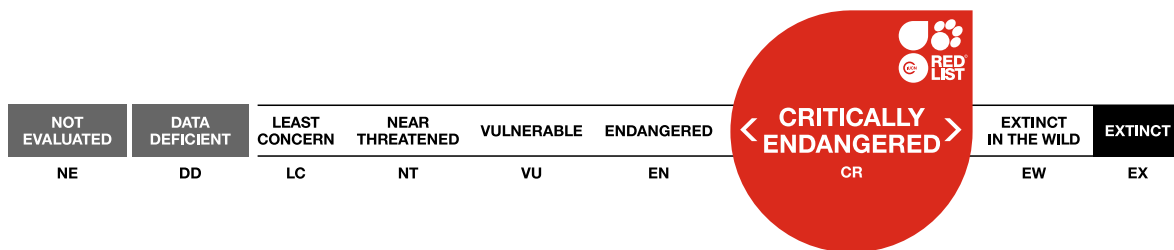


Dalbergia cochinchinensis, Siamese Rosewood

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Taxonomy

Kingdom	Phylum	Class	Order	Family
Plantae	Tracheophyta	Magnoliopsida	Fabales	Fabaceae

Scientific Name: *Dalbergia cochinchinensis* Pierre

Synonym(s):

- *Dalbergia cambodiana* Pierre
- *Dalbergia fusca* Pierre var. *enneandra* S.Q.Zou & J.H.Liu

Common Name(s):

- English: Siamese Rosewood, Rose Wood, Thailand Rosewood, Tracwood
- Central Khmer: Kra Nhoung
- Lao: Kha Nhoung
- Thai: Payung
- Vietnamese: Trac

Taxonomic Source(s):

WCVP. 2022. World Checklist of Vascular Plants (WCVP), version 2.0. Facilitated by the Royal Botanic Gardens, Kew. Available at: <http://wcvp.science.kew.org/>. (Accessed: 2022).

Assessment Information

Red List Category & Criteria: Critically Endangered A2cd+4cd [ver 3.1](#)

Year Published: 2022

Date Assessed: May 21, 2020

Justification:

Dalbergia cochinchinensis is a large, timber tree native to Cambodia, Lao PDR, Thailand and Viet Nam. The species has a wide geographic range but within this, the area of occupancy of the species is considerably small and the population is fragmented. This is due to the unsustainable harvest of this tree and habitat loss across the range of this species. This has driven the population of the species to experience a suspected population decline of at least 90% over a three generation window (1820 to 2120), with the majority of decline occurring in the last two decades, since the late 1990s.

Unsustainable, illegal harvest of the species is driven by demand on the international timber market for the species, as a source of hongmu timber. This timber is specifically used to produce expensive and luxurious Ming and Qing dynasty style furniture for a growing Chinese middle class. The threat to the species for this purpose is relatively recent and is thought to be caused due to the switch in trade from *Dalbergia odorifera* another rosewood species which had previously reached commercial exhaustion. The same is now happening to *Dalbergia cochinchinensis*. The illegal trade of the species is rife at all stages of the supply chain, sustained by the value of Siamese Rosewood on the market. Now not only are remaining mature trees targeted for timber harvest, but also tree stumps and roots to reach demand. The species has been listed on CITES Appendix II since 2013 the species however is still known

to be traded legally (on CITES trade database), illegally and to still be logged from the wild from protected areas. There is a need for improved enforcement of national and international legislation and tackling of corruption to be able to implement this policy effectively. Sanctions from countries in the EU and the US should be put in place against organised, illegal international trade of the species. Concerted effort for the *in situ* and *ex situ* conservation of the species is needed including surveys to document and protect remaining individuals in the wild.

Geographic Range

Range Description:

The species is native to Viet Nam, Cambodia, Thailand and Laos PDR (Niyomdham *et al.* 1997, POWO 2020). The species is widespread in most of its range states but is scattered within these.

In Cambodia it is recorded from the provinces of Kampong Thom, Kampong Speu, Preah Vihear, Ratanakiri, Pursat, Siem Reap, Kratie, Koh Kong, Stung Treng, and Modulrik (UNEP-WCMC 2018). In Lao PDR the species occurs in the southern provinces of Champasak, Attapeu and Sekong and the central provinces of Bolikhamsai and Khammouane (UNEP-WCMC 2018). In Viet Nam it also occurs in the south and center in the provinces of Da Nang, Quang Nam, Kon Tum, Gia Lai, Dak Lak, Lam Dong, Binh Duong, Dong Nai, Ba Ria-Vung Tau and Kien Giang (UNEP-WCMC 2018). In Thailand the species is mostly found in the North, Northeast and East regions of the country and has been recorded from 14 provinces.

A recent quantitative study based on species distribution modeling estimated the species' potential natural range at 441,912 km² (Gaisberger *et al.* 2022). Using herbarium and observation records the extent of occurrence is 624,595 km².

Country Occurrence:

Native, Extant (resident): Cambodia; Lao People's Democratic Republic; Thailand; Viet Nam

Population

This species experiences continuing population decline due to demand for rosewood timber on the international timber market. A major consumer of rosewood timber is China and there has been a boom in rosewood consumption in the country due to a growing wealth and a consequent demand for traditional Ming and Qing Dynasty style furniture made from hongmu or rosewood timber (Treanor 2015). *Dalbergia cochinchinensis* is listed as an official hongmu species hence it is under significant pressure in the wild. In general, global hongmu resources are considered by Treanor (2015) 'to be increasingly under threat from extinction'. The species has considerable value at all stages of the supply chain encouraging exploitation and is broadly considered one of the most expensive timber species in the world (CoP16 Prop. 60 2013). As the range of *D. cochinchinensis* neighbours China, it was one of the first species to be targeted for trafficking once China had depleted its national supplies of rosewood. Most rosewood trade into China (at least 50%) since the year 2000, is from *D. cochinchinensis* (EIA 2016a), therefore, there has been high pressure on rosewood populations in this region. However, considering the popularity of this species in trade over the last two decades, there is a paucity of population information available. Only Thailand has estimates of standing stock, and these were last estimated in 2011 (EIA 2016b). Also often population and trade data is not species specific and recorded at the generic or trade name level due to difficulty in distinguishing *Dalbergia* species at the point of trade.

In general across the range of the species the population is in decline due to over exploitation for timber and also due to conversion of lowland habitat to agriculture and settlement space. This decline, historically occurred at a faster rate due to the shift in trade and demand in China for *D. odorifera* at the beginning of the 21st century (EIA 2014). As resources of *D. cochinchinensis* have become more scarce, the trade has shifted to harvesting of the roots of the species rather than the logs (EIA 2016a, EIA 2016b), but still remains high. Root harvesting is observed across Cambodia. Remaining mature trees are still logged from inside and outside of protected areas (EIA 2014) and there are continued pressures from development within the species' range states. Siamese rosewood that now finds its way onto the timber market often has a small diameter (Treanor 2015).

Remaining individuals are found in pockets of protected areas, occurring in increasingly low densities and subpopulations are isolated from each other (Moritsuka *et al.* 2017, Hartvig *et al.* 2018). The species has relatively high overall levels of genetic diversity, but the level varies considerably across its range, with highest level of diversity found in the center of the distribution area in Cambodia and eastern Thailand, and lower levels in peripheral populations in Northeast Thailand, Laos PDR and Viet Nam (Hartvig *et al.* 2018, Hartvig *et al.* 2020). Studies report a very high level of genetic differentiation among populations in the species (Moritsuka 2017, Hartvig *et al.* 2018, Hartvig *et al.* 2020), which suggests very limited gene flow among populations and regions. The species frequently regenerates from root suckers, and in some subpopulations the level of clonality can be high (Hartvig *et al.* 2020). The effective population size can, therefore, be smaller than expected from number of individuals observed in natural subpopulations. There is no observed inbreeding in the species, but observed selfing in disturbed subpopulations suggest that this could potentially be a problem in small, isolated populations (Hartvig *et al.* 2018).

D. cochinchinensis is fast growing in young stages, but is a medium pioneer species (So 2000, So *et al.* 2010). It has a high seed set and seedling growth rate but very few trees reach maturity (CoP16 Prop60 2013, Winfield *et al.* 2015). These attributes require the species to have a long harvest (CoP16 Prop60

2013) rotation cycle and selective, sustainable logging methodology in place to enable regeneration. Further, clonal reproduction from root suckers may be mistaken for seedling regeneration. This raises additional concern about the population status in the future and ability to recover from historical logging.

In 2011 Thailand reported a standing stock of 63,000 m³ of *D. cochinchinensis* (COP13 Prop60 2013) which is equivalent to 80,000 to 100,000 trees (CoP16 Prop60 2013). The current volume of standing stock is unknown, but is likely to be much less than the 2011 estimate. Decline of the species in Thailand since 2013 is considered limited due to strict protective measures in place. However, information on decline before 2013 is not available and remaining trees are now, broadly speaking, only present in protected areas and the species is still thought to experience some decline due to habitat loss and illegal logging operations in the country. In 2013, Thailand reported that it had less than 1,000 km² of suitable habitat left for the species, and only around 10% of this was in a protected areas (CoP16 Prop60 2013). In Thailand, it is reported that even the roots of the species are taken at the point of felling, due to high demand (CoP16 Prop60 2013). The demand causes illegal harvest of trees from Thai national parks, especially those bordering Laos PDR and Cambodia where timber smugglers cross borders into the parks and poach rosewood trees. Due to limited national park staff capacity compared to the well-equipped and resourced timber poachers, illegal timber harvest is still a major continuing threat to the species in Thailand (Arnold 2013, Stokes 2017, Solomon and Paddock 2019). The species is grown in some plantations in Thailand.

In Cambodia the species is subject to illegal logging, causing national level population decline. Despite an export ban on round logs, established in 2002, and a ban of rosewood harvest declared in 2013, the species is still at risk in the country as these policies lack enforcement (Treanor 2015). Rosewood trade is considered 'a multimillion dollar smuggling operation in Cambodia' (Global Witness 2015). Between 2013 and 2014, the extent of hongmu export increased by 150% (Global Witness 2015). Much of the timber from Cambodia is laundered through Economic Land Concessions (ELC), which are granted to clear forested land for agricultural development (Treanor 2015). However, these have been historically used to target areas with rosewood density and clearance for timber occurs outside the limits of the ELC. The use of ELCs has caused the loss of at least 20% of Cambodian primary forest (data from 2010) (Treanor 2015). The remaining individuals of *D. cochinchinensis* are mostly restricted to protected areas and the species is considered rare (UNEP-WCMC 2018). Subpopulations in Cambodia are relatively diverse, but highly differentiated, likely due to limited gene flow across landscape barriers (Moritsuka *et al.* 2017, Hartvig *et al.* 2018) some healthy subpopulations exist ie. in Siem Reap and Kampong Speu provinces (Moritsuka *et al.* 2017, Hartvig *et al.* 2018). Reports by Cambodia Human Rights Task Forces (CHRTF 2020) and by Global Initiative against Transnational Organised Crime (2021) documented widespread illegal logging and export of *D. cochinchinensis* by well connected logging cartels in collusion with authorities.

In Lao PDR the species is 'over exploited and threatened in protected areas' (EIA 2016b). Complete population data for Lao PDR is not known. However, in 2011, between 40,000 and 60,000 m³ was recorded to be exported from the country (Treanor 2015) suggesting a high level of decline in the standing stock of the species. This is supported by evidence gathered by EIA in 2016b which stated that 'field surveys in 2012 in two provinces ... found no mature individuals and all trees with a DBH of > 15cm to have been logged, even within strictly protected areas'. Lao PDR is considered to have been under-reporting the volume of *D. cochinchinensis* exported from the country. Timber of this species is known

to be smuggled across bordering countries and misdeclared at customs (Treanor 2015). In the country the species, it is anecdotally considered to be at risk of extinction within the next 10 years from the country (EIA 2014). Most rosewood now traded in Lao PDR is considered smuggled from Thailand, as even trees providing up to 2 m³ of timber are now rarely found in Lao PDR (EIA 2014).

In the 2016(b) EIA report 'Red Alert' it stated 'total imports of Siamese Rosewood reported to the CITES secretariat between 2013 and 2014 are equivalent to 120% of Thailand's standing stock'. Most of the imports were recorded to be sourced from Laos PDR and Cambodia and totalled 62,253 m³ (EIA 2016b). The majority of this is thought to have been harvested before *Dalbergia* species were listed on CITES Appendix II. However, this in turn, highlights the demand and plight the species faces, even in the wake of international conservation policy.

In Viet Nam, the species has a low population density of 1 to 10 trees per hectare in protected areas (CoP16 Prop. 60 2013). In the country it was also considered that 50–60% population decline has occurred in the last five to ten years (CoP16 Prop. 60 2013). No trade of the species has been reported from Vietnamese stocks since 2014 (UNEP-WCMC 2018), which is likely due to exhaustion of the species (as reported in EIA 2014) and listing of the species on CITES Appendix II in 2013. However Viet Nam remains an important transit hub for the species (Winfield *et al.* 2016) with a large volume of timber (including reports of *D. cochinchinensis*) being trafficked between Cambodia and Viet Nam (EIA 2017). EIA investigations found warehouse along the Cambodian border of several hundred tonnes of *D. cochinchinensis* that had been illegally cut and was to be transported to Viet Nam (EIA 2018). Cambodian logs can be 'legalised' upon entry over the border at Viet Nam. Logging in Cambodia was encouraged by quotas from Viet Nam and occurred in protected areas in 2016-17 (EIA 2017) but this system has since changed (in 2018 - EIA 2018) but there is still high quantities of Cambodian timber being taken across the border to Viet Nam in complete disregard for Cambodian timber ban (EIA 2018) and CITES listing of the species.

Globally some would consider species of Siamese Rosewood as commercially extinct (EIA 2016a, 2016b) in parts of its range. Considering the population decline anecdotally recorded from each range state and the growing price of the species on timber markets, which suggests an increasing rarity from wild sources, the population of the species is considered to experience decline of at least 90% over a three generation window, with the majority of the decline concentrated between 2000 and 2013.

Globally some would consider species of Siamese Rosewood as commercially extinct (EIA 2016a, 2016b) in parts of its range. Each country where the species is found reports a high level of population decline: in Laos despite surveys no mature trees were found, in Thailand the species now only remains in Protected Areas and in Cambodia the species has declined due to illegal harvest and targeting from ELC's. Additionally in some parts of the ranges of the species due to a lack of trees (and where only tree stumps remain) the roots are now harvested to meet a continuing demand for rosewood. Considering the population decline anecdotally recorded from each range state and the growing price of the species on timber markets, which suggests an increasing rarity from wild sources, the population of the species is considered to experience decline of at least 90% over a three generation window, with the majority of the decline concentrated between 2000 and 2013. Decline is continuing and in addition, a quantitative vulnerability assessment indicates that 7% of the total modeled distribution range of *D. cochinchinensis* is under medium to very high threat from climate change by 2055 (Gaisberger *et al.* 2022). If stumps or roots are left, there is potential for the species to coppice and regenerate allowing the population to

recover but more information is needed to confirm to what extent these occur in the wild.

Current Population Trend: Decreasing

Habitat and Ecology (see Appendix for additional information)

This is a large evergreen tree species, reaching from 15–35 m in height and producing boles from 60 to 120 cm in diameter at breast height (Eiadthong and Tangmitcharoen 2015). It is found in lowland mixed deciduous or dry evergreen forests (Moritsuka 2017). It also occurs sparsely in open, semi-deciduous forests from 400 – 500 m asl. It can occur at higher elevations but is then less frequent. It is also an occasional in riparian or evergreen forest (CoP16 Prop60 2013). It is known as an intermediate pioneer species (So *et al.* 2010). As a seedling the species is light demanding but requires forest cover for continued vigour. In general the species is slow growing, with few trees reaching maturity. The species can also reproduce through coppicing and root suckering (CTSP 2004, So *et al.* 2010, Hartvig *et al.* 2020). In most countries flowering occurs from March to June and fruiting is usually completed by December the same year (CoP16 Prop60 2013). However, large trees capable of flowering and fruiting are rare (Moritsuka *et al.*, 2017). The species is assumed to be insect-pollinated, and the fruits to be wind-dispersed because of the flattened seedpods (Moritsuka *et al.*, 2017, Hartvig *et al.* 2018).

Systems: Terrestrial

Use and Trade

This species is primarily used for timber. The species is traded under the names Siamese rosewood, Thai Rosewood, Vietnamese Rosewood and Trac wood. The species produces a red to dark red heartwood which is durable and has a fine grain. It is classified as one of only 33 official hongmu producing trees (EIA 2014). It is therefore in high demand to produce fashionable and luxurious Ming and Qing Dynasty furniture in China (Treanor 2015). The species is one of the most desirable hongmu producing trees and therefore one of the most expensive (EIA 2014). The timber can also be used for interior decoration, fire art articles and carving, musical instruments and some construction activities (Winfield *et al.* 2016). The root of trees are often logged to supply wood for carvings. In 2013, 2,588 m³ of *Siamese* rosewood was shipped from Viet Nam to China.

In 2008 the commercial value of sawn wood was between US\$ 1,900 and \$3,900 per/m³ and in the same year round logs were between US\$ 1,500 and \$2,000 per/m³ (Winfield *et al.* 2016). Since then prices have increased dramatically due to the growing rarity of the species, continuing demand and the illegal trading. The wood is not locally popular, so logging is primarily driven by international demand. However, the species has been used locally for crafts and furniture, as well as for stilts and construction of houses before broad international demand began (van Sam *et al.* 2004, CTSP 2004). In Viet Nam it is classified as first class prime timber, used for furniture (beds, wardrobes, desks, etc.), wood turnery, fine-art articles, musical instruments and sewing-machines.

The species is listed on CITES to protect it in international trade, requiring permits at import and export for the trade of the species, adherences to quotas and knowledge of the origin and harvest procedure. Many countries also have export bans for Siamese Rosewood (Treanor 2015). However there is limited capacity to enforce regulation and much of the trade of the species is now through illegal activities (EIA 2014). Following CITES trade database (downloaded May 2020), since 2013 31,131 m³ of logs have been imported, 9,832 m³ of sawn wood and 53,059 m³ of timber/timber pieces with the main players in this

being Laos PDR, Viet Nam and China. Much of this trade occurred in the year following the listing of *Dalbergia* species in which over 62,253 m³ was registered to have been imported between 2013 and 2014 (EIA 2016b). Log sale may be from harvest of the species prior to CITES listing but this requires further investigation.

This tree also confers some medicinal value (Xu *et al.* 2019, Liu *et al.* 2016). Parts can be boiled to treat syphilis and as an anti-tumour treatment.

Threats (see Appendix for additional information)

A quantitative vulnerability assessment indicates that 76% of the total modelled distribution range of *D. cochinchinensis* is under medium to very high threat from the combination of current threats (overexploitation, habitat conversion, fire, and overgrazing (Gaisberger *et al.*, 2022). Illegal logging of the species is driven by the demand and preference for the species as a hongmu producing timber (Treanor 2015). The threat to this species has only emerged in the last two decades, since the late 1990's, due to the 'boom and bust' cycles of rosewood production and use. Unsustainable harvest of the species began when stocks of Chinese Rosewood *Dalbergia odorifera* were commercially exhausted and an alternative supply was needed (EIA 2016a, EIA 2016b). This shifted pressure to the wild population of *D. cochinchinensis* to meet a growing demand.

In most parts of its range mature trees of the species are actively poached (EIA 2014). Scouts are thought to be driven to these activities due to poverty. Bribery and the illegitimate issuing of land clearance permits (the boundaries of which are often exceeded) (EIA 2014, Treanor 2015) also take place. In the EIA 2014 report 'Routes to Extinction', it is stated that 'many populations of those [rosewood] species are being methodically exhausted [in the region] in order to meet demand'.

Many countries have policies to prevent the export of round logs. However, there is limited capacity to enforce these policies and it can often be dangerous, due to the power held by illegal crime syndicates (EIA 2016b). This means that trees are targeted and logged for timber even in national parks and other protected areas (EIA 2014). This is a major concern in Thai national parks bordering Cambodia because since 2010 these parks have seen an increase in Cambodian timber hunters poaching *D. cochinchinensis* (Arnold 2013, Stokes 2017, Solomon and Paddock 2019). This activity is reported from Ta Phraya National Park (Solomon and Paddock 2019) and Thap Lan National Park (Stokes 2017).

The species is also biologically predisposed to threat from logging activities because of the long life cycle, often requiring multiple decade to reach maturity and become of harvestable diameter. Although some seedlings and seed set were witnessed in the wild (Treanor 2015, Winfield *et al.* 2016), regeneration to juvenile and mature trees is even more limited. Loss of habitat limits the area in which the species can regenerate, logging activities create an inhospitable environment for regeneration and logging of mature trees reduce the possibility of cross pollination and seed set. These factors all contribute to the future decline of the species and may be further exacerbated by climate change.

Mining activities and dam construction are considered a threat to the species in Thailand (EIA 2014). In Cambodia, Economic Land Concessions (ELC) causes the clearance of forested land for agricultural development, sometimes in sites of rosewood (Treanor 2015). The granting of ELCs have caused a 20% loss of Cambodian lowland forest over the last few decades. Very little lowland areas are adequately protected in the range of the species, therefore habitat loss is a continuing threat to the species (CoP16

Prop 60 2013).

Conservation Actions (see Appendix for additional information)

There are country level conservation practises and policies in place for the species which are upheld to varying degrees.

- In Cambodia, the species is defined as a priority species for conservation and protected by Cambodian Forestry Law from 2002 (CTSP 2004). There is a ban on the processing, use and export of the species since 2013. Additionally, a network of conservation stands has been protected by Ministerial Declaration in order to preserve the genetic variation within the species. The conservation stands may serve as future seed sources for future replanting and plantation programme. A restoration programmes for the species occurs at Khun Ream commune, Siem Reap, where a natural stand of mature trees has been strictly preserved. Trial plantations were established in Kbal Chay watershed area, Sihanouk province, in 2004. A grafted seed orchard (0.45 ha) was established by a farmer in Pursat province for seed production (with technical and financial support from the UK Darwin Initiative).
- In 2008 Lao PDR banned the logging of *D. cochinchinensis* and in 2011 it banned the export of timber from the species. Also, under 2007 Lao PDR Forestry Law efforts should be made to enrich non-timber products from forest trees, this includes surveying and planning conservation of threatened species (Winfield *et al.* 2016). Recently, the Government of Lao is taking in more actions to conserve the species in the revised Forestry Law in 2019 (GoL 2019) and has listed species in the Tree List I of prohibited tree species (MAF 2021)
- In Thailand the species is specifically restricted timber and since 1989 there has been a logging ban of Natural Forest Specimens (Winfield *et al.* 2016). In Thailand the species remains present in protected areas (CoP16 Prop 60 2013).
- In Viet Nam, use of the species is only accepted for scientific purposes (including breeding and artificial propagation). Commercial harvesting was banned in 2014 (EIA 2012). The country passed an original logging ban in 1992, which was expanded in 2006 to include logs and sawn wood from natural forests, excluding plantations. The country has also ratified CITES and initiated the EU FLEGHT VPA (EIA 2018), but despite this between 2016-17 there were quotas to encourage timber trade across the border between Viet Nam and Cambodia with protected areas (in Cambodia) targeted for the harvest of such timber (EIA 2017). EIA 2017, also found that records of timber imports into Viet Nam are much lower than those from countries exporting to Viet Nam, therefore more work needs to be done to improve transparency and discourage illegal logging activities in Viet Nam.

The species is on CITES Appendix II along with all other species of *Dalbergia*. This requires declaration at import and export of trade in *Dalbergia cochinchinensis* for records and correct permits to be held by importers and exporters who act as limit to trade. It is also difficult to identify some species of *Dalbergia* at the point of export due to similarities in the heartwood between rosewood producing *Dalbergia* spp.. Therefore often the species is misdeclared as a less valuable timber on customs and export papers. National legislation to protect the species is affected by this misdeclaration practice making protective laws harder to implement.

The species is assessed as Endangered in the Viet Nam Red Data Book for Plants (2007). The species was also assessed as Vulnerable on the IUCN Red List in 1998 (Asian Regional Workshop 1998). The species is found in some protected areas however the adequacy of these sites is limited by funds and ability to police them. It is still known that individuals of *D. cochinchinensis* are removed from protected areas. Better enforcement alongside the expansion of designated protected areas specifically targeted to the

protection of Siamese Rosewood is needed.

A recent quantitative study based on species distribution modeling estimated that populations in the following ecoregions are particularly underrepresented in protected area networks: Chao Phraya lowland moist deciduous forests, Northern Indochina subtropical forests, Northern Khorat Plateau moist deciduous forests, and Northern Thailand – Laos moist deciduous forests (Gaisberger *et al.* 2022).

In general more information on the remaining stands of the species needs to be collected including locality information in less surveyed and more remote areas in the region, so the species can be effectively conserved *in situ* across its distribution area. Given the high level of genetic differentiation and possible high level of local adaptation, *in situ* conservation should consist of a network of subpopulations across its range states in order to represent broad genetic variation in the species and ensure sufficient genetic variation for long-term viability and adaptability of the species (Hartvig *et al.* 2018, Hartvig *et al.* 2020, Gaisberger *et al.* 2022.). The continued level of illegal logging and the limited enforcement of protection measures also calls

for a broad *ex situ* conservation program, that preferably should be based on germplasm collection from a similar network of populations across the distribution area. Given the scarcity of mature fruiting individuals in natural populations, collection of germplasm and propagation of *ex situ* stands may rely on vegetative propagation methods, which have been developed in Cambodia (IFWRD 2021).

As part of a regional project “Conserving Rosewood Genetic Resources for Resilient Livelihoods in Greater Mekong” (UK Darwin Initiative in 2018-2022), four new *in situ* reserves and five new *ex situ* reserves were established for the species. The *in situ* reserves are in Cambodia (established by the Institute for Forest and Wildlife Research and Development, one reserve), Lao PDR (National Agriculture and Forestry Research Institute, NAFRI, two reserves) and Viet Nam (Vietnamese Academy of Agricultural Sciences, one reserve). The *ex situ* reserves are in Cambodia (2) Lao PDR (2), and Viet Nam (1).

All national and international policy should remain in place and be further enforced and enhanced to reduce the illegal logging and trade of the species. International sanctions should be used to control organised illegal trade of the species. US Treasury under the Global Magnitsky Act sanctioned in 2019 a notorious Cambodian rosewood dealer and businesses related to him for corruption and misappropriation of state assets (US Department of Treasury, 2019). EU and other countries can impose similar sanctions to increase pressure on operators in illegal trade.

Credits

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External Resources

For [Supplementary Material](#), and for [Images and External Links to Additional Information](#), please see the Red List website.

Appendix

Habitats

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Habitat	Season	Suitability	Major Importance?
1. Forest -> 1.5. Forest - Subtropical/Tropical Dry	-	Marginal	-
1. Forest -> 1.6. Forest - Subtropical/Tropical Moist Lowland	-	Suitable	Yes

Plant Growth Forms

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Plant Growth Form
TS. Tree - small
TL. Tree - large

Use and Trade

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

End Use	Local	National	International
3. Medicine - human & veterinary	No	Yes	No
9. Construction or structural materials	Yes	Yes	Yes
11. Other household goods	No	No	Yes
12. Handicrafts, jewellery, etc.	No	No	Yes

Threats

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Threat	Timing	Scope	Severity	Impact Score
1. Residential & commercial development -> 1.1. Housing & urban areas	Ongoing	Minority (50%)	No decline	Low impact: 4
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
1. Residential & commercial development -> 1.2. Commercial & industrial areas	Ongoing	Whole (>90%)	Very rapid declines	High impact: 9
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
2. Agriculture & aquaculture -> 2.1. Annual & perennial non-timber crops -> 2.1.1. Shifting agriculture	Past, unlikely to return	Minority (50%)	Causing/could cause fluctuations	Past impact

	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
2. Agriculture & aquaculture -> 2.1. Annual & perennial non-timber crops -> 2.1.3. Agro-industry farming	Ongoing	Whole (>90%)	Very rapid declines	High impact: 9
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
2. Agriculture & aquaculture -> 2.2. Wood & pulp plantations -> 2.2.2. Agro-industry plantations	Ongoing	Majority (50-90%)	Very rapid declines	High impact: 8
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
3. Energy production & mining -> 3.3. Renewable energy	Ongoing	-	Rapid declines	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
5. Biological resource use -> 5.3. Logging & wood harvesting -> 5.3.2. Intentional use: (large scale) [harvest]	Ongoing	Majority (50-90%)	Rapid declines	Medium impact: 7
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
11. Climate change & severe weather -> 11.1. Habitat shifting & alteration	Future	Minority (50%)	Causing/could cause fluctuations	Low impact: 3
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
11. Climate change & severe weather -> 11.2. Droughts	Ongoing	Minority (50%)	Causing/could cause fluctuations	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
11. Climate change & severe weather -> 11.3. Temperature extremes	Ongoing	Minority (50%)	Causing/could cause fluctuations	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		

Conservation Actions in Place

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Conservation Action in Place
In-place land/water protection
Occurs in at least one protected area: Yes
In-place species management
Subject to ex-situ conservation: Yes
In-place education
Included in international legislation: Yes
Subject to any international management / trade controls: Yes

Conservation Actions Needed

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Conservation Action Needed
1. Land/water protection -> 1.1. Site/area protection

Conservation Action Needed
1. Land/water protection -> 1.2. Resource & habitat protection
2. Land/water management -> 2.1. Site/area management
2. Land/water management -> 2.3. Habitat & natural process restoration
3. Species management -> 3.1. Species management -> 3.1.2. Trade management
3. Species management -> 3.2. Species recovery
3. Species management -> 3.3. Species re-introduction -> 3.3.1. Reintroduction
3. Species management -> 3.3. Species re-introduction -> 3.3.2. Benign introduction
3. Species management -> 3.4. Ex-situ conservation -> 3.4.1. Captive breeding/artificial propagation
3. Species management -> 3.4. Ex-situ conservation -> 3.4.2. Genome resource bank
4. Education & awareness -> 4.3. Awareness & communications
5. Law & policy -> 5.1. Legislation -> 5.1.1. International level
5. Law & policy -> 5.1. Legislation -> 5.1.2. National level
5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.1. International level
5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.2. National level
6. Livelihood, economic & other incentives -> 6.1. Linked enterprises & livelihood alternatives
6. Livelihood, economic & other incentives -> 6.4. Conservation payments

Research Needed

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Research Needed
1. Research -> 1.2. Population size, distribution & trends
1. Research -> 1.5. Threats
2. Conservation Planning -> 2.1. Species Action/Recovery Plan
2. Conservation Planning -> 2.2. Area-based Management Plan
3. Monitoring -> 3.1. Population trends
3. Monitoring -> 3.2. Harvest level trends
3. Monitoring -> 3.3. Trade trends
3. Monitoring -> 3.4. Habitat trends

Additional Data Fields

Distribution
Estimated extent of occurrence (EOO) (km ²): 624595
Lower elevation limit (m): 0
Upper elevation limit (m): 700
Habitats and Ecology
Generation Length (years): 50

The IUCN Red List Partnership



The IUCN Red List of Threatened Species™ is produced and managed by the [IUCN Global Species Programme](#), the [IUCN Species Survival Commission \(SSC\)](#) and [The IUCN Red List Partnership](#).

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