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

FINDINGS, REFLECTIONS AND AN INVITATION TO FEEDBACK

AIMS

- To give an overview of the study commissioned to TRAFFIC as part of Decision 19.243
- To seek feedback on:
  - the prioritisation exercise
  - alignment of the study with the guidance in Module 10
- Q/A and feedback

Overview of the study

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 in 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

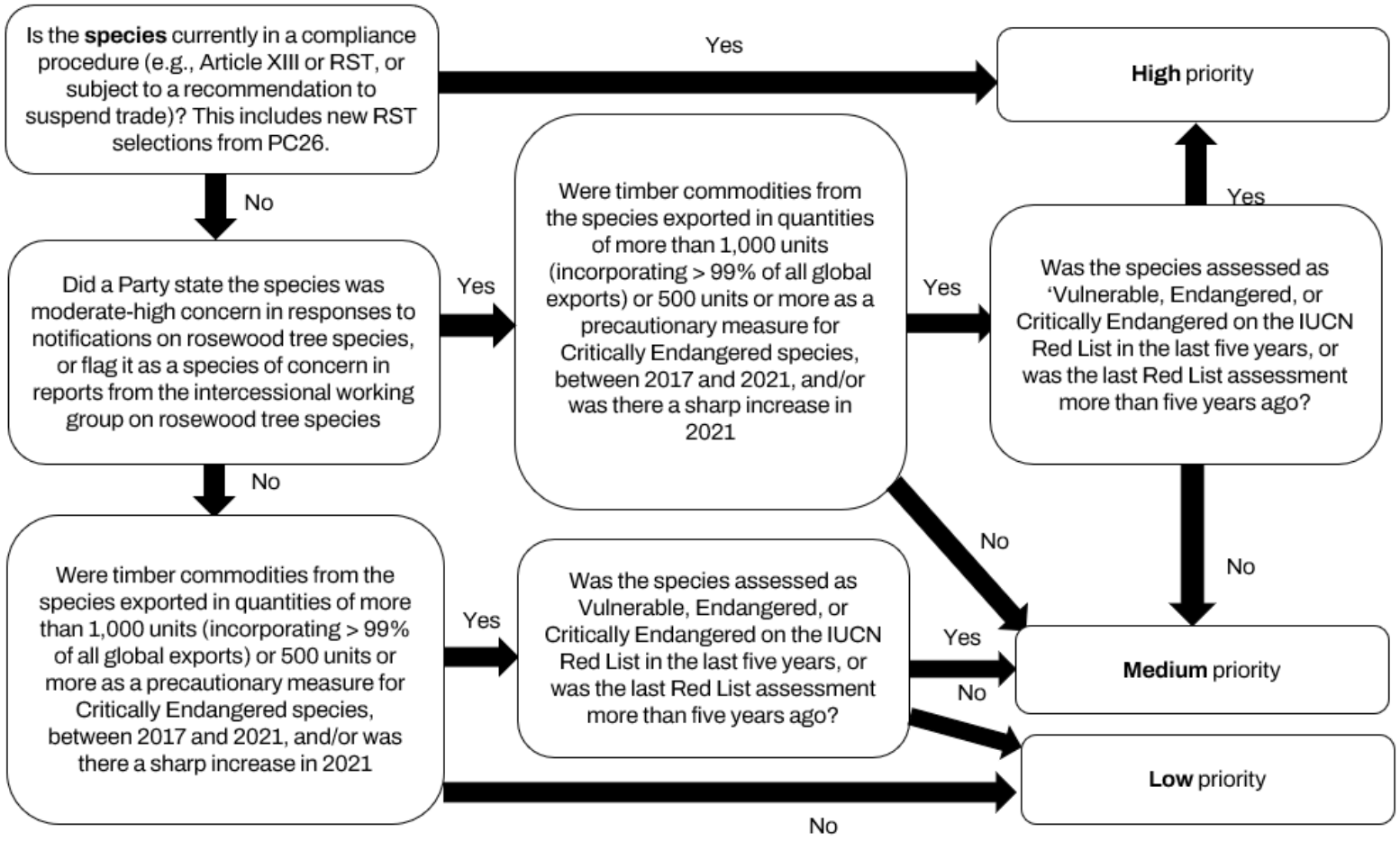
Overview of the study

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

2. Study on the conservation and trade of CITES-listed rosewood tree species (with a focus on those identified as ‘high’ and ‘medium’ priority)

- Review of information relevant to non-detriment findings for priority rosewood tree species
- Overview of sources and production systems for rosewood tree specimens in international trade
- 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
- Case studies of practices (with a focus on Article IV and non- detriment findings)

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



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

13 ‘high priority’ species

- Five species are native to Africa
- Four to Central and South America and the Caribbean
- Three to North America
- Four to Asia

Species (Appendix)	Region
Dalbergia cochinchinensis (II)	Asia
Dalbergia oliveri (II)	Asia
Dalbergia granadillo (II)	North America and Central and South America and the Caribbean
Dalbergia latifolia (II)	Asia
Dalbergia melanoxylon (II)	Africa
Dalbergia retusa (II)	Central and South America and the Caribbean
Dalbergia stevensonii (II)	North America and Central and South America and the Caribbean
Dalbergia tucurensis (II)	North America and Central and South America and the Caribbean
Guibourtia pellegriniana (II)	Africa
Guibourtia tessmannii (II)	Africa
Pterocarpus erinaceus (II)	Africa
Pterocarpus santalinus (II)	Asia
Pterocarpus tinctorius (II)	Africa

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

14 ‘medium priority’ species

- Nine species were included based on the decision tree
- Five species were included as medium due to being listed at CoP19 and identified by Parties as rosewoods

Species (Appendix)	Region
Dalbergia baronii (II)	Africa
Dalbergia calderonii (II)	Africa
Dalbergia congestiflora (II)	North America and Central and South America and the Caribbean
Dalbergia glomerata (II)	North America and Central and South America and the Caribbean
Dalbergia maritima (II)	Africa
Dalbergia sericea (II)	Asia
Dalbergia spruceana (II)	Central and South America and the Caribbean
Guibourtia demeusei (II)	Africa
Paubrasilia echinata (II)	Central and South America and the Caribbean
Pterocarpus angolensis (II)	Africa
Pterocarpus soyauxii (II)	Africa
Afzelia africana (II)	Africa
Khaya ivorensis (II)	Africa
Khaya senegalensis (II)	Africa

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

50 ‘low priority’ species

- 30 species were determined as ‘low priority’ based on the decision tree

Species (Appendix)	Region
Aniba rosaeodora (II)	Central and South America and the Caribbean
Dalbergia nigra (I)	Central and South America and the Caribbean
Dalbergia abrahamii (II)	Africa
Dalbergia arbutifolia (II)	Africa
Dalbergia assamica (II)	Asia
Dalbergia boehmii (II)	Africa
Dalbergia brownei (II)	North America and Central and South America and the Caribbean
Dalbergia calycina (II)	North America and Central and South America and the Caribbean
Dalbergia cearensis (II)	Central and South America and the Caribbean
Dalbergia cubilquitzensis (II)	North America and Central and South America and the Caribbean
Dalbergia decipularis (II)	Central and South America and the Caribbean
Dalbergia frutescens (II)	Central and South America and the Caribbean
Dalbergia glabra (II)	North America and Central and South America and the Caribbean
Dalbergia greveana (II)	Africa
Dalbergia longepedunculata (II)	North America and Central and South America and the Caribbean
Dalbergia louvelii (II)	Africa
Dalbergia luteola (II)	North America and Central and South America and the Caribbean
Dalbergia madagascariensis (II)	Africa
Dalbergia melanocardium (II)	North America and Central and South America and the Caribbean
Dalbergia modesta (II)	North America and Central and South America and the Caribbean
Dalbergia monetaria (II)	North America and Central and South America and the Caribbean
Dalbergia odorifera (II)	Asia
Dalbergia palo-escrito (II)	North America and Central and South America and the Caribbean
Dalbergia pinnata (II)	Asia
Dalbergia obtusa (II)	Africa
Dalbergia rhachiflexa (II)	North America and Central and South America and the Caribbean
Dalbergia ruddiae (II)	North America and Central and South America and the Caribbean
Dalbergia sissoo (II)	Asia
Platymiscium parviflorum (II)	Central and South America and the Caribbean
Senna meridionalis (II)	Africa

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

50 ‘low priority’ species

- 20 species were included as ‘low priority’ due to being listed at CoP19 but not yet reported by Parties to be traded as rosewoods

Species (Appendix)	Region
Pterocarpus brenanii (II)	Africa
Pterocarpus lucens (II)	Africa
Pterocarpus mildbraedii (II)	Africa
Pterocarpus officinalis (II)	Africa
Pterocarpus osun (II)	Africa
Pterocarpus rotundifolius (II)	Africa
Pterocarpus santalinoides (II)	Africa
Pterocarpus tessmannii (II)	Africa
Afzelia bella (II)	Africa
Afzelia bipindensis (II)	Africa
Afzelia pachyloba (II)	Africa
Afzelia parviflora (II)	Africa
Afzelia peturei (II)	Africa
Afzelia quanzensis (II)	Africa
Khaya agboensis (II)	Africa
Khaya anthotheca (II)	Africa
Khaya euryphylla (II)	Africa
Khaya grandifoliola (II)	Africa
Khaya madagascariensis (II)	Africa
Khaya nyasica (II)	Africa

Main exemptions permitted by CITES for trade in rosewood timber specimens

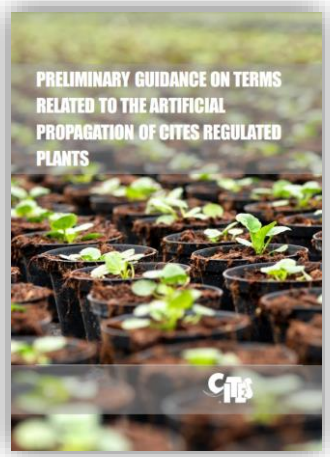
Two key concepts:

Most common annotations for Appendix II rosewood trees

- They specify the specimens that are subject to or excluded from the provisions of the Convention.
- ***Example:***
- Annotation #15 for ***Dalbergia*** spp. (except for those from **Mexico and *D. cochinchinensis***) and ***Guibourtia*** spp.
- It ***excludes*** from CITES controls **musical instruments** and **wood shipments of up to 10 kg**.
- Annotation# 17 for African populations of ***Pterocarpus, Afezlia*** and ***Khaya*** spp.
- It ***excludes*** from CITES controls **products other than logs, sawn wood, veneer sheets, plywood and transformed wood**

Appendix-II Artificially propagated specimens (source A)

- Trees grown under controlled conditions or from cultivated parental stock are exempted from CITES controls.
- Find out more here!



- https://cites.org/sites/default/files/eng/prog/captive_breeding/Art_Prop_Guidance_Feb2022.pdf

Information relevant to non-detriment findings for priority species

Fact sheets

Conf. 16.7
(Rev. CoP17)*

Non-detriment findings

ix) the non-detriment finding is based on resource assessment methodologies which may include, but are not limited to, consideration of:

A. species biology and life-history characteristics;

B. species range (historical and current);

C. population structure, status and trends (in the harvested area, nationally and internationally);

D. threats;

E. historical and current species-specific levels and patterns of harvest and mortality (e.g. age, sex) from all sources combined;

F. management measures currently in place and proposed, including adaptive management strategies and consideration of levels of compliance;

G. population monitoring; and

H. conservation status; and

A. Species biology and life-history characteristics
(i) Habitat characteristics
(ii) Growth rate*
(iii) Characteristics of timber and tree e.g., maximum diameter size, height, annual increment, minimum diameter at fruiting (e.g maturity)
(iv) Role of species in the ecosystem*
(v) Resilience of timber and tree

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) Regeneration (or recovery capacity) *
(v) Minimum felling diameter*
(vi) Rotation cycle*
(vii) Annual allowable cut
(viii) Silviculture
(ix) Harvest techniques
(x) Conversion of standing tree volume to timber specimens or products*
(xi) Establishment of suitable harvest and export quotas

G. Population monitoring

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

Information relevant to non-detriment findings for priority species

Fact sheets

Species name	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g., soil, climate)	
Tree and timber characteristics (e.g., maximum height and diameter)	
Growth rates*	
Role of species in Ecosystem*	
Resilience of tree and timber	
B. Species range	
Global/geographic distribution	
D. Threats	
Global	
E. Historical and current species-specific levels and patterns of harvest and mortality	
Global legal/illegal trade volumes	
Known uses	

F. Management measures	
Regeneration (or recovery capacity) *	
Minimum felling diameter/rotation cycle*	
Conversion of standing tree volume to timber specimens or products*	
H. Conservation status	
Global Red List assessment	
Bibliography	
Useful resources for other information related to NDFs	

Information relevant to non-detriment findings for priority species

Fact sheet high priority example

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 15-35°C, but the species can tolerate temperatures over 40 °C (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 and timber 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. The wood 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). 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) 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).
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 reconstitution rates for the species, 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 and timber	*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). 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). 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).
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 km², but the state of the population across its distribution is not known (Barstow, 2018) 
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 its 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). Other specific threats evidenced 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.

E. Historical and current species-specific levels and patterns of harvest and mortality	
Global legal/illegal trade volumes	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	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). 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	
Regeneration (or recovery capacity)	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*	*P. 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 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 export quotas on this basis, with 50 year felling cycles as a conservative measure (SC77 Inf. 8, 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

Information relevant to non-detriment findings for priority species

Fact sheet high priority example

	diameters of between 15-25cm (both assumedly dbh, but not explicitly stated) (Zon et al., 2022). The NDF states rotation periods 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 quotas in the current (2023) 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 reconstitution 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 (at breast height) that allowed for optimal restoration of populations for *P. erinaceus* were 35 cm in the Guinean and Sudanian climatic zones, and 65 cm 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 of standing tree volume to timber specimens or products*	A typical yield is 0.8 m^3 of timber and 1.2 m^3 of firewood for a relatively large (50 cm diameter at breast height) 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 factors 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 ($V= 0.0004634(d^{2.305})$ Where: V= tree volume, d= diameter at breast height but does not provide a source for the formula (SC77 Inf. 6, 2023)
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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Mbowa, C., Chhinb, S., Samboua, B. and Skole, D. (2013). Potential of dendrochronology to assess annual rates of biomass productivity in savanna trees of West Africa. Dendrochronologia, 31, PP. 41-51. https://doi.org/10.1016/j.dendro.2012.06.001

B. Species range and C. Population structure, status, and trends

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)

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

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 factors 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. Up-to-date surveys in countries would be useful to confirm the scale of current domestic use/harvest alongside international legal and illegal trade.

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)

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

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 export quotas for the species in specific areas based on data such as minimum felling diameters and regeneration rates. See also 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) 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)

Information relevant to non-detriment findings for priority species

Fact sheet high medium priority example

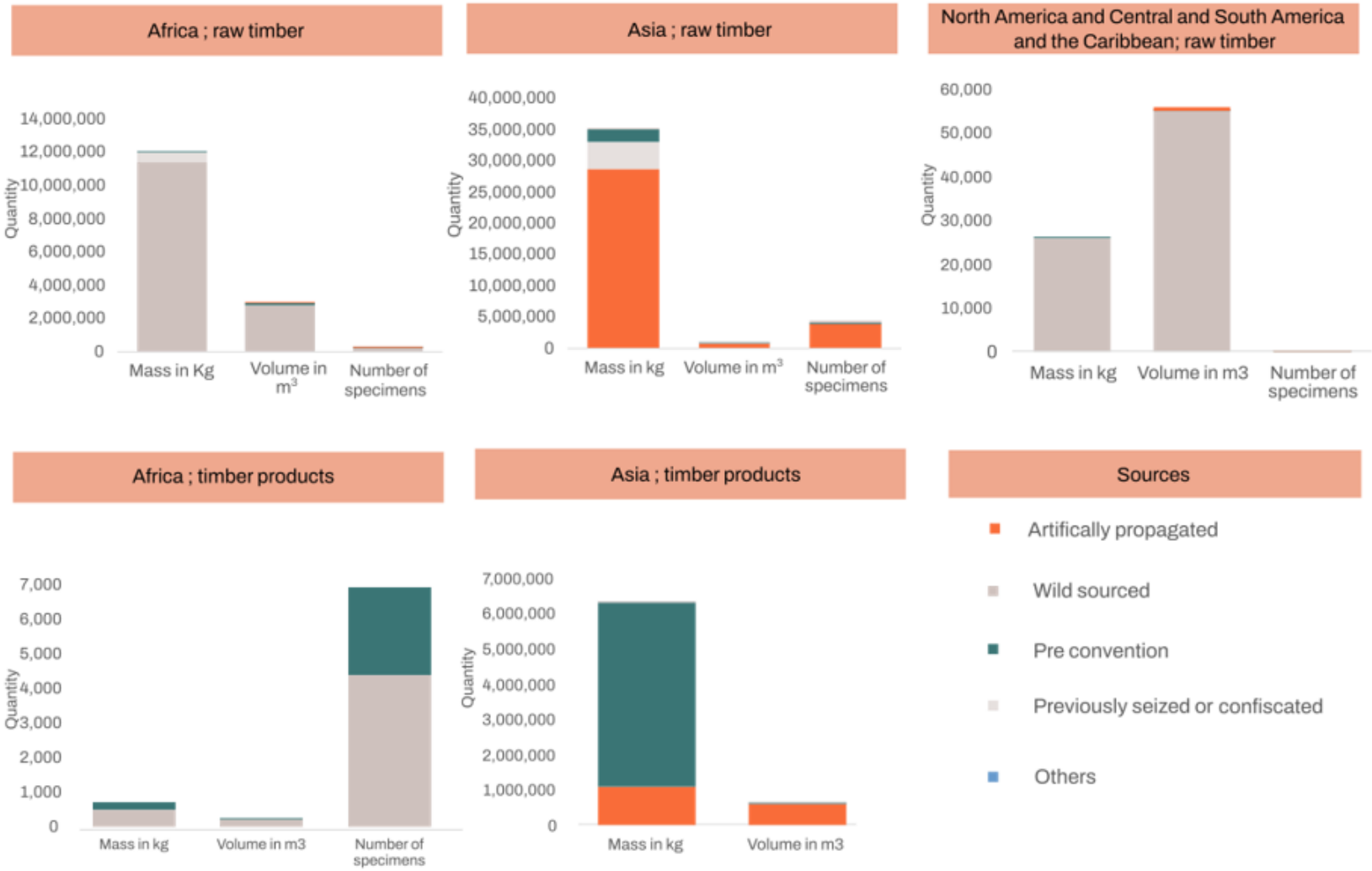
CITES-listed rosewood tree species assigned the status of 'medium' priority	
A. Species biology and life-history characteristics	
Habitat characteristics (e.g., soil, climate) Tree and timber characteristics (e.g maximum height and diameter) * Growth rates * Role of species in ecosystem Resilience of tree and timber	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 calderanii, Dalbergia congestiflora* and *Dalbergia sericea*) All *Dalbergia* species • The *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) • 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*) 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 3.) • 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 *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
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 volumes	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 *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	
Regeneration (or recovery capacity)	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 of standing tree volume to timber specimens or products*	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)
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)

Overview of sources and production systems

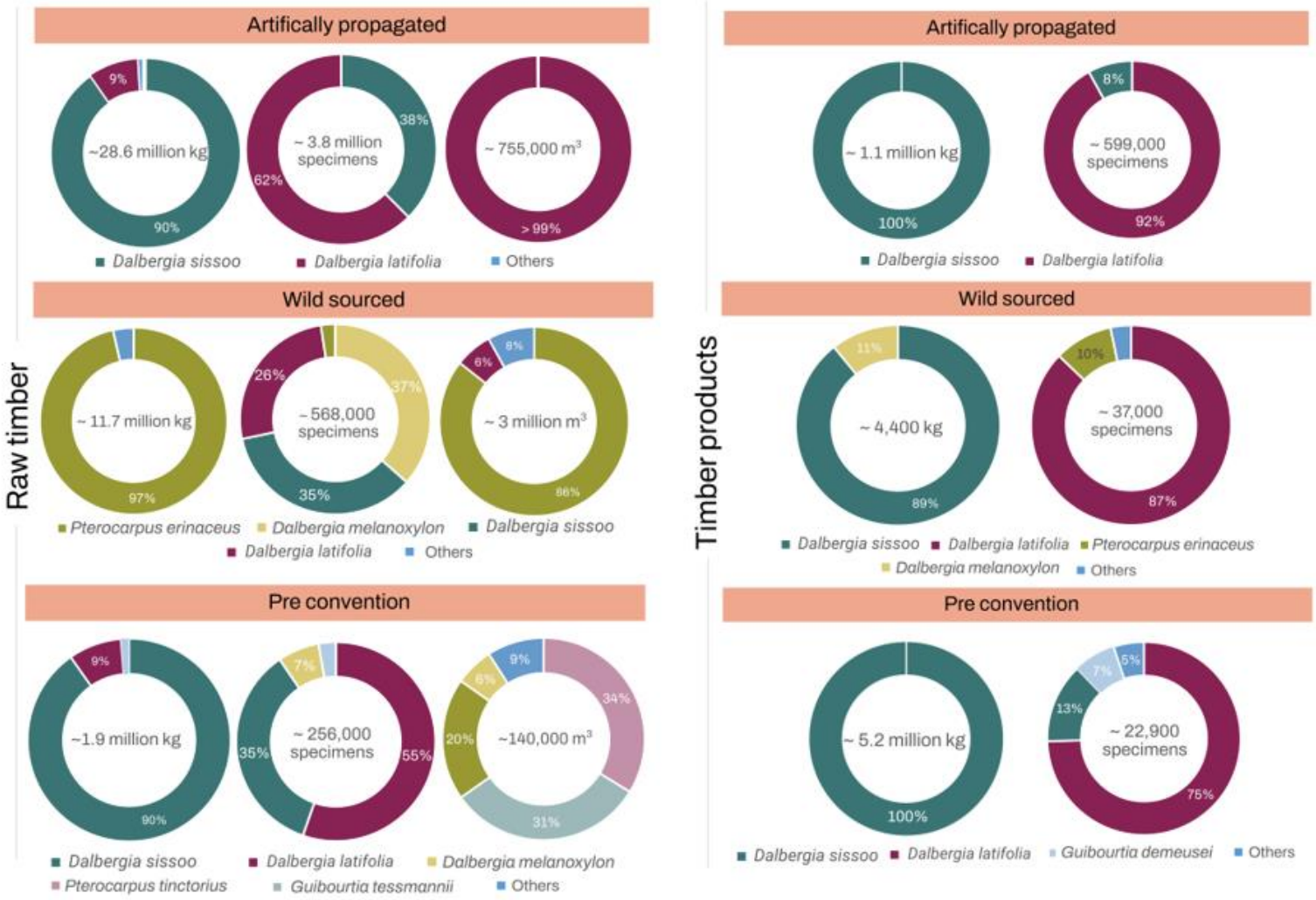
- In most regions, most imports reported in CITES Trade Data are from wild-sourced specimens
- Asia is the exception: raw timber is mostly reported to be from artificially propagated specimens and timber products mostly from pre-convention specimens



Overview of sources and production systems

- Imports in artificially propagated rosewood specimens are almost entirely from two Asian species: *Dalbergia sissoo and Dalbergia latifolia*

- Imports in wild-sourced raw timber from rosewoods are mostly from African species *Pterocarpus erinaceus* and *Dalbergia melanoxylon*



Regional overview of sources and production systems

a) African rosewood tree species

A guide to CITES-listed tree species, last updated in 2023, states there does not appear to be any known large-scale commercial plantations of *Pterocarpus* species, so all products 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 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 (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 was 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.

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, South and Central 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 plantation for the species were established in once province 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 (illegally) sourced from wild populations (CoP16 Proposal 60, 2013).

A 2022 NDF for the species in Viet Nam stated a number of 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 Laos 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.

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 auhtors 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 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* specimens imported from Mexico between 2012 and 2021.

Rosewood Case studies of practices (with a focus on NDFs)

- 13 publicly available NDFs for CITES-listed rosewood tree species before SC77
- Those for predominately wild-sourced specimens (in bold) were reviewed

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

Rosewood Case studies of practices (with a focus on NDFs)

Region	Country	Species	Aspect of the NDF highlighted in the case study				
			Forest inventory protocols and determination of size class distribution of trees	Collecting historical and current species-specific levels and patterns of harvest and mortality:	Calculation of regeneration (or recovery capacity) and establishment of sustainable harvest quotas	Forest management plans	Other; use of surveying during inventories to collect other data relevant to NDFs
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			

Forest inventory protocols and determination of size class distribution of trees

Benin and *Pterocarpus erinaceus*

<u>Selection of sampling area</u>

The researchers identified five forests within five protected areas with natural occurrence of the species, based on data from previous inventories and research (see 1 in figure). 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 and 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)

<u>*Impact on NDF Opinion*</u>

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 (e.g. based on population structures as shown in graphs in the figure) 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 before a positive NDF opinion can be made.

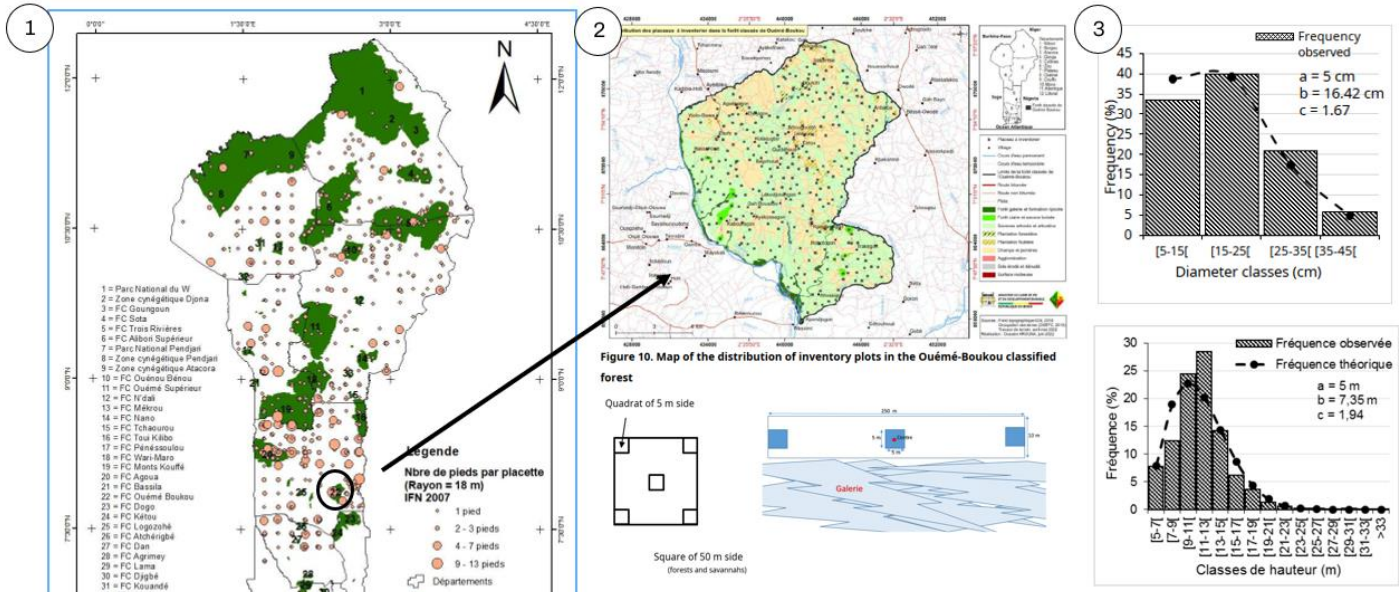


Figure 8. Distribution map of *P. erinaceus* in Benin

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

Collecting historical and current levels and patterns of harvest and mortality

Sierra Leone and *Pterocarpus erinaceus*

To better understand use patterns specific to each district where the species occurs, the researchers documented uses by local communities while collecting data for their forest inventory. They carried out a questionnaire survey that generated other socio-economic data but did not detail the questions within the survey in the NDF.

The researchers produced a summary document for each district detailing the use of various parts of the tree. They include information on whether the use was regulated or unregulated, and for subsistence or commercial purposes. There is no further detail in the methodology to inform how the percentage of off-take was determined.

<u>Impact on NDF Opinion</u>

Whilst it is not clear from this (draft) NDF if this influenced positive or negative NDF decisions for each district, this data may be used when determining any export quotas in their finalised NDF.

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%		✓	✓	

Calculation of regeneration and establishment of sustainable harvest quotas

Mali and *Pterocarpus erinaceus*

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 25 cm for a rotation varying from 6-10 years. They point out this does not allow for regeneration of the species after exploitation, so state the quotas will be calculated based on longer rotation times of 12.5 years and larger 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 formula opposite to calculate the regeneration rate

Establishment of sustainable harvest quotas

The authors of the NDF supply an Excel document that shows the regeneration rate for each forest massif and state that only forests with regeneration rates of greater than 50% after the second rotation will be retained for exploitation 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 (reference could not be found for this source). They also account for average yields of 80% from the harvestable timber into plans for export based on statements from dealers of the species in field visits.

They calculate that a total of 103 out of 148 forest massifs can be regenerated 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 from these forests. Some minimum export diameters have been increased to 65 cm in some forest massifs, assumedly to allow for adequate regeneration; 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 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

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

Re = Percentage of reconstitution 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, 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 individuals (e.g., in this case, the number of individuals of 50cm dbh, and in the three subsequent dbh classes above this)

Calculation of regeneration and establishment of sustainable harvest quotas

Ghana and *Pterocarpus erinaceus*

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 sustainable 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 conservation, destructions caused by wildfire, clearance for farming and domestic use, and 20% solely for use in charcoal production.

They state that felling 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 quotas. They calculate quotas per district for different potential felling cycles of 30 years (~38,680 m^3), 40 years (~29,010 m^3) and 50 years (~23,208 m^3). The 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. There is an annual quota of 40,000m^3 over a 16-year period (e.g., until stocks are depleted) for this submerged 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 harvest quota of 23,207.97m^3, with a separate annual quota of 40,000m^3 over 16 years (e.g. until stocks are depleted) for submerged stocks under Lake Volta.

They provide in an Annex a quota for each forest district and 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 and enable a more informed review of current conservative quotas

Forest management plans

Côte d'Ivoire and *Pterocarpus erinaceus*

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 estimated 2% of the species distribution area) covered in the current inventory

Long-term management objectives

The authors of the NDF 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 the interests of local communities: national parks are priority areas for conservation, rural estate for 'rational use', and classified forests are a mixture of both.

The authors go on to outline five long-term objectives required for these purposes. Each long-term objective is broken down into operational goals and actionable activities. A table details the actors involved in each activity, and deliverables/success indicators with activities prioritised (see 1 in Figure).

Time frames for each activity to be completed over ten years are outlined in a separate table (see 2 in the figure), with the budget for each in a third table (see 3 in the figure).

1

ACTION PLAN MATRIX

Objectives to Long term	Influencing factors	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 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	2030	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

Use of surveying during inventories to collect other data relevant to NDFs

Costa Rica and *Dalbergia retusa*

Whilst conducting their systematic survey for the 2010 study, researchers collected a wide range of data on factors relating to the biology of the species including

- Geographical locations using GPS; these were used in conjunction with digital databases to identify climatic factors such as altitude and precipitation in areas where 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

They summarised these data to show typical habitat types where the species was distributed (see 1 and 2 in figure) and the altitude and average annual precipitation where individuals were most frequently found. They also noted reproductive patterns and other species found commonly associated with the species.

<u>Impact on NDF Opinion</u>

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 that a lack of these characteristics may limit establishment of the species.

They do not directly link this data to their decision to recommend no harvest of the species from its natural distribution areas, but it is likely it in part informed this conclusion.

1

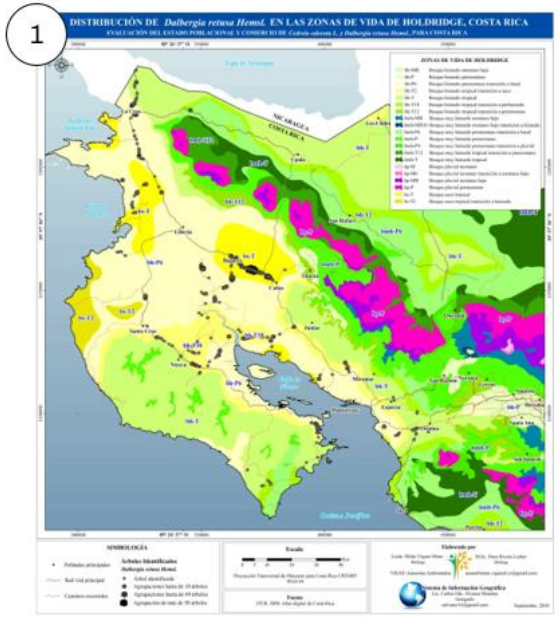


Figure 33. Distribution map of *Dalbergia retusa* Hemsl., by Life Zone, in Coast Delicious. 2010.
Prepared by H. Víquez, D. Rivera and C. Álvarez.

2

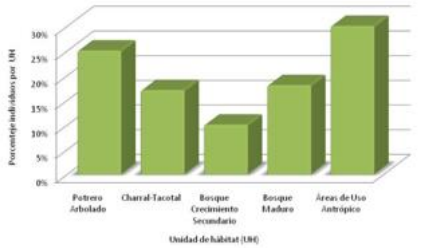


Figure 54. Habitat Units used by *Dalbergia retusa* Hemsl., for Costa Rica. 2010.

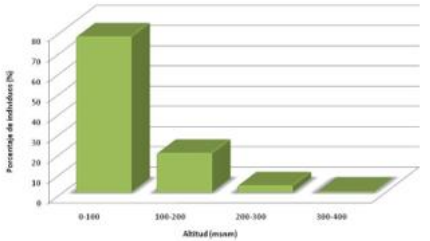


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Figure 36. Altitudinal levels (masl) and percentages (%) of individuals in which presents *Dalbergia retusa* Hemsl., in Costa Rica. 2010.

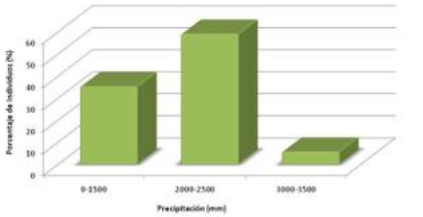


Figure 34. Precipitation levels (mm) and percentages (%) of individuals in which it occurs *Dalbergia retusa* Hemsl., in Costa Rica. 2010.

Challenges and opportunities (e.g. from a management perspective)

- **Before SC77, 29 CITES-listed rosewood tree species/taxa country combinations were subject to compliance procedures**
- **Close to 40% of Parties had established voluntary zero-export quotas**
- **Around a third had published NDFs**

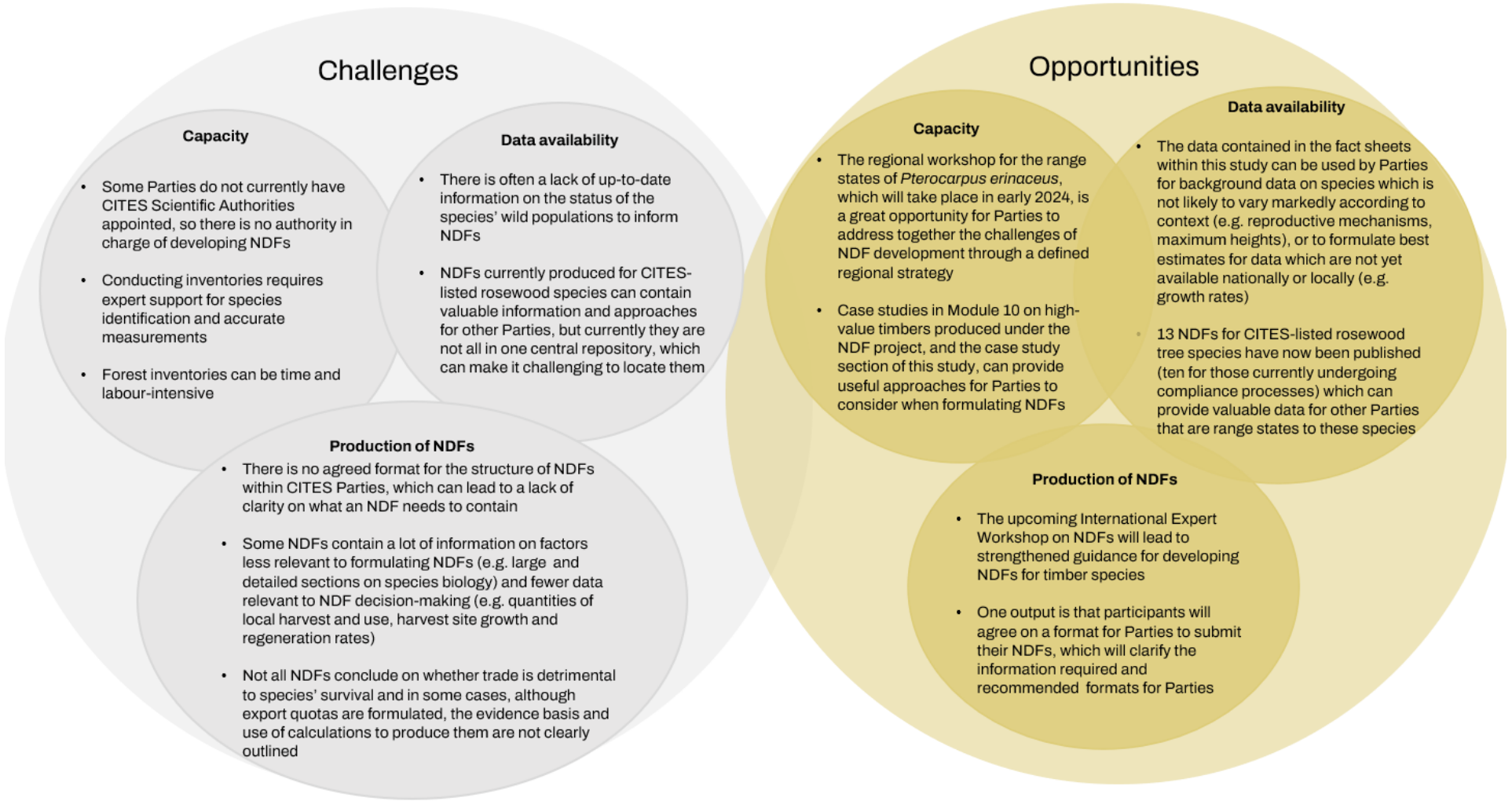
Species	Party	Article XIII	RST	Recommendation to suspend trade	Voluntary zero export quota	NDF (publicly) available
Pterocarpus erinaceus	Nigeria	Yes	Yes	Yes	No	No
Pterocarpus erinaceus	The Gambia	Yes	Yes	Yes	No	No
Pterocarpus erinaceus	Guinea Bissau	Yes	Yes	Yes	No	No
Pterocarpus erinaceus	Mali	Yes	Yes	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

Challenges and opportunities (e.g. from a management perspective)

- **Before SC77, 29 CITES-listed rosewood tree species/taxa country combinations were subject to compliance procedures**
- **Close to 40% of Parties had established voluntary zero-export quotas**
- **Around a third had published NDFs**

Species	Party	Article XIII	RST	Recommendation to suspend trade	Voluntary zero export quota	NDF (publicly) available
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
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

Challenges and opportunities (e.g. from a management perspective)



Challenges and opportunities (e.g. from a management perspective)

Reflections toward future recommendations for all rosewood tree species

- Starting with a quota in mind and using the NDF to verify if this is sustainable
- Using information from this study to provide background information for NDFs
- Focusing only on the information required for an NDF decision
- Using existing tools and guidance (e.g. Res. Conf. 16.7 (Rev. CoP17), Module 10 and the 9-step guidance)
- Regional collaborations for Parties producing NDFs for the same species
- Sharing NDFs in a central place, such as the CITES NDF database
- Production of an exemplar NDF

Challenges and opportunities for *Pterocarpus erinaceus*

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

- **The five NDFs publicly available were assessed against aspects recommended in NDFs**
- **Common strengths and gaps were identified and used to identify reflections toward future recommendations**

A. Species biology and life-history characteristics
(i) Habitat characteristics
(ii) Growth rate*
(iii) Characteristics of timber and tree e.g., diameter size, height, annual increment, minimum diameter at fruiting (e.g maturity)
(iv) Role of species in the ecosystem
(v) Resilience of timber and tree

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) Uses (domestic and international)*

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) Regeneration (or recovery capacity)*
(v) Minimum felling diameter*
(vi) Rotation cycle*
(vii) Annual allowable cut
(viii) Silviculture
(ix) Harvest techniques
(x) Conversion of standing tree volume to timber specimens or products*
(xi) Establishment of suitable harvest and export quotas

G. Population monitoring

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

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 the 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 the species in the ecosystems they inhabit within each country is often lacking due to insufficient evidence and studies
- Inventory data, as it not a one-off sample, cannot be 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 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 (which are a recommendation in all NDFs), would enable estimates of growth rates for the species in different habitat types and climatic conditions.
- Encourage research by relevant institutions into the role of the species within habitats where Parties intend to harvest from

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

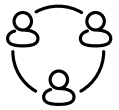
Gaps
- These data often come from a range of sources (e.g., herbarium specimens, anecdotal evidence, literature reviews, previous inventories) and are not the result of national large scale systematic surveys

Reflections [towards any future recommendations]
- Parties are encouraged, where possible, to collaborate with relevant agencies mandated to conduct forest inventories (e.g., concessions, forestry departments) to access data on species' distribution

Challenges and opportunities (e.g. from a management perspective)

Reflections toward future recommendations for *P. erinaceus*

Repeat inventories in the same area with the use of nationally standardised inventory protocols



Collaborations with agencies mandated to conduct national or concession-level forest inventories

Interviews and observations during inventories to collect other data relevant to NDFs

Worked examples of formulas used in determining export quotas to enable replication of methods by other Parties

Permanent sampling plots to inform more accurate calculations needed for export quotas

Regular reports and records of incidents of illegal trade and harvest

Sharing of forest management plans with time frames, actors responsible, and adaptive management strategies

Questions and feedback

With a focus on

- **The prioritisation exercise**
- **Alignment of the study with the guidance in Module 10**

Emails for any additional questions and feedback by Friday 8th December:

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Paola.Mosig@traffic.org