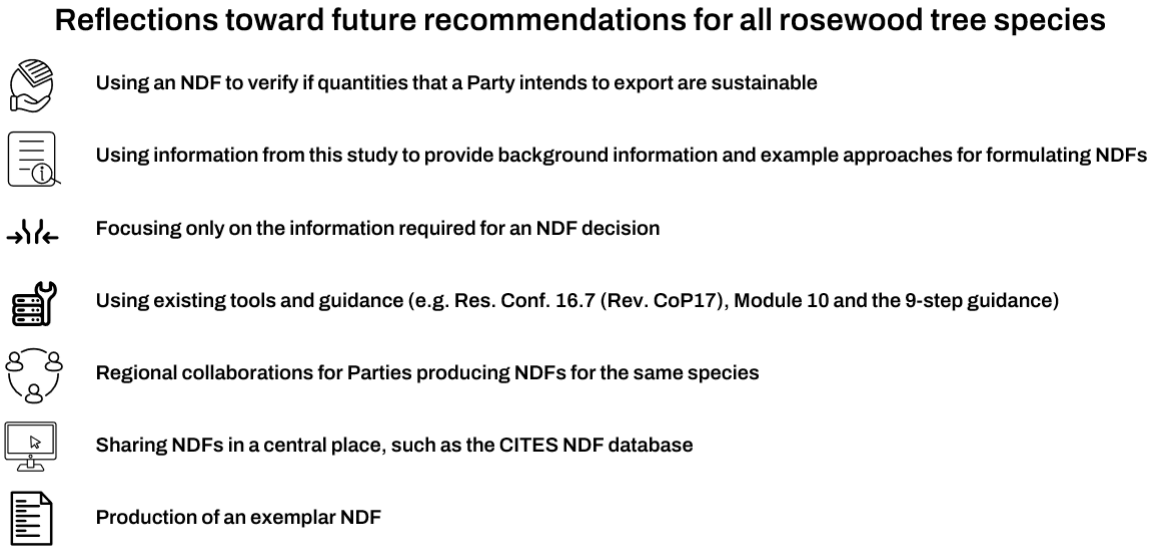


Figure 6. General reflections towards future recommendations for improved implementation of CITES for all rosewood tree species currently subject to compliance procedures.

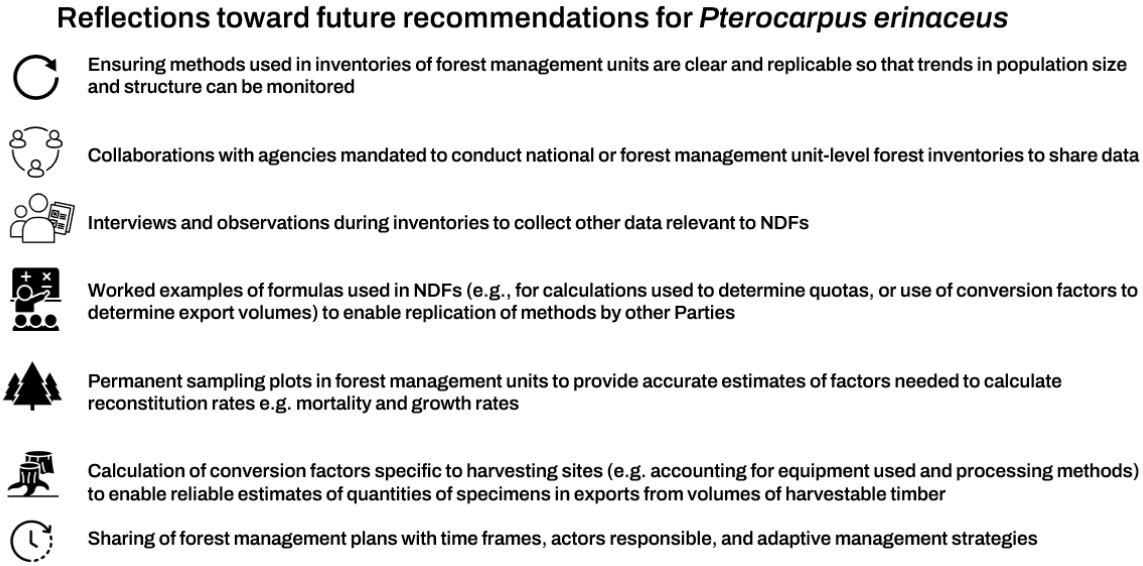


Figure 7. General reflections towards future recommendations for improved implementation of CITES for range States of *Pterocarus erinaceus* based on a review of common gaps in NDFs publicly available as of October 2023.

e) Case studies

This study identified 13 publicly available NDFs for CITES-listed rosewood tree species: five from Africa, five from Asia, and two from Central and South America and the Caribbean. Many of these were for species country combinations currently subject to compliance procedures under the Convention. From these, several approaches to forest inventory were outlined illustrative in case studies, as well as example approaches toward the collection of current and historical harvesting levels, calculation of recovery rates and the formulation of harvest quotas, and forest management plans.

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The “high”, “medium”, and “low” priority list of CITES-listed rosewoods

TABLE 2 – HIGH PRIORITY

High priority CITES-listed rosewood tree species	Appendix	Annotation	CITES Region	IUCN Red List status (assessment date)	Raw timber imports 2017-2021			Timber products imports 2017-2021			Other criteria used to assign priority category			Criteria met for high priority	
					kg	m^3	Number of specimens	kg	m^3	Number of specimens	Was there a sharp increase in imports of raw timber or timber products in 2022	Did one or more Party state the species was high to moderately affected by trade	Is the species currently in a compliance procedure (e.g., Article XIII or RST, or a recommendation to suspend trade).	Species is in a compliance process	One or more Party stated the species was affected by trade + high trade volumes from wild sources 2017-2021 + species was assessed as globally threatened on the IUCN Red List 2019-2023, or has not been assessed since 2019
Dalbergia cochinchinensis	II	15	Asia	Critically Endangered (2020)	0	150	0	0	1	0	No	Yes	Yes	Yes	
Dalbergia oliveri	II	15	Asia	Critically Endangered (2020)	0	9,986	0	0	1,066	0	No	Yes	Yes	Yes	Yes
Dalbergia granadillo	II	15	North America and Central and South America and the Caribbean	Critically Endangered (2019)	0	1,706	0	0	0	0	Yes	Yes	No		Yes
Dalbergia latifolia	II	15	Asia	Vulnerable (2020)	130,820	193,408	10,682	26,404	65	168,908	Yes	Yes	No		Yes
Dalbergia melanoxylon	II	15	Africa	Near Threatened (2020)	107,080	54,859	0	5,756	153	208,161	No	Yes	Yes	Yes	Yes
Dalbergia retusa	II	15	Central and South America and the Caribbean	Critically Endangered (2019)	26,070	50,260	0	0	0	148	No	Yes	Yes	Yes	Yes
Dalbergia stevensonii	II	15	North America and Central and South America and the Caribbean	Critically Endangered (2019)	0	633	0	0	0	18	No	Yes	No		Yes
Dalbergia tucurensis	II	15	North America and	Endangered (2019)	0	2,242	0	0	0	0	No	Yes	Yes	Yes	Yes

			Central and South America and the Caribbean												
Guibourtia pellegriniana	II	15	Africa	Endangered (2020)	0	1,644	0	0	0	0	No	Yes	No		Yes
Guibourtia tessmannii	II	15	Africa	Endangered (2020)	0	62,178	0	0	0	0	No	Yes	Yes	Yes	Yes
Pterocarpus erinaceus	II	17	Africa	Endangered (2017)	11,286,618	2,568,517	13,746	0	33,409	3,500	No	Yes	Yes	Yes	Yes
Pterocarpus santalinus	II	17	Asia	Endangered (2020)	0	0	0	0	0	0	No	Yes	Yes	Yes	
Pterocarpus tinctorius	II	17	Africa	Least Concern (2017)	0	17,945	0	0	0	0	No	Yes	No		Yes

Medium priority CITES-listed rosewood tree-species	Appendix	Annotation	CITES Region	IUCN Red List status (assessment date)	Raw timber imports 2017-2021			Timber products imports 2017-2021			Other criteria used to assign priority category			Criteria met for medium priority	
					kg	m^3	Number of specimens	kg	m^3	Number of specimens	Was there a sharp increase in imports of raw timber or timber products in 2022	Did one or more Party state the species was high to moderately affected by trade	Is the species currently in a compliance procedure (e.g., Article XIII or RST, or a recommendation to suspend trade).	One or more Party stated the species was affected by trade	Listed at CoP19 and identified by a Party as traded under the commercial term rosewood
Dalbergia baronii	II	15	Africa	Vulnerable (1998)	0	0	0	0	0	1	No	Yes	No	Yes	
Dalbergia calderonii	II	15	Africa	Critically Endangered (2019)	0	14	0	0	0	0	No	Yes	No	Yes	
Dalbergia congestiflora	II	15	North America and Central and South America and the Caribbean	Endangered (2019)	0	56	0	0	0	0	No	Yes	No	Yes	
Dalbergia glomerata	II	15	North America and Central and South America and the Caribbean	Critically Endangered (2019)	0	0	0	0	0	0	No	Yes	No	Yes	
Dalbergia maritima	II	15	Africa	Endangered (2022)	0	0	0	0	0	0	No	Yes	No	Yes	
Dalbergia sericea	II	15	Asia	Least Concern (2022)	0	0	0	0	0	0	No	Yes	No	Yes	
Dalbergia spruceana	II	15	Central and South America and the Caribbean	Vulnerable (2021)	0	0	0	0	0	0	No	Yes	No	Yes	
Guibourtia demeusei	II	15	Africa	Near Threatened (2020)	1,300	39,560	60	0	221	210	No	Yes	No	Yes	
Paubrasilia echinata	II	10	Central and	Endangered (1998)	0	0	0	0	0	0	No	Yes	No	Yes	

			South America and the Caribbean												
Pterocarpus angolensis	II	17	Africa	Least Concern (2018)	Listed at CoP19 with no CITES trade data reported as of October 2023							No	No		Yes
Pterocarpus soyauxii	II	17	Africa	Not assessed								No	No		Yes
Afzelia africana	II	17	Africa	Vulnerable (2019)								No	No		Yes
Khaya ivorensis	II	17	Africa	Vulnerable (1998)								No	No		Yes
Khaya senegalensis	II	17	Africa	Vulnerable (1998)								No	No		Yes

Low priority CITES-listed rosewood tree species	Appendix	Annotation	CITES Region	IUCN Red List status (assessment date)	Raw timber imports 2017-2021			Timber products imports 2017-2021			Other criteria used to assign priority category			Criteria met for low priority		
					kg	m^3	Number of specimens	kg	m^3	Number of specimens	Was there a sharp increase in imports of raw timber or timber products in 2022	Did one or more Party state the species was high to moderately affected by trade	Is the species currently in a compliance procedure (e.g., Article XIII or RST, or a recommendation to suspend trade).	No Party stated the species was affected by trade + low trade volumes from wild sources 2017-2021	No Party stated the species was affected by trade + high trade volumes from wild sources 2017-2021 + species was assessed as NOT globally threatened on the IUCN Red List 2019-2023	Listed at CoP19 and NOT identified by a Party as traded under the commercial term rosewood
Aniba rosaeodora	II	12	Central and South America and the Caribbean	Endangered (2020)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia nigra	I	N/A	Central and South America and the Caribbean	Vulnerable (1998)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia abrahamii	II	15	Africa	Endangered (2014)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia arbutifolia	II	15	Africa	Least Concern (2010)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia assamica	II	15	Asia	Least Concern (2010)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia boehmii	II	15	Africa	Least Concern (2018)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia brownei	II	15	North America and Central and South America and the Caribbean	Least Concern (2019)	0	0	0	0	0	0	No	No	No	ü		

Dalbergia calycina	II	15	North America and Central and South America and the Caribbean	Vulnerable (2019)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia cearensis	II	15	Central and South America and the Caribbean	Near Threatened (2018)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia cubilquitzensis	II	15	North America and Central and South America and the Caribbean	Least Concern (2019)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia decipularis	II	15	Central and South America and the Caribbean	Least Concern (2020)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia frutescens	II	15	Central and South America and the Caribbean	Least Concern (2021)	0	21	0	0	0	0	No	No	No	ü		
Dalbergia glabra	II	15	North America and Central and South America and	Least Concern (2019)	0	0	0	0	0	0	No	No	No	ü		

			the Caribbean													
Dalbergia greveana	II	15	Africa	Vulnerable (2018)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia longepedunculata	II	15	North America and Central and South America and the Caribbean	Endangered (2019)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia louvelii	II	15	Africa	Endangered (2022)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia luteola	II	15	North America and Central and South America and the Caribbean	Critically Endangered (2019)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia madagascariensis	II	15	Africa	Vulnerable (2018)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia melanocardium	II	15	North America and Central and South America and the Caribbean	Endangered (2019)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia modesta	II	15	North America and Central and South America and the Caribbean	Data deficient (2019)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia monetaria	II	15	North America	Least Concern (2010)	0	0	0	0	0	0	No	No	No	ü		

			and Central and South America and the Caribbean													
Dalbergia odorifera	II	15	Asia	Vulnerable (1998)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia palo-escrito	II	15	North America and Central and South America and the Caribbean	Endangered (2019)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia pinnata	II	15	Asia	Least Concern (2018)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia obtusa	II	15	Africa	Vulnerable (2018)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia rhachiflexa	II	15	North America and Central and South America and the Caribbean	Endangered (2019)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia ruddiae	II	15	North America and Central and South America and the Caribbean	Endangered (2019)	0	0	0	0	0	0	No	No	No	ü		
Dalbergia sissoo	II	15	Asia	Least Concern (2020)	0	16		125,665	0	199,947	No	No	No		Yes	
Platymiscium parviflorum	II	4	Central and South America and the	Critically Endangered (2018)	0	0	0	0	0	0	No	No	No	ü		

			Caribbean													
Senna meridionalis	II	N/A	Africa	Vulnerable (2019)	0	0	0	0	0	0	No	No	No	ü		
Pterocarpus brenanii	II	17	Africa	Least Concern (2020)	Listed at CoP19 with no CITES trade data reported as of October 2023							No	No			Yes
Pterocarpus lucens	II	17	Africa	Least Concern (2010)								No	No			Yes
Pterocarpus mildbraedii	II	17	Africa	Least Concern (2011)								No	No			Yes
Pterocarpus officinalis	II	17	Africa	Near Threatened (2018)								No	No			Yes
Pterocarpus osun	II	17	Africa	Least Concern (2020)								No	No			Yes
Pterocarpus rotundifolius	II	17	Africa	Least Concern (2018)								No	No			Yes
Pterocarpus santalinoides	II	17	Africa	Least Concern (2018)								No	No			Yes
Pterocarpus tessmannii	II	17	Africa	Near Threatened (2020)								No	No			Yes
Afzelia bella	II	17	Africa	Least Concern (2019)								No	No			Yes
Afzelia bipindensis	II	17	Africa	Vulnerable (1998)								No	No			Yes
Afzelia pachyloba	II	17	Africa	Vulnerable (1998)								No	No			Yes
Afzelia parviflora	II	17	Africa	Least Concern (2018)								No	No			Yes
Afzelia peturei	II	17	Africa	Vulnerable (2019)								No	No			Yes
Afzelia quanzensis	II	17	Africa	Least Concern (2019)								No	No			Yes
Khaya agboensis	II	17	Africa	Not assessed								No	No			Yes
Khaya anthotheca	II	17	Africa	Vulnerable (1998)								No	No			Yes
Khaya euryphylla	II	17	Africa	Not assessed								No	No			Yes
Khaya grandifoliola	II	17	Africa	Vulnerable (1998)								No	No			Yes
Khaya madagascariensis	II	17	Africa	Vulnerable (2020)								No	No			Yes
Khaya nyasica	II	17	Africa	Vulnerable (1998)								No	No			Yes