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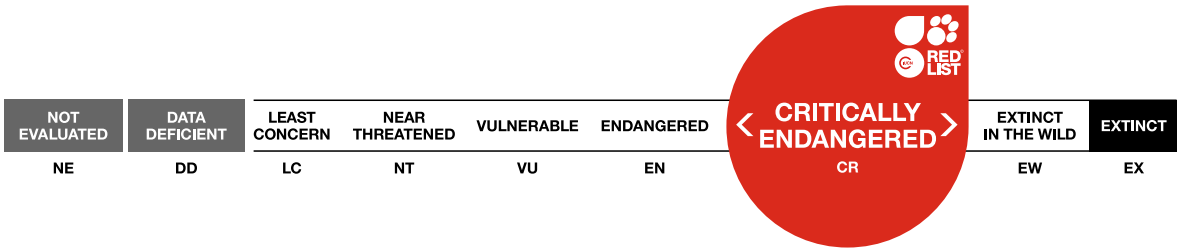
Dalbergia oliveri, Tamalan

Assessment by: Barstow, M. *et al.*



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Taxonomy

Kingdom	Phylum	Class	Order	Family
Plantae	Tracheophyta	Magnoliopsida	Fabales	Fabaceae

Scientific Name: *Dalbergia oliveri* Gamble ex Prain

Synonym(s):

- *Dalbergia bariensis* Pierre
- *Dalbergia dongnaiensis* Pierre
- *Dalbergia duperreana* Pierre
- *Dalbergia mammosa* Pierre

Common Name(s):

- Burmese: Tamalan, Chingchan
- English: Burmese Rosewood
- Central Khmer: Neang Nuon
- Lao: Kampee, Mai Kor Phee, Pa Dong Daeng
- Thai: Mai Ching Chan
- Vietnamese: Cam Lai

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+3cd+4cd ver 3.1

Year Published: 2022

Date Assessed: July 3, 2020

Justification:

Dalbergia oliveri (Burmese Rosewood) is native to Thailand, Cambodia, Viet Nam, Myanmar and Laos PDR. The species has a wide geographic range, and is widespread in each country within its range however the subpopulations are small and scattered. The species was once more common and widespread, however in recent years the species has come under increasing pressure from the international timber market. This is due to a rise in demand for rosewood timber for the production of hongmu furniture within China and Viet Nam with China as the major consumer. Imports of Rosewood to China have increase by 65-times since 2005, including imports of this species. Already, half of China's rosewood is from range states of *Dalbergia oliveri.* Demand on the species has also increased as other species of hongmu timber producing trees have declined in the wild and are also put under increasing conservation protocol, causing a shift in harvest to *D. oliveri.* Overexploitation is also driven by corruption in political systems and crime syndicates, who can target *D. oliveri* trees for harvest in National Parks and through the guise of land development (as is the case in Cambodia). Due to the value earned for *D. oliveri* logs on the international market, there is drive to keep harvesting the trees even

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though they become rarer and there is also increasing risk.

Complete population information is not available for each country in it's range. However, the greatest loss is recorded from Myanmar where the species is predicted to reach commercial exhaustion between 2016 and 2023. In Viet Nam, rosewood species (not just *D. oliveri*) are considered to have declined by 50 to 60% in the last few decades and in Thailand rosewood trees now only remain in protected areas. Therefore, it is suspected that the population of the species has experienced a decline of at least 80% in the last three generations, and decline will continue at a similar rate into the future. Decline is continuing due to limited capacity to police the illegal logging of the species due to corruption and expense. There is also continuing decline due to lowland forest loss. The species is therefore assessed as Critically Endangered.

Geographic Range

Range Description:

This species is native to Laos PDR, Myanmar, Cambodia, Thailand and Viet Nam. The species is widespread in Cambodia, Laos PDR and Myanmar. In Thailand the species is found in the Northeast of the country (Winfield 2016). A recent quantitative study based on species distribution modeling estimated the species' potential natural range at 997,383 km^2 (Gaisberger *et al.* 2022).

Using herbarium records, field surveys and observations it is calculated that the species has an extent of occurrence of 1,489,222 km^2.

Country Occurrence:

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

Population

Currently this species is the main target for rosewood trade in Southeast Asia (CoP17 inf 79. 2017). Therefore, 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 oliveri* is listed as an official hongmu species hence it is under significant pressure in the wild from timber harvest. In general, global hongmu resources are considered by Treanor (2015) 'to be increasingly under threat from extinction'. Specifically to this species, a 2016a EIA*)* report stated that 'the commercial extinction of Burmese Rosewood is imminent'. The species has considerable value at all stages of the supply chain encouraging exploitation and is broadly considered to be one of the most expensive timber species in the world (CoP16 Prop. 60 2013). The majority of rosewood trade into China (at least 50%) since the year 2000, is from *D. oliveri* range states (CoP17 inf 79 2015, EIA 2016a), therefore there has been high pressure on rosewood tree stocks in this region. *Dalbergia oliveri* alone contributes to one third of all rosewood trade in to China (CoP17 inf 79 2016). However, considering the popularity of this species in trade over the last two decades, there is a paucity of population information available for the species. 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 overexploitation for timber and also due to conversion of lowland habitat to agriculture and settlement space. This rate of decline has increased in the last decade, as there has been a shift in demand from the desirable and now increasingly rare species of *Dalberia cochinchinensis* (common name Siamese Rosewood) to *Dalbergia oliveri* (EIA 2016a). This has occurred due to the continuing high demand for hongmu, additional protective conservation measures targeted at *D. cochinchinensis* and the declining stocks of other hongmu producing species across the globe, leaving *D. oliveri* under high pressure in the wild. This has slowed down the population decline, but mature trees are still taken from inside and outside of protected areas (EIA 2014) where they are found and there are continued pressures from human development within the species' range states.

Like other species of *Dalbergia* this species is slow growing (CTSP 2004). Seed production is generally sufficient but can vary widely between individuals and subpopulations (CTSP 2004), natural regeneration is limited (Aerts *et al*. 2009) and seedlings grow slowly compared to *D. cochinchinesis* (I. Theilade and T. So, pers. comm.) so very few trees reach maturity (Winfield *et al.* 2016). 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. However, this has not occurred for the species and now regeneration is only occasionally observed in the wild (Winfield *et al.* 2016). Seed production varies between individuals, and the trees do not necessarily bear seed every year. The species is able of coppice regeneration from stumps and clonal reproduction from root suckers (Hartvig *et al.* 2018, So *et al.* 2010), and seed regeneration and shoots from root suckers may be difficult to distinguish. This raises additional concern to the population status of the species in the future and ability to recover from historical logging. The species exhibit high levels of genetic diversity (Hartvig *et al*. 2018), but in some subpopulations level of clonality can be high (Hartvig *et al*. 2018) and thus the effective population size can be smaller than expected from number of individuals observed in natural subpopulations. Levels of genetic diversity vary considerably across the range of the species, most diverse subpopulations are

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found in central Cambodia and least diverse in Southeast Cambodia and Viet Nam and a high levels of genetic differentiation across the distribution area indicates somewhat limited level of gene flow among regions (Hartvig *et al*. 2018). There are currently no signs of inbreeding in the species (Hartvig *et al*. 2018).

In Cambodia the species is widespread, however, subpopulations are small and dispersed (Hartvig *et al.* 2018). It is found in Koh Kong, Kampong Speu, Kampong Chhnang, Pursat,Preah Vihear, Mondul Kiri, Ratanak Kiri, Stoeng Treng, Kratie, Battambang and Kampong Thom provinces. Important sites include the Cardamom mountains, Keo Seima Protection Forest and Tbeng Meanchey in Preah Vihear, but all are subject to illegal logging. The species experiences high local loss and very few trees that can be used as seed sources remain present (Winfield *et al.* 2015). This has been caused due to overexploitation for timber despite an export ban on round logs, established in 2002, and a ban of rosewood harvest declared in 2013 (Treanor 2015, EIA 2016b). The species is still at risk in the country as these policies lack enforcement capacity (Treanor 2015) and due to corruption. Between 2013 and 2014, the extent of hongmu export has increased by 150% (Global Witness 2015). The expansion of human settlement and agricultural development is also a major threat to the species in Cambodia. This is mostly done through the over provision of Economic Land Concessions (ELC), which are used to clear forested land for agricultural development (Treanor 2015). However, permits that allow too much land to be cleared are often offered and they have historically been given to foreign investors and timber companies (Global Witness 2015). They are also given for areas with a high rosewood density contributing further to the species decline. The use of ELC permits has caused the loss of at least 20% of Cambodian primary forest (data from 2010) (Treanor 2015), which will have had a negative impact on the species.

There is limited population information for this species in Laos PDR. Illegal logging has been observed from subpopulations in national parks (Hartvig, pers obs). Field surveys by the National Agriculture and Forestry Research Institute (NAFRI) in 2021-2022 in the provinces of Bolirkhamsay, Khammouan, Savannaketh, Salavan, Champasak and Attapue found very few large trees across all forest classes. Trees remain mainly on farmlands and are small to medium-sized. Alongside Cambodia, Lao PDR is one of the main contributors of rosewood to China and between 2013 and 2014 exports of Rosewood (*D. cochinchinensis* and *D. oliveri*) from these two countries increased by 150% (Global Witness 2015). This suggests significant demand for Burmese rosewood from Laos PDR and significant pressure and loss of the subpopulation here.

In general, in Viet Nam rosewood stock is suspected to have declined by 50 to 60% in the last five to ten years (CoP16 Prop. 60 2013). In the past 60 years the species has been mostly lost from Tai Phu Forest, where it was once the dominant species (Winfield *et al.* 2016) and additionally across the country the species is considered to be becoming locally extinct (Winfield *et al.* 2016). Viet Nam acts as the main transit pathway for rosewood timber to China, and mostly registers imports of 'Rosewood' not exports (UNEP - WCMC 2018). There is a high occurrence of trafficking of timber across the border between Cambodia and Viet Nam as reported by EIA in 2017 and 2018, with Cambodian logs being 'legalised' upon entry over the border at Viet Nam. Logging was encouraged by quotas 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 (and likely *D. oliveri*) being taken across the border to Viet Nam in complete disregard for Cambodian timber ban (EIA 2018).

In Thailand the species is under similar pressures across it's range. It is likely that the species exists in

protected areas alongside, *Dalbergia cochinchinensis.* Siamese Rosewood in National Parks is still at risk in Thailand, due to the illegal timber trade, timber smuggling and poaching (Arnold 2013, Stokes 2017, Solomon and Paddock 2019). As *D. oliveri* grows in similar habitats to *D. cochinchinensis* and is found alongside this species it is also likely that *D. oliveri* in Thailand is at risk of poaching from these areas, although never explicitly stated. Further information on *D. oliveri* standing stock in Thailand should be collected (as has been done for *D. cochinchinensis*) to provide further information on the threat to the species in the country.

In 2014, a Myanmar Forestry document accounted for over 2 million trees of *D. oliveri* in the state of Sagaing, just under 1 million in the state of Shan and all other states having less than 250,000 individuals (Kyaw *et al.* 2014). This accounts for 1,203,600 m^3, 354,000 m^3 and 141,600 – 212,400 m^3 timber respectively (EIA 2014). Myanmar is one of China's main suppliers of hongmu timber (*D. oliveria* and *Pterocarpus macrocarpus*) before the CITES listing of *Dalbergia* species and post this international policy implementation. Between 2000 and 2013, 624,000 m3 of rosewood (*D. oliveri* and *P. macrocarpus*) was traded, with the majority of the trade occurring in 2013 (EIA 2014). In 2013 at total of 237,000 m^3 of rosewood was exported to China, triple the volume traded in 2012 and six times the volume traded in 2010 (EIA 2014). This shows the huge and continuously increasing demand for rosewood out of Myanmar. There are not figures post 2013. There has been an increase in the seized volume of timber in transit from from Myanmar to China. In the 2014 EIA report 'Myanmar's Rosewood Crisis' they predict that with the current rate of extraction of rosewood (*D. oliveri* and *P. macrocarpus*) the species could become extinct from the country in the next 13 years, but if exploitation were to carry on exponentially increasing rosewood (*D. oliveri* and *P. macrocarpus*) would become extinct in the next three years i.e. before 2020 (EIA 2014). Current status of the species in Myanmar is not available, however it is obvious that the species has experienced a high rate of population decline and the species is close to if not extinct from the country.

Across the range of the species (except in Thailand) this species remains exploited for timber despite various logging bans and a depleted population size. The species is subject to illegal logging and harvesting the impact of which is compounded by the natural biology of the species to be slow growing. Demand for rosewood timber continues to be high and pressure on *D. oliveri* to meet this demand will also remain. Although more recent information is not available this is highlighted by an increase in export of rosewood from Laos and Cambodia by 150% in 2013-2014 (Global Witness 2015). Therefore, it is suspected that across all range states the population will have experienced decline of at least 80% in a single generation. This rate of loss is suspected to continue into the next 100 years. If stumps 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 this is occurring in the wild.

Current Population Trend: Decreasing

Habitat and Ecology **(see Appendix for additional information)**

Dalbergia oliveri is a large tree species. It can attain a height of over 20 m and a diameter at breast height of over 60 cm (CTSP 2004). It is found in a variety of forest types including primary and secondary forests, evergreen, semi-evergreen and semi-deciduous forests and is most often found along streams (CTSP 2004). The species is mainly found in low densities. The species can be found growing in association with *Dalbergia cochinchinensis.* The species can have a long regeneration time and establishment in the wild is now rarely seen. It can also have high seed set but low rates of germination

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in natural subpopulations (Winfield 2014). It occurs in lowland areas from 100 to 800 m asl, and rarely exceeds 1,000 m asl. *Dalbergia oliveri* is site specific and prefers fertile soils. The seedlings and juveniles of the species are shade tolerant but past this phase the species is light demanding (Winfield 2014). The species is assumed to be insect pollinated and Hartvig *et al.* 2018 considered it likely that the seed of the species was dispersed by wind and water.

Systems: Terrestrial

Use and Trade

This species produces a desirable rosewood timber. It is one of only 33 registered hongmu producing species and due to a recent increasing wealth in the Chinese middle class, there is a demand for hongmu products e.g. furniture in Ming and Quing dynasty design (EIA 2016a). Hongmu furniture is also desirable in Viet Nam but China is the main market for these products. *Dalbergia oliveri* was not the original target species for hongmu furniture production but as other hongmu producing timbers have become rarer (e.g. *D. odifera* or *D. cochinchinensis*) there has been a shift in trade and demand for *D. oliveri* (CoP17 Inf. 79 2015, EIA 2016a). 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 species is traded under the name Burmese Rosewood or Tamalan (Winfield *et al.* 2016).

Due to rarity of the species and other hongmu timber trees, logs and products of *D. oliveri* are increasing in price. Winfield *et al* (2015) reported that from the Mekong Burmese Rosewood was worth 2,000 to 3,000 US dollars per m3 and from Myanmar one ton of Burmese Rosewood could fetch 7,000 US Dollars. Between 2000 and 2013, rosewood (*D. oliveri* and *Pterocarpus macrocarpus*) trade between Myanmar and China totaled US$737 million (EIA 2014). In 2013, US$324 million of Rosewood (*D. oliveri* and *Pterocarpus macrocarpus*) was traded between Myanmar and China which is three times the value of the trade in 2012 (EIA 2014). In 2014, an additional US$52 million imports occurred between Myanmar and China (EIA 2014).

Much of the current trade of *D. oliveri* is illegal due to the listing of the species on CITES in 2016. Logging and trade of this precious species also goes against much national legislation with many nations having logging bans in place since the early 2000's. There is limited capacity to enforce the regulations, and the value of *D. oliveri* drives the continuing illegal trade of the species. Since the species has been listed on CITES this requires import and export permits to show the species was legally and sustainably harvested, however most range countries do not have non-detriment findings to support the continued harvest of *Dalbergia* species (EIA 2016b). This means there is often forgery, bribery and corruption across the supply chain of the species. Between 2017 and 2018, CITES trade database records 154,471 m^3 of imports of *D. oliveri* in range state countries. Much of this trade is between Laos and China, sometimes with Viet Nam operating in the middle. It is also key to note that the value of exports (275,569 m3) is larger than the registered value of imports. Most of the registered trade takes the form of sawn wood, logs, or wood products (CITES trade database 2020).

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).

Threats **(see Appendix for additional information)**

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A quantitative vulnerability assessment indicates that 71% of the total modelled distribution range of *Dalbergia oliveri* is under medium to very high threat from the combination of current threats (overexploitation, habitat conversion, fire, and overgrazing) (Gaisberger *et al.* 2022).

This species is threatened by overexploitation for timber. This threat has emerged in the last two decades (since 1990) and has caused a high decline in the global population of the species. There is high demand for the hongmu timber this tree produces, due to a growing Chinese wealth (CoP17 Inf. 79 2015, Winfield *et al.* 2016). Due to this there is a rife illegal trade of *Dalbergia oliveri* and other hongmu producing timber trees from Southeast Asia. The threat to the species has recently increased due to the global, conservation protection of *D. cochinchinensis* and the growing rarity of other hongmu producing timber species in the wild (CoP17 Inf. 79 2015). This has caused a shift in trade to *D. oliveri*, putting pressure on an already depleted population (CoP17 Inf. 79 2015).

In the range states of *D. oliveri*, there is national level protection often banning the logging of the species and the exportation of it's round logs (Winfield *et al.* 2016). There is also international legislation, the listing of the species on CITES Appendix II, to limit the import and export of the species. However there is often poor capacity to enforce these policies and loop holes exist which enable the trade of *D. oliveri* products (EIA 2016b). Also protective policies are often flouted, due to the value earned from rosewood timber on unofficial markets which drives people into the continual illegal exploitation of the species. There is also corruption and bribery at all stages of the supply chain (Arnold 2013, Stokes 2017, Solomon and Paddock 2019). Due to these activities species can more easily be removed from protected areas and there is forgery of import and export permits (Global Witness 2015). There is also poverty in many places where the species is found, and timber barons and crime syndicates can often take advantage of this enabling the continuation of illegal activities and limiting the success of conservation (Global Witness 2015). Some of the largest remaining populations of the species, ranging from 70 to a few hundred individuals, are found in Community Forests (unpublished data, Institute of Forest and Wildlife Research and Development, Cambodia).

The species is found in a region of the world with a high rate of habitat loss. Therefore deforestation is a major threat to the species (Winfield *et al.* 2016, Gaisberger *et al.* 2022). This leads to land use change, including the conversion of land to industrial agricultural (e.g. rubber plantations), human settlements, hydroelectric power and other anthropocentric activities (Winfield *et al.* 2016). In Cambodia habitat loss is a particular threat. This is mostly driven by the over delivery of economic land concessions (ELC's) since the 1990's (Treanor 2015). This encouraged forests to be developed for human use, however the quota of annual permits were often exceeded, permits were sold to foreign investors and the upper boundary of land in a concession was also exceeded. It is also suggested that ELC's were unfairly granted to areas with known rosewood subpopulations acting as a method to legalise the logging of these trees (Global Witness 2015).

The species is also biologically predisposed to threat from logging and deforestation activities. This is due to the long life cycle of the species, 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 make an inhospitable environment for regeneration and cutting of mature trees reduce the possibility of seed set and cross pollination. These factors all contribute to the future decline of the species and may be further

exacerbated by climate change. In fact, a quantitative vulnerability assessment indicates that 13% of the total modelled distribution range of *D. oliveri* is under medium to very high threat from climate change by 2055 (Gaisberger *et al*., 2022).

Conservation Actions **(see Appendix for additional information)**

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

• In Cambodia, it has been illegal to harvest rare tree species since 2002, which includes *D. oliveri* (EIA 2012). There has also been a been a ban on the processing, use and export of the species since 2013 however there is still known illegal trade routes for the species in the country (Winfield *et al.* 2016).

• in 2008 Lao PDR banned the logging of the species and in 2011 banned the export of the species. Also under 2007 Forestry Law efforts should be made to enrich non-timber products from forest trees, this includes surveying and planning conservation for threatened species (Winfield *et al.* 2016).

• In Thailand the species is a 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 for scientific purposes only (including breeding and artificial propagation) and commercial harvesting of the species 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 initialed a 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 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.

• In Myanmar, the species is a 'reserved' tree which means explicit permission from the Ministry of Environmental Conservation and Forestry (MOECAF) is needed to harvest this species (Kyaw 2014).

The species is on CITES Appendix II along with all other species of *Dalbergia* (since 2016). This requires declaration at import and export of trade in *Dalbergia oliveri* for records and also correct permits to be held by importers and exporters which acts as limit to trade. However, there is still illegal trade of the species with loop holes and bribery across the supply chain. There is also difficulty in identifying some species of *Dalbergia* at the point of export due to similarities in the heartwood of the genus, therefore some individuals may be misdeclared as a less threatened species. It is due to similar activities that often National legislation to protect the species is difficult to implement.

The species is assessed as Endangered in the Vietnam Red Data Book for Plants (2007). The species was also assessed as Endangered on the IUCN Red List in 1998 (Nghia 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. oliveri* are removed from protected areas. More successful opportunities for enforcement should occur alongside the expansion of designated protected areas specifically targeted to the protection of Siamese Rosewood and *D.oliveri*.

A recent quantitative study based on species distribution modelling estimated that populations in the following ecoregions are particularly underrepresented in protected area networks: Irrawaddy dry forests, Myanmar coastal rainforests, Northern Indochina subtropical forests, and Northern Khorat Plateau moist deciduous forests (Gaisberger *et al.* 2022). These sites should be prioritized for *in situ*

conservation.

In general more information on the remaining localities of the species needs to be collected alongside information on population size and regeneration potential. Viable *ex situ* collections should be developed as well as effective *in situ* conservation activities. While *in situ* conservation is desirable, the high level of threat from illegal logging and the challenges of enforcing protection laws, as described above, means that *ex situ* protection should also be given high priority. *Ex situ* conservation should be based on germplasm material from representative subpopulations across the distribution area in order to conserve a broad range of the genetic variation in the species, which reportedly show high degree of differentiation and potential local adaptation (Hartvig 2018). The species already exists in a few botanic garden collections (BGCI 2020), but more collections need to be made. Botanic gardens need to support seed collection, propagation and establishment of plantations for this species.
As part of a regional project "Conserving Rosewood Genetic Resources for Resilient Livelihoods in Greater Mekong" (UK Darwin Initiative in 2018-2022), two new *in situ* reserves and three new *ex situ* reserves were established for *D. oliveri*. The *in situ* reserves are in Lao PDR (established by the National Agriculture and Forestry Research Institute, NAFRI) and Viet Nam (Vietnamese Academy of Agricultural Sciences). The *ex situ* reserves are in Lao PDR, Vietnam and Cambodia (Institute for Forest and Wildlife Research and Development). A small grafted seed orchard was also established by a farmer for seed production in Pursat province, Cambodia, in 2021, with technical and financial support from the same project.
All national and international policy should remain in place and be further enforced and enhanced to reduce the complete extinction of the species. This should be hinged on the support of the international conservation community.

Credits

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Reviewer(s): Oldfield, S. & Souladeth, P.

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Disclaimer

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 -> 1.6. Forest - Subtropical/Tropical Moist Lowland	-	Suitable	-

Plant Growth Forms
(http://www.iucnredlist.org/technical-documents/classification-schemes)

Plant Growth Form
TL. Tree - large

Use and Trade
(http://www.iucnredlist.org/technical-documents/classification-schemes)

End Use	Local	National	International
9. Construction or structural materials	No	Yes	Yes
11. Other household goods	No	Yes	Yes
12. Handicrafts, jewellery, etc.	No	Yes	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	Unknown	Rapid declines	Unknown
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		
2. Agriculture & aquaculture -> 2.1. Annual & perennial non-timber crops -> 2.1.3. Agro-industry farming	Ongoing	Unknown	Rapid declines	Unknown
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		
2. Agriculture & aquaculture -> 2.2. Wood & pulp plantations -> 2.2.2. Agro-industry plantations	Ongoing	Unknown	Rapid declines	Unknown
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion		

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		1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		
4. Transportation & service corridors -> 4.1. Roads & railroads	Ongoing	Unknown	Unknown	Unknown
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		
5. Biological resource use -> 5.3. Logging & wood harvesting -> 5.3.2. Intentional use: (large scale) [harvest]	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. Species Stresses -> 2.1. Species mortality 2. Species Stresses -> 2.2. Species disturbance		

Conservation Actions Needed

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

Conservation Action Needed
1. Land/water protection -> 1.1. Site/area protection
1. Land/water protection -> 1.2. Resource & habitat protection
3. Species management -> 3.2. Species recovery
5. Law & policy -> 5.2. Policies and regulations
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
5. Law & policy -> 5.4. Compliance and enforcement -> 5.4.3. Sub-national level
6. Livelihood, economic & other incentives -> 6.2. Substitution
6. Livelihood, economic & other incentives -> 6.3. Market forces
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 -> 1.4. Harvest, use & livelihoods
2. Conservation Planning -> 2.1. Species Action/Recovery Plan
2. Conservation Planning -> 2.3. Harvest & Trade Management Plan

Additional Data Fields

Distribution
Estimated extent of occurrence (EOO) (km²): 1489222
Habitats and Ecology
Generation Length (years): 60-100

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.

The IUCN Red List Partners are: ABQ BioPark; Arizona State University; BirdLife International; Botanic Gardens Conservation International; Conservation International; Missouri Botanical Garden; NatureServe; Re:wild; Royal Botanic Gardens, Kew; Sapienza University of Rome; Texas A&M University; and Zoological Society of London.