



**NON-DETRIMENT FINDINGS REPORT FOR *DALBERGIA COCHINCHINENSIS*  
AND *DALBERGIA OLIVERI* IN VIETNAM**  
(for CITES Management Authority of Vietnam)

Prepared by: Center for Nature Conservation and Development



Ha Noi, 2021

Project title: Strengthening the management and conservation of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in Vietnam.

Programme: CITES Tree Species Programme

Project funding: European Union support to CITES Secretariat

Implementing partner: Center for Nature Conservation and Development

Cover illustration: Upper left photo – *D. cochinchinensis* in Dak Uy Protected Area (1)  
Upper right photo – *D. oliveri* in Cat Tien National Park (2)  
Lower photo – NDF workshop (3)  
Photo credit: La Quang Trung/CCD (1) (2) & Le Thi Trang/CCD (3).

Citation: Center for Nature Conservation and Development. (2021). Non-detriment findings for *D. cochinchinensis* and *D. oliveri* in Vietnam. CITES Management Authority of Vietnam, Ha Noi.

Copyright: Center for Nature Conservation and Development  
No. 5, Alley 56/119, Tu Lien Street, Tay Ho District, Ha Noi, Vietnam.  
Tel: +84 (0) 246 682 0486  
E-mail: info@ccd.org.vn

Ministry of Agriculture and Rural Development  
CITES Management Authority of Vietnam  
B9 Building  
No. 2 Ngoc Ha Street, Ba Dinh District, Ha Noi, Vietnam.  
Tel: +84 (0) 243 733 5676  
E-mail: cites\_vn.kl@mard.gov.vn

## CONTENTS

ACKNOWLEDGEMENT .....	5
ABBREVIATION .....	6
I. BACKGROUND .....	7
1.1. The needs for non-detriment findings .....	7
1.2. Non-detriment findings (NDF) procedures .....	7
II. SPECIES IDENTITY .....	8
2.1. Scientific name and common name .....	8
2.1.1. <i>Dalbergia cochinchinensis</i> .....	8
2.1.2. <i>Dalbergia oliveri</i> .....	8
III. BIOLOGICAL DATA .....	8
3.1. Biological characteristics .....	8
3.1.1. Provide a summary of general biological and life history characteristics of the species .....	8
3.1.2. Habitat types .....	11
3.1.3. Role of the species in its ecosystem .....	13
IV. NATIONAL STATUS .....	13
4.1. National distribution .....	13
4.1.1. <i>Dalbergia cochinchinensis</i> .....	13
4.1.2. <i>Dalbergia oliveri</i> .....	14
4.2. National and international population size .....	16
4.2.1. <i>Dalbergia cochinchinensis</i> .....	16
4.2.2. <i>Dalbergia oliveri</i> .....	16
4.3. National population trends .....	17
4.4. Main threats .....	17
V. HARVEST MANAGEMENT .....	17
5.1. Illegal harvest .....	17
5.2. Management history .....	18
5.2.1. Previous species management .....	18
5.2.2. Current management .....	19
5.3. Management plan .....	19
5.4. Quotas .....	20
VI. CONTROL OF HARVEST .....	20
6.1. Harvest in protected areas .....	20
6.2. Harvesting in areas with strong resource tenure or open access .....	20
6.3. Confidence in harvest management .....	21
VII. MONITORING SYSTEM .....	21
7.1. Methods used to monitor harvest .....	21
7.2. Confidence in harvest monitoring .....	21
VIII. INCENTIVES AND BENEFITS FROM HARVESTING .....	21
8.1. Utilization compared to other threats .....	21
8.2. Incentives for species conservation .....	21
8.3. Incentives for habitat conservation .....	21
IX. PROTECTION FROM HARVEST .....	21
9.1. Protection status .....	21
9.1.1. Global protection status .....	21
9.1.2. National protection status .....	22
9.2. Proportion strictly protected .....	22
9.3. Effectiveness of strict protection .....	22
9.4. Regulation of harvest effort .....	22
X. TRADE DATA .....	23
10.1. Legal trade levels .....	23
10.1.1. <i>Dalbergia cochinchinensis</i> .....	23
10.1.2. <i>Dalbergia oliveri</i> .....	23
10.2. Illegal trade levels: .....	24
XI. OTHER INDICATORS .....	24
11.1. Restoration or alleviation measures .....	24
XII. CONCLUSION AND RECOMMENDATIONS .....	24
12.1. Conclusion .....	24
12.2. Recommendations .....	26
REFERENCES .....	27

## List of Figures

<b>Figure 1.</b> A seedling of <i>D. cochinchinensis</i> in Dak Uy SUF. Photo: La Quang Trung/CCD – 2020.....	9
<b>Figure 2.</b> Young leaves of coppices in Yok Don national park. Photo: La Quang Trung/CCD – 2020. .	9
<b>Figure 3.</b> Coppicing saplings in Bu Gia Map national park. Photo: La Quang Trung/CCD – 2020.....	10
<b>Figure 4.</b> <i>D. cochinchinensis</i> distributes in the evergreen broad-leaved forests of Dak Uy protected area with the altitude between 627 – 655 m a.s.l. Photo: La Quang Trung/CCD – 2019. ....	11
<b>Figure 5.</b> One of three individuals of <i>D.cochinchinensis</i> was found at Don hill of Yok Don National Park at the attitude of 381 m a.s.l. Photo: La Quang Trung/CCD – 2020.....	11
<b>Figure 6.</b> <i>D. oliveri</i> distributes in the lowland evergreen broad-leaved forests of Cat Tien national park with the altitude ranging 133 – 175 m a.s.l. Photo: Nguyen Manh Ha/CCD – 2019. ....	12
<b>Figure 7.</b> <i>D. oliveri</i> also distributes in small Dipterocarpaceae deciduous forests and wood-bamboo mixed forests of Bu Gia Map national park (348 – 540 m a.s.l). Photo: La Quang Trung/CCD – 2020. ....	12
<b>Figure 8.</b> Map of distribution of <i>D. cochinchinensis</i> and <i>D. oliveri</i> in Vietnam by districts. ....	14
<b>Figure 9.</b> Map of distribution of <i>D. cochinchinensis</i> and <i>D. oliveri</i> in Vietnam by protected areas.....	15
<b>Figure 10.</b> Radar plot of factors affecting the management of <i>D. cochinchinensis</i> in Vietnam.....	25
<b>Figure 11.</b> Radar plot of factors affecting the management of <i>D. oliveri</i> in Vietnam.....	26

## List of Tables

<b>Table 1.</b>	List of <i>D. cochinchinensis</i> and <i>D. oliveri</i> violation cases in four key protected areas.	17
<b>Table 2.</b>	Direct exports of <i>Dalbergia cochinchinensis</i> from Vietnam.	23
<b>Table 3.</b>	Direct exports of <i>Dalbergia oliveri</i> from Vietnam.	24

## ACKNOWLEDGEMENT

The “Non-detriment findings of *D. cochinchinensis* and *D. oliveri* in Vietnam” report was made for the CITES Management Authority of Vietnam through the project “Strengthening the management and conservation of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in Vietnam”, funded by the European Union for the CITES Tree Species Programme.

We would like to thank the following individuals and organizations for their time to contribute to the development of the report and participate in our technical meetings. They are Mr. Truong Tat Do – VNFOREST, Mr. Ngo Le Tru – VNFOREST, Mr. Tran Cao Nguyen – SRI (VAFS), Mr. Nguyen Tu Kim RIFI (VAFS), Mr. Nguyen Quoc Dung (FIPI), Mr. Do Van Truong – VNMN (VAST), Mrs. Nguyen Thi Kim Thanh – HUS, Mr. Bui Van Thanh – IEBR (VAST), Mr. Vu Anh Tai – IG (VAST), Mr. Nguyen Tien Hiep – Plant Conservation Specialist, Mr. Do Van Ban – Timber Management Specialist, Mr. Tran Dinh Nghia – Botanical Expert, and our project team members.

We are grateful to Mrs. Ha Thi Tuyet Nga – Director, Mr. Vuong Tien Manh – Deputy Director and Mr. Nguyen Tuan Anh – Expert of CITES Management Authority of Vietnam, Ministry of Agriculture and Rural Development for their support and assistance in this project.

We would like to express our gratitude to Mr. Hooi Chiew Thang – Regional Coordinator for Asia and Ms. Milena Sosa Schmidt – CITES Tree Species Programme Coordinator and Regional Coordinator for Central and South America and the Caribbean for their generous supports during the implementation of the project.

On behalf of the project team.

Nguyen Manh Ha

Project Team Leader

## ABBREVIATION

a.s.l	Above sea level
CCD	Center for Nature Conservation and Development
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CTSP	CITES Tree Species Programme
DBH	Diameter at Breast Height (at 1.3 m from the ground level)
<i>D.</i>	<i>Dalbergia</i>
EN	Endangered
FIPI	Forest Inventory Planning Institute
FPD	Forest Protection Department
GPS	Global Positioning System
HUS	Ha Noi University of Science – Vietnam National University
IEBR	Institute of Ecology and Biological Resources
IG	Institute of Geography
IUCN	International Union for Conservation of Nature
MARD	Ministry of Agriculture and Rural Development
MOST	Ministry of Science and Technology
NP	National Park
ND-CP	Decree of the government
PA	Protected area
RIFI	Research Institute of Forest Industry
SMART	Spatial Monitoring and Reporting Tool
SRI	Silviculture Research Institute
SUF	Special Use Forests, known as Protected Areas, are mainly used to conserve natural forest ecosystems, genetic resources of forest organisms, carry out scientific research, preserve historical - cultural relics, beliefs and places of scenic beauty associated with ecotourism; and provide forest environmental services. SUFs include national parks; nature reserves; species and habitat conservation areas; landscape protection areas; and scientific research or experiment forests
VAFS	Vietnamese Academy of Forest Sciences
VAST	Vietnam Academy of Science and Technology
VNFOREST	Vietnam Administration of Forestry
VNMN	Vietnam National Museum of Nature
VUSTA	Vietnam Union of Science and Technology Associations

## I. BACKGROUND

### 1.1. The needs for non-detriment findings

Vietnam is one of 25 highest level of biodiversity countries in the world with about 20,000 species of plants, 3000 species of fish, more than 1000 species of birds and over 300 species of mammals (Loc et al., 2018). In 2020, the total forested area of Vietnam was 14,677,215 hectares (ha) and forest cover was about 42%, according to the Decision 1558/QĐ-BNN-TCLN dated on 13 April 2021. Out of total of 14,677,215 ha, more than 5.2 million ha are watershed protection forests and protected areas. This is the home to most of fauna and flora species. However, Vietnam has been also facing serious biodiversity loss due to deforestation and forest degradation as well as illegal hunting, logging and trade in wild plants and animals.

Known as rosewood species, *Dalbergia* spp. of the family Fabaceae have been subject for booming timber trade in recent decades, in which Siamese rosewood (*Dalbergia cochinchinensis*) has been the most wanted species in trade for making luxury furniture products (EIA, 2017). *Dalbergia cochinchinensis* and *Dalbergia oliveri* have been illegally exploited and commercialized in Vietnam for many years because they are very hard, beautiful, durable rosewood species. Consequently, wild populations of these species have been seriously declined. Remaining populations are fragmented while viable populations are mainly found in protected areas but also facing at high risk of exploitation.

*Dalbergia cochinchinensis* and *Dalbergia oliveri* are listed in group IIA of Decree 06/2019/ND-CP on management of endangered, precious and rare species of forest fauna and flora and observation of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the Decree 84/2021/ND-CP which amended and supplemented some articles of Decree 06/2019/ND-CP. According to these Decrees, species in group II including forest fauna (IIB) and flora (IIA) that although currently not threatened with extinction but may become so without strict control of exploitation and use for commercial purpose. This means that these two species could be legally traded with strict control of exploitation and permit grant.

*Dalbergia cochinchinensis* and *Dalbergia oliveri* are classified in the Appendix II of CITES. According to the point 2a of Article IV of the Convention, specimen of species in the Appendix II may be exported with conditional permit provided that the exportation will not be detrimental to the survival of species.

Given trade in these two species is not prohibited so long as the utilization is sustainable, a science-based risk assessment or non-detriment findings of these species is needed to ensure that harvest and trade do not pose threats to populations of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in the wild.

### 1.2. Non-detriment findings (NDF) procedures

The NDF procedures were followed by IUCN guidance to assist in making NDF for export of species in the CITES Appendix II (Rosser & Haywood, 2002). The guidance includes two steps of review corresponding with two tables (Table 1P for initial review and Table 2 for deep review) (Rosser & Haywood, 2002). After the initial review relating to harvest of *Dalbergia cochinchinensis* and *Dalbergia oliveri*, it was found that there are negative opinions. Therefore, the assessors had to carry out thorough review to see if the international trade could be detrimental to the survival of *Dalbergia cochinchinensis* and *Dalbergia oliveri*.

The second review looked at parameters on biology, distribution, population size, population trend, main threats and management, harvest management, capacity for monitoring the harvest, benefits of harvest, and strict protection. These parameters were divided into seven categories with a total of 26 indicators corresponding to 26 multiple-choice questions, including i) Biological characteristics (4 questions), ii) National status (5 questions), iii) Harvest management (5 questions), iv) Control of harvest (4 questions), v) Monitoring of harvest (2 questions), vi) Incentives and benefits from harvesting (3 questions), and vii) Protection from harvest (3 questions). Data and information were collected to fill in these indicators (see section III to section IX below). In each question, there are five answers arranged in order from 1 to 5, and where the assessors responded to the questions based on information and data collected above in the multiple-choice answers is the score for that indicator. Score 1 reflected for lowest risk, whilst score 5 represents for highest risk. These values were then formed up a radar plot to indicate the level of each indicator to help understand an overview of NDF for *Dalbergia cochinchinensis* and *Dalbergia oliveri*.

## II. SPECIES IDENTITY

### 2.1. Scientific name and common name

#### 2.1.1. *Dalbergia cochinchinensis*

Scientific name: *Dalbergia cochinchinensis* Pierre (family Fabaceae).

Common names: English (Siamese rosewood, Rose Wood, Thailand rosewood, Tracwood); Thai (Phayung); Khmer (Kra nhoung); Lao (Kha nhoung), China (Suan zhī mù); Vietnamese (Trac, Cam lai nam bo).

#### 2.1.2. *Dalbergia oliveri*

Scientific name: *Dalbergia oliveri* Gamble ex Prain (family Fabaceae).

Common names: English (Asian rosewood, Burmese rosewood, Laos rosewood); Burmese (Tamalan, Chingchan), Khmer (Neang Nuon); Thai (Mai Ching Chan); Lao (Kampee, Mai Kor phee, Pa dong daeng); Vietnamese (Cam Lai, Cam lai bong, Cam lai mat, Trac lai).

## III. BIOLOGICAL DATA

### 3.1. Biological characteristics

#### 3.1.1. Provide a summary of general biological and life history characteristics of the species

##### 3.1.1.1. *Dalbergia cochinchinensis*

**Morphology**: According to Nguyen et al., (2019a), *Dalbergia cochinchinensis* is a large tree from 60 to 80 cm in diameter and up to 30 m in height. Outer bark is brownish-yellow, longitudinally fissured or peeled off into fragments. Tree is profusely branched. Wood is dark red and then becomes black later. Young leaves appear in March. Leaves are pinnately compound from 15 – 20 cm in length, 7 – 9 leaflets growing almost opposite. Petiole is 2.5 – 5 cm long and rachis is 6.5 – 15 cm long and glabrous. Stipule is caducous. Leaflet is coriaceous, oval to ovoid, white mold on lower surface, 3.5 – 8(–10) cm long, 2 – 4(–5) cm wide, with acute apex, obtuse or rounded at base. Lateral veins are 7 – 9 pairs and prominent on both sides. Secondary venules are clearly reticulate on the lower surface. Petiolule is 2 – 5 mm long.

Inflorescence is corymbose-paniculate at or nearly terminal, 7 – 15(–20) cm long. Bracts are caducous. Peduncle is 1 mm long. Flowers are white to milky white, 5.5 – 6 mm long, aromatic. Calyx tube is 5 mm, glabrous; calyx lobes are oval to obtuse; inner calyx lobes are slightly longer than lateral calyx lobes but as long as calyx tube; calyx is stiff. Stamens are 9 – 10; filaments stick together; ovary is 2 – 4 ovules, glabrous to villose at base. Fruit is oblong, 4.5 – 7.5(–8) cm long, 0.8 – 1.2 cm wide, thin, glabrescent with compartments containing 1 – 2 seeds. Seeds are reniform, have a size of 4 x 6 mm, reddish brown. Flowering is from June to July. Fruiting is from September to November.

**Regeneration and growth rate**: *Dalbergia cochinchinensis* regeneration is depending on the geography, climate conditions and forest types. Observations from field surveys in Dak Uy SUF and Yok Don national park revealed that coppicing ability of *Dalbergia cochinchinensis* is strong with 56.7% and 88.98% respectively (Dinh et al., 2021). A study on natural regeneration of this species in Di Linh district, Lam Dong province showed strong coppicing ability (73.3%) compared with seed regeneration ability (26.7%) (Bui et al., 2018). Growth rate is low (Nguyen et al., 1996).

**Bioactivity**: A study in bioactivity of some species in *Dalbergia* genus in Vietnam showed that *Dalbergia cochinchinensis* inhibited two microbial strains (*S. aureus* and *A. niger*) and exhibited cytotoxic activity against lung and pericardial cancers (Pham et al., 2011). Chemical compounds of 5-O-methylatlofia, 2,4,5-trimethylxadabergiquinol, R(+)-4 methoxydalbergiona, and obturafural were found from *Dalbergia cochinchinensis* (Pham et al., 2011).

**Utilization**: Timber of *Dalbergia cochinchinensis* is hard, durable, fine texture, and termite resistant (Nguyen et al., 2021; Nguyen et al., 2019a). *Dalbergia cochinchinensis* timber is classified as a special timber group in Vietnam Standards TCVN 12619-2:2019 (MOST, 2019). Timber is used for making high-class carpentry items, fine art articles, musical instruments, furniture, and ornament. There were not records on the use of *Dalbergia cochinchinensis* for medicine.



**Figure 1.** A seedling of *D. cochinchinensis* in Dak Uy SUF. Photo: La Quang Trung/CCD – 2020.

### 3.1.1.2. *Dalbergia oliveri*

**Morphology:** *Dalbergia cochinchinensis* is a large tree with 15 – 30m in height and 60 – 90cm in diameter. Bark is grey; branches are stout and slightly pubescent. Leaves are pinnately compound, 15 – 25 cm in length with from (9 –) 10 –15 leaflets and caducous. Petiole is 3 – 5 cm long and rachis is 10 –18cm long and glabrous. Leaves are sparsely pubescent. Leaflet is brittlely soft to slightly coriaceous, oval, oblong to lanceolate, 4 – 8 cm long, 1.5 – 3 cm wide, glabrous, apex obtuse or subacute, often acute, rounded at base; lateral veins are 9 – 12 pairs and venule is prominently reticulate on both sides; petiolule is 3 – 4 mm long (Nguyen et al., 2019b). Young leaves of saplings and even small timber trees vary in color, from red-brown, yellow-brown, orange, yellowish, light green to green (Dinh et al., 2021) (see **Figure 2** and **Figure 3**).



**Figure 2.** Young leaves of coppices in Yok Don national park. Photo: La Quang Trung/CCD – 2020.



**Figure 3.** Coppicing saplings in Bu Gia Map national park. Photo: La Quang Trung/CCD – 2020.

Inflorescence is corymbose-paniculate at or nearly terminal, 10 – 15 cm long. Bracts and bracteoles are caducous. Pedicel is 1.5 mm long and pubescent. Flower is bright mauve or purple inside, 12 mm long; calyx tube is 4 – 5 mm, glabrous or pubescent at base; upper calyx lobes are obovate, outer calyx lobes are obtuse oval and nearly the same length, inner calyx lobes are oval, acute and slightly longer than other calyx lobes or nearly as long as calyx tube. Stamens are 10; filaments are diadelphous; ovary is 2 – 3 ovules and pubescent (Nguyen et al., 2019b).

Fruit is lanceolate, 9 – 14 cm long, 2.4 – 4 cm wide, glabrous, sometimes coriaceous, and bright brown. Seed is from 1 – 2 (rarely 3), globose or reniform with a size is 12.5 x 9 mm, and red brown. Flowering from April to May. Fruit is from September to December (Nguyen et al., 2019b).

**Regeneration and growth rate:** Similar to *Dalbergia cochinchinensis*, natural regeneration of *Dalbergia oliveri* is various depending on the geography, climate conditions and forest types. Observations from field surveys in three national parks of Yok Don, Cat Tien and Bu Gia Map indicated that ability of coppicing and seed regeneration in the wild are various. Coppicing ability of *Dalbergia oliveri* in Yok Don national park 91.44%, in Bu Gia Map national park is 55.69%, and in Cat Tien national park is 11.66% (Dinh et al., 2021).

**Propagation:** In nursery condition, germination rate in nursery is very high, at 86.7% (Pham et al., 2013). After nine months, *Dalbergia oliveri* reached an average height and diameter of 19.3 cm and 0.31 cm respectively (Pham et al., 2013). The average height of seedlings in the first month is 6.68 cm and in the ninth month is 19.31 cm; the average height growth is 2.14 cm per month (Pham et al., 2013)..

There is a lack of detail studies in growth rate of *Dalbergia oliveri* in the wild, however it is considered as a slow growing rosewood species like *Dalbergia cochinchinensis*.

**Bioactivity:** *Dalbergia oliveri* inhibited 3 microbial strains including *E.coli*, *F. oxysporum*, and *S. cerevisiae* (Pham et al., 2011).

**Utilization:** Timber of *Dalbergia oliveri* is hard, durable, and termite resistant (Nguyen et al., 2021; Nguyen et al., 2019b). It is also classified as a special timber group in Vietnam Standards TCVN 12619-2:2019 (MOST, 2019). Timber is used for making high-class carpentry items, fine art articles, musical instruments, furniture, and decoration.

### 3.1.2. Habitat types

#### 3.1.2.1. *Dalbergia cochinchinensis*

*Dalbergia cochinchinensis* is found in the evergreen broad-leaved forests with altitude between 600 – 700 m a.s.l. (see **Figure 4**) or lowland dry evergreen broad-leaved forests mixed with Dipterocarpaceae deciduous forests on the altitude between 160 – 390 m a.s.l. (see **Figure 5**) and preferably in the areas of sandy clay. *Dalbergia cochinchinensis* was also reported to distribute at the altitude up to 1000 m in Kon Ka Kink national park (La, et al., 2021). The annual average temperature is 24 – 26°C and the annual rainfall ranges between 1600 – 1800 mm.



**Figure 4.** *D. cochinchinensis* distributes in the evergreen broad-leaved forests of Dak Uy protected area with the altitude between 627 – 655 m a.s.l. Photo: La Quang Trung/CCD – 2019.



**Figure 5.** One of three individuals of *D.cochinchinensis* was found at Don hill of Yok Don National Park at the altitude of 381 m a.s.l. Photo: La Quang Trung/CCD – 2020.

### 3.1.2.2. *Dalbergia oliveri*

*Dalbergia oliveri* distributes in the lowland tropical monsoon evergreen broadleaf forests, tropical semi-deciduous broadleaf forests, lowland tropical monsoon Dipterocarpaceae deciduous forests and wood-bamboo mixed forests with altitudes from 100 to 700 m a.s.l. (see **Figure 6** and **Figure 7**), and up to 1,200 m a.s.l. (Dinh et al., 2021; La et al., 2021; Nguyen et al., 2019b).



**Figure 6.** *D. oliveri* distributes in the lowland evergreen broad-leaved forests of Cat Tien national park with the altitude ranging 133 – 175 m a.s.l. Photo: Nguyen Manh Ha/CCD – 2019.



**Figure 7.** *D. oliveri* also distributes in small Dipterocarpaceae deciduous forests and wood-bamboo mixed forests of Bu Gia Map national park (348 – 540 m a.s.l.). Photo: La Quang Trung/CCD – 2020.

*Dalbergia oliveri* is suitable on loamy soil, ferralsol soil established from Basalt, ferralsol soil established from shale, and ferralsol soil established from ancient alluvium. The annual average temperature is 24 – 26.5°C and the annual rainfall ranges between 1600 – 2175 mm.

### 3.1.3. Role of the species in its ecosystem

#### 3.1.3.1. *Dalbergia cochinchinensis*

*Dalbergia cochinchinensis* has at least three key roles in forest ecosystem. Firstly, like other species of the Fabaceae, *Dalbergia cochinchinensis* has ability of fixing atmosphere nitrogen in soil, which will then be used by other nearby plants for their growth. Therefore, *Dalbergia cochinchinensis* is highly potential for rehabilitation of degraded forest ecosystem where it is present. Secondly, *Dalbergia cochinchinensis* is one of the species contributing to the dominant canopy of the forest to increase the forest cover that protects soil from direct rain and sun, protects wild animals from natural disasters such as typhoon, whirlwind, hail, and heavy rain, and creates beautiful landscape (Dinh et al., 2021; Nguyen et al., 2019a). Thirdly, *Dalbergia cochinchinensis* plays as a key role in food chain because their leaves of seedlings and coppicing saplings are food of large ungulates such as banteng (*Bos javanicus*), gaur (*Bos gaurus*), southern red muntjac (*Muntiacus muntjac*), and samba deer (*Cervus unicolor*).

In addition, *Dalbergia cochinchinensis* trees were seen to grow in cashew gardens at Song Ba village, Chu Rcam commune, Krong Pa district, Gia Lai province to make garden fences and help farmers reduce fertilizer costs for their crops through replenishing biological nitrogen in the depleted cultivation soil (Nguyen et al., 2019a).

#### 3.1.3.2. *Dalbergia oliveri*

*Dalbergia oliveri* has the same three main roles as *Dalbergia cochinchinensis* has in its ecosystem. The species joins the main canopy of the evergreen broad-leaved forests, lowland tropical monsoon Dipterocarpaceae deciduous forests or lowland tropical monsoon evergreen broad-leaved forests, and wood-bamboo mixed forests to protect soil fertility for other species. *Dalbergia oliveri* can contribute to the degraded forest rehabilitation in deforestation areas. *Dalbergia oliveri* is the food source of large ungulates.

## IV. NATIONAL STATUS

### 4.1. National distribution

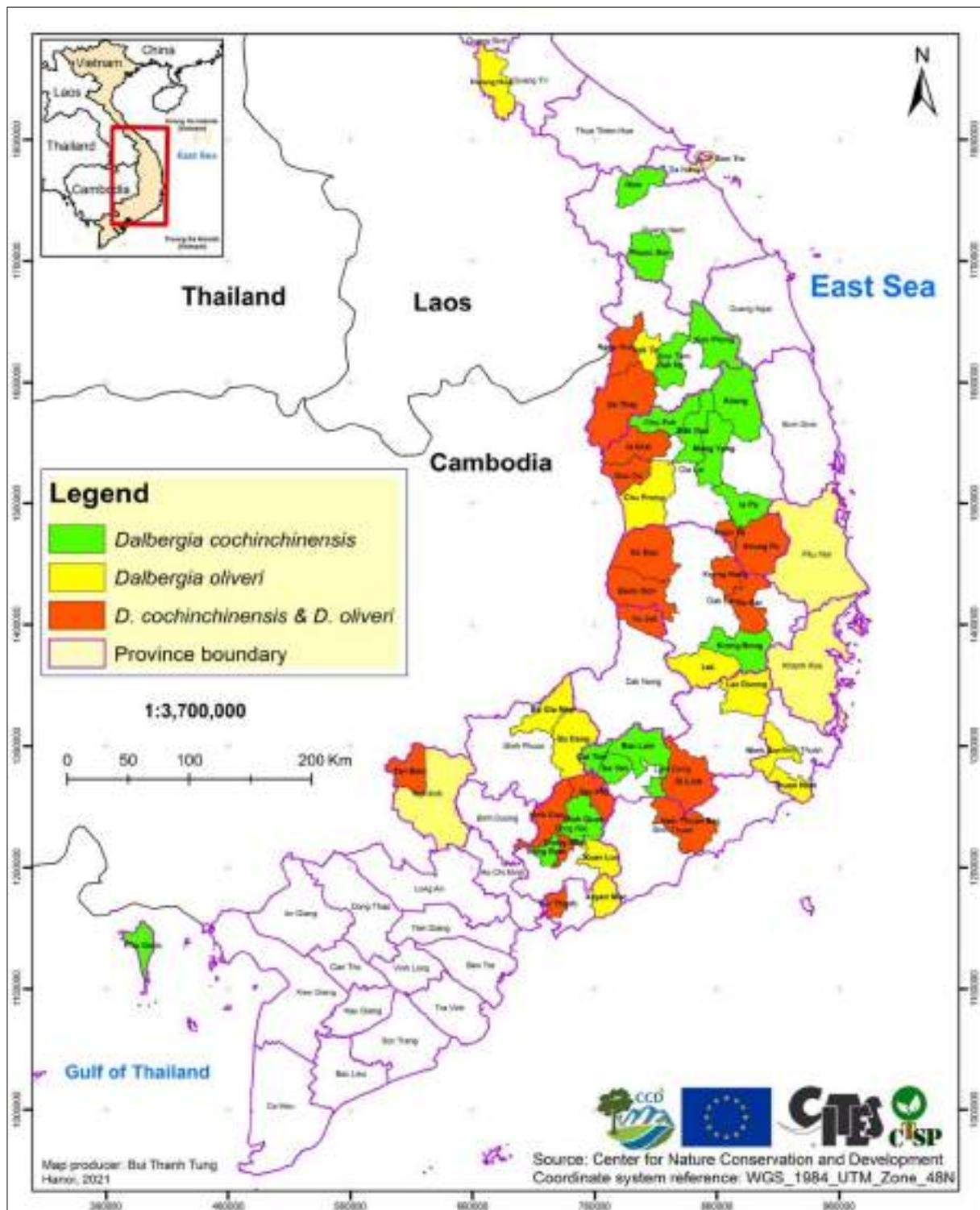
#### 4.1.1. *Dalbergia cochinchinensis*

In Vietnam, *Dalbergia cochinchinensis* sparsely distributes in central and southern provinces including Da Nang city, Quang Nam province (Hien and Phuoc Son districts), Kon Tum province (Dak Ha, Sa Thay, Ngoc Hoi and Kon Plong districts), Gia Lai province (Krong Pa, Chu Pah, Ia Pa, Ayun Pa, Mang Yang, Dak Doa, Ia Grai, K'Bang and Duc Co districts), Dak Lak province (Buon Don, Ea Sup, Ea Kar, Krong Nang and Krong Pong districts), Lam Dong province (Cat Tien, Bao Lam and Da Teh districts), Binh Thuan province (Ham Thuan Bac district), Dong Nai province (Dinh Quan, Trang Bom, Vinh Cuu, Tan Phu, and Thong Nhat districts), Tay Ninh province (Tan Bien district), and Kien Giang province (Phu Quoc district) (La et al., 2021; Nguyen et al., 2019a) (see **Figure 8**). *Dalbergia cochinchinensis* may have been exterminated in some historical distribution locations such as Ben Cat and Thu Dau Mot towns of Binh Duong province and Thu Duc district of Ho Chi Minh city due to the urbanization (Nguyen et al., 2019a).

In protected area system of Vietnam, *Dalbergia cochinchinensis* is found in Dak Uy Special Use Forests (SUF), Chu Mom Ray national park, Kon Plong watershed protection forests, Yok Don national park, Ea So nature reserve, Krong Nang watershed protection forests, Ia Rsai watershed protection forests, Nam Song Ba watershed protection forests, Kon Ka Kinh national park, Ia Grai watershed protection forests, Kon Chu Rang nature reserve, Duc Co watershed protection forests, Chu Mo watershed protection forests, Dong Nai nature reserve, Cat Tien national park, Tan Phu watershed protection forests, Ham Thuan – Da Mi watershed protection forests, and Phu Quoc national park (La et al., 2021) (see **Figure 9**).

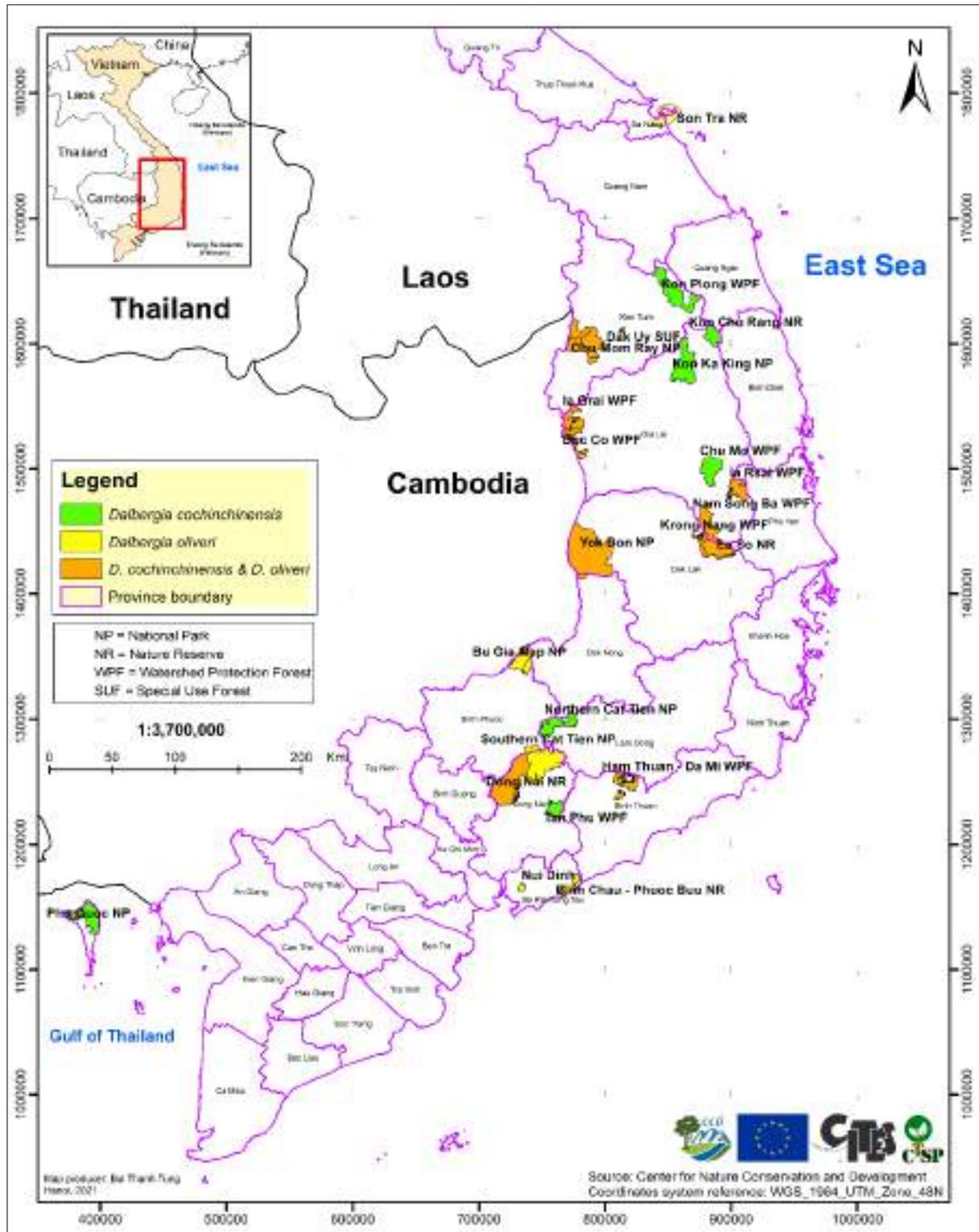
#### 4.1.2. *Dalbergia oliveri*

In Vietnam, *Dalbergia oliveri* distributes in the following provinces: Quang Tri province (Huong Hoa district), Da Nang city (Son Tra district), Kom Tum (Sa Thay, Ngoc Hoi and Dak To districts), Gia Lai province (Krong Pa, Ia Grai, Duc Co and Chu Prong districts), Dak Lak province (Ea Kar, Krong Nang, Ea Sup, Buon Don and Lak districts), Dak Nong province (Dak Mil and Cu Jut districts), Lam Dong province (Lang Biang, Lac Duong, Da Teh and Di Linh districts), Dong Nai province (Vinh Cuu, Tan Phu, Thong Nhat and Xuan Loc district), Phu Yen province, Khanh Hoa province, Ninh Thuan province (Thuan Nam and Ninh Son districts), Binh Thuan (Ham Thuan Bac district), Binh Phuoc province (Bu Dang and Bu Gia Map districts), Tay Ninh province and Ba Ria-Vung Tau provinces (Tan Thanh and Xuyen Moc districts) (La et al., 2021; Nguyen et al., 2019b) (see **Figure 8**).



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

In protected area system of Vietnam, *Dalbergia oliveri* is found at Chu Mom Ray national park, Yok Don national park, Ea So nature reserve, Krong Nang watershed protection forests, Ia R Sai watershed protection forests, Nam Song Ba watershed protection forests, Ia Grai watershed protection forests, Duc Co watershed protection forests, Dong Nai nature reserve, Cat Tien national park, Ham Thuan – Da Mi watershed protection forests, Bu Gia Map national park, Dinh mountain, Binh Chau-Phuoc Buu national park (La, et al., 2021) (see **Figure 9**).



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

## 4.2. National and international population size

### 4.2.1. *Dalbergia cochinchinensis*

In the world, *Dalbergia cochinchinensis* is mainly distributed in Cambodia, Laos, Thailand, and Vietnam (Nguyen et al., 2019a).

In Cambodia, *Dalbergia cochinchinensis* was recorded in Kampong Thom, Kampong Speu, Preah Vihear, Ratanakiri, Pursat, Siem Reap, Kratie, Koh Kong, Stung Treng, and Modulriki provinces but the population size was unknown (UNEP-WCMC, 2018). The latest study indicated that the population density of *Dalbergia cochinchinensis* with DBH above 5 cm is 2.6 trees/ha in Choam Ksant district of Preah Vihear province (Say et al., 2021a; Say et al., 2021b).

In Laos, *Dalbergia cochinchinensis* was reported to distribute in southern provinces of Champasak, Attapeu and Sekong and the central provinces of Bolikhamsai and Khammouane (UNEP-WCMC, 2018). The population size is unknown and seems to be faded as field surveys in 2012 did not record mature individuals (UNEP-WCMC, 2018).

In Thailand, *Dalbergia cochinchinensis* distributes in the Northeast and the stock was estimated between 80,000 – 100,000 trees (Rose, 2014).

In Vietnam, *Dalbergia cochinchinensis* was documented to mainly distribute in central provinces, some south-eastern provinces and very few southwestern provinces (La et al., 2021). Based on population density from field surveys and calculated areas of the surveyed protected areas, it is estimated that there are about 8,000 trees of *Dalbergia cochinchinensis* with the DBH<sub>1.3</sub> above 6 cm (called timber trees) in Dak Uy SUF, and 8,000 – 10,000 trees in Yok Don national park (Dinh et al., 2021). A population of *Dalbergia cochinchinensis* in Kon Ka Kinh national park with the number of trees as many as those in Dak Uy SUF was also reported, however, the number of large trees is few (Hoang Thanh Son, personal communication, August 31, 2020). Another population of *Dalbergia cochinchinensis* with about 1,000 trees in Tan Phu watershed protection forest, which can provide seeds (Le Viet Dung, personal communication, October 10, 2019). Many other small populations of *Dalbergia cochinchinensis* were also reported to sparsely distribute in different places such as Chu Mom Ray national park, Watershed Protection Forests of Nam Song Ba and Ia Rsai, and plantations, especially in the forest gardens, production forests and/or crop fields of local villagers in central provinces. Unfortunately, no detail surveys were undertaken to document quantity of timber trees (La et al., 2021; Nguyen et al., 2019a).

### 4.2.2. *Dalbergia oliveri*

In the world, the species distributes in Cambodia, Myanmar, Laos, Thailand and Vietnam (Nguyen et al., 2019b).

In Cambodia, *Dalbergia oliveri* was reported to sparsely distribute in upper part of the country including Kratie, Preah Vihear, Kampong Thom, Ratanakiri, Stung Treng, Pursat and Siem Reap provinces (Say et al., 2021a; Say et al., 2021b). The population size is unknown but the latest surveys in Choam Ksant district of Preah Vihear province showed that population density of *Dalbergia oliveri* is 0.8 plants/ha with DBH above 0.5 cm (Say et al., 2021a).

In Laos, information on distribution of *Dalbergia oliveri* is limited. *Dalbergia oliveri* was recorded in Khammouane, Bolikhamsai, Attapeu, Savannakhet, and Saravane (Salavan) provinces<sup>1</sup>. Population size of this species is not well known.

In Myanmar, the majority of *Dalbergia oliveri* populations is found in upper part of the country (Nyi, 2014). About 4,000,000 trees of *Dalbergia oliveri* were reported including more than two million trees in Sagaing, about 900,000 trees in Shan, 350,000 trees in Mandalay, 200,000 trees in Kachin, 100,000 trees in Chin, 80,000 trees in Magway, 50,000 trees in Bago and, more than 10,000 trees in Rakhine and Ayeyarwaddy (EIA, 2014; Nyi, 2014).

In Vietnam, *Dalbergia oliveri* distributes mainly in central provinces and some southeast provinces (La et al., 2021). Based on population density from field surveys and calculated areas of the surveyed protected areas, it is estimated that there are about 70,000 – 80,000 *Dalbergia oliveri* trees with the

---

<sup>1</sup> Global Biodiversity Information Facility: [https://www.gbif.org/occurrence/search?taxon\\_key=2968432](https://www.gbif.org/occurrence/search?taxon_key=2968432)

DBH<sub>1.3</sub> above 6 cm in Bu Gia Map national park, 140,000 – 160,000 trees in Cat Tien national park, 50,000 – 60,000 trees in Yok Don national park (Dinh et al., 2021).

### 4.3. National population trends

Given the fact that *Dalbergia cochinchinensis* and *Dalbergia oliveri* growth rate and natural reproduction by seeds are low; wild populations have significantly decreased in the past; and main threats (see section 4.4 and section 5.1) are continuous, the population trends of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in Vietnam keep decreasing.

### 4.4. Main threats

Both *Dalbergia cochinchinensis* and *Dalbergia oliveri* have been facing the main threats of illegal logging and trade, and habitat loss in a long time causing the severe decline of mature individuals and fragmented populations. Currently, most of the *Dalbergia cochinchinensis* and *Dalbergia oliveri* trees that can give heartwood are found in protected areas.

## V. HARVEST MANAGEMENT

### 5.1. Illegal harvest

Illegal loggings of *Dalbergia cochinchinensis* and *Dalbergia oliveri* are still happening in Vietnam, even in the most strictly protected forest, the Dak Uy SUF. The total area of Dak Uy SUF is only 546.24 ha, however, the management board had 27 staff and 12 – 16 additional people from surrounded district FPDs and provincial FPD involving in protection of *Dalbergia cochinchinensis* forest in 2019.

The followings are logging cases of *Dalbergia cochinchinensis* and *Dalbergia oliveri* from Vietnam's forests.

**Table 1.** List of *D. cochinchinensis* and *D. oliveri* violation cases in four key protected areas.

Taxon	Violation cases	Location	Lost (m <sup>3</sup> )	Year
<i>D. cochinchinensis</i>	26 cases of timber logging and 2 case of timber transportation	Dak Uy SUF, Kon Tum province	4.4	2017
	7 cases of digging roots remaining from previous logging	Dak Uy SUF, Kon Tum province	0	2018
	1 case of timber logging	Yok Don NP, Dak Lak province	0.048	2021
	1 case of root transportation	Krong Pa district, Kon Tum province	0	2018
<i>D. oliveri</i>	3 cases of timber transportation	Bu Gia Map NP, Binh Phuoc province	1.181	2016
	4 cases of timber logging	Bu Gia Map NP, Binh Phuoc province	0	2017
	5 cases of timber logging	Bu Gia Map NP, Binh Phuoc province	0.268	2018
	3 cases of timber transportation	Bu Gia Map NP, Binh Phuoc province	0.1	2019
	3 cases of timber transportation	Bu Gia Map NP, Binh Phuoc province	0	2020
	1 case of timber logging	Da The district, Lam Dong province (*)	0.508	2020
	1 case of keeping timber at home	Da The district, Lam Dong province (*)	0.258	2021
	3 cases of timber logging	Bu Gia Map NP, Binh Phuoc province	0.125	2021
	18 cases of logging	Cat Tien NP, Dong Nai province	2.712	2017

Taxon	Violation cases	Location	Lost (m <sup>3</sup> )	Year
	9 cases of logging	Cat Tien NP, Dong Nai province	1.121	2018
	2 cases of logging	Cat Tien NP, Dong Nai province	0	2019
	2 cases of logging	Cat Tien NP, Dong Nai province	0.377	2020
	1 case of logging	Yok Don NP, Dak Lak province	0.064	2018

Note: Violation cases in Dak Uy SUF were collected to September 2019, in Cat Tien NP were to June 2020, and in Bu Gia Map NP and Yok Don NP were to June 2021.

(\*) Nguyen Tu Kim, personal communication, December 25, 2021.

The above data were only quantities taken away by forest criminals. In fact, the damages were much greater because once a tree was cut down, the entire volume of that tree must be counted as damage. For example, in Cat Tien national park, the total losses of *Dalbergia oliveri* from 2017 to June 2020 were 8.42 m<sup>3</sup>; however, 31.22 m<sup>3</sup> were reported as the remaining quantities that have not been taken away by criminals. It means that the total volume of the trees cut down by violators were 39.64 m<sup>3</sup>. This is actual lost number. Similarly, 22.492 m<sup>3</sup> of *Dalbergia oliveri* timber in Bu Gia Map NP were reported to be untaken-away timber. The total damage should be calculated as 24.166 m<sup>3</sup>.

## 5.2. Management history

### 5.2.1. Previous species management

Since 1977, Vietnam Forestry Ministry (now is Ministry of Agriculture and Rural Development/MARD) has issued a Decision 2198-CNR dated on 26 November 1977 stipulating the temporary classification table of timber species, which is still valid today. This table consists of 354 timber species divided into eight groups based on rarity, high economic and scientific research value, wood physical and mechanical properties and natural durability. *Dalbergia cochinchinensis* and *Dalbergia oliveri* are classified in the group 1 (timbers are rare and precious, and high scientific and economic value) and have been strictly managed by Vietnam's legislations.

On 17 January 1992, the Council of Ministers gave a Decree 18-HDBT stipulating the List of rare forest plants and animals, and the regime for management and protection with two groups, in which *Dalbergia cochinchinensis* and *Dalbergia oliveri* were listed in the group IIA<sup>2</sup>. According to the Article 8 of this Decree, species in the group II could only be exploited with a limited extent in terms of type, quantity and area if having approval from the Chairman of the Council of Ministers for annual planning targets and license to cut from the Minister of Forestry (now is MARD). Exploited timber of these species were only used for construction of special works of the State, processing fine art goods and high-class furniture for domestic consumption and export. Logs and semi-processed timber were ban on the export.

In 1995, the inter-ministries Circular 01-TTLB dated on 22 December 1995 issued by MARD, Ministry of Trade, and General Department of Customs to instruct the implementation of the Decree no. 664-TTG dated on 18 October 1995 on the export of wood and forest products said "the following types of wood, forest products and products processed from wood may only go through export procedures at Customs when they have the permit to produce for export from the MARD":

- Point 1.1. Products using timber of species in group IIA of the Decree 18-HDBT, which its exploitation and utilization plan was approved by the Prime Minister and assigned to the Minister of MARD for the implementation. Both *Dalbergia cochinchinensis* and *Dalbergia oliveri* were in group IIA.
- Point 1.2. The products did not use timber of species in groups IA and IIA but used wood of group 1 and group 2 in the wood temporary classification table promulgated together with

<sup>2</sup> Group I included endemic, high extinction threat, special scientific-economic valued wild plants (IA) and wild animals (IB). Species in the Group I were strictly prohibited for exploitation and utilization. Group II included over-exploited, extinction risk, high economic valued wild plants (IIA) and wild animals (IIB). Species in the Group II were limited for exploitation and utilization.

Decision No. 2198-CNR dated 26 November 1977 of the Vietnam Forestry Ministry. Both *Dalbergia cochinchinensis* and *Dalbergia oliveri* were listed in group 1 as mentioned above.

Later, the Decree 32/2006/ND-CP on management of endangered, precious and rare forest plants and animals, which was issued on 30 March 2006 to replace the Decree 18-HDBT in 1992. *Dalbergia cochinchinensis* and *Dalbergia oliveri* were still listed in group IIA, which consists of plant species restricted from exploitation or use for commercial purposes.

### 5.2.2. Current management

Currently, *Dalbergia cochinchinensis* and *Dalbergia oliveri* are still in the group 1 of Decision 2198-CNR on the temporary classification table of timber species issued on 26 November 1977 for their heavy, naturally durable, high economic value timbers.

*Dalbergia cochinchinensis* and *Dalbergia oliveri* are listed in group IIA of the Decree 06/2019/ND-CP on management of endangered, precious and rare species of forest fauna and flora and observation of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), dated on 22 January 2019 and the Decree 84/2021/ND-CP dated on 22 September 2021 which amended and supplemented some articles of Decree 06/2019/ND-CP. According to this Decree, species in Group II including forest fauna (IIB) and flora (IIA) that although currently not threatened with extinction but may become so without strict control of exploitation and use for commercial purpose, and species specified in CITES Appendix II naturally inhabiting Vietnam. Hence, *Dalbergia cochinchinensis* and *Dalbergia oliveri* are the subject for strict control of exploitation and use for commercial purpose in Vietnam.

### 5.3. Management plan

There is no management plan developed and approved for *Dalbergia cochinchinensis* and *Dalbergia oliveri* at central and local levels in Vietnam. However, there is a general forest management plan called the sustainable forest management and forest certification proposal that was approved by the government of Vietnam in Decision 1288/QĐ-TTg dated on 1 October 2018. According to this proposal, all management boards of protected areas, protection forests, economic organizations and enterprises currently managing 7,216,889 hectares of forests must complete the development and implementation of sustainable forest management plans. The Circular 28/2018/TT-BNNPTNT dated on 16 November 2018 provides the enforcement of Point a, Clause 1 of Article 27 of 2017 Forestry Law that forest owners being organizations shall make and implement sustainable forest management plans. At the current time, many protected areas' management boards are developing sustainable forest management for their forests regulates details of sustainable forest management.

Some protected areas have conducted informal unplanned management activities. For example, Dak Uy SUF counted 800 trees of *Dalbergia cochinchinensis* with DBH greater than 20 cm and 500 trees with DBH between 15 - 20 cm in 2018 (Nguyen et al., 2019a); Cat Tien national park identified locations of 4,183 trees of *Dalbergia oliveri* (DHB above 25 cm) out of 18 threatened, precious, rare timber tree species by GPS coordinates from 2014 – 2017.

Under the project “Strengthening the management and conservation of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in Vietnam” sponsored by CITES Secretariat, a conservation and management plan for these two species is being developed. The management plan aims to protect, preserve, and rehabilitate populations of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in Vietnam.

The specific objectives include:

- Manage, conserve and thrive mother/mature population in priority conservation areas.
- Identify and manage seed forests for propagation and rehabilitation activities.
- Include *Dalbergia cochinchinensis* and *Dalbergia oliveri* in the list of native species for annual afforestation plan.
- Plant at least 500ha of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in their previous distribution areas for restoration.
- Promote the participation of society in planting and restoring *Dalbergia cochinchinensis* and *Dalbergia oliveri*.

The management plan has the following elements:

- Conduct a census on populations and develop distribution maps of *Dalbergia cochinchinensis* and *Dalbergia oliveri* for each prioritized area.
- Develop protocols and technical guidelines on seed, rehabilitating plantation, assisted natural regeneration and forest enrichment with *Dalbergia cochinchinensis* and *Dalbergia oliveri*.
- Mainstream planting *Dalbergia cochinchinensis* and *Dalbergia oliveri* into annual forest afforestation programs.
- Strengthen wild population management measures of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in important areas such as (Dak Uy SUF; Chu Yang Sin, Bu Gia Map, Cat Tien, Kon Ka Kinh and Yok Don national parks; Tan Phu, Ham Thuan-Da Mi watershed protection forests).
- Apply new technologies such as SMART in monitoring and restoring and rehabilitating wild populations.
- Develop and implement SMART data-based forest patrolling plans in areas where *Dalbergia cochinchinensis* and/or *Dalbergia oliveri* distribute.
- Enhance the legislation communication and law enforcement.
- Engage local communities in planting and protecting *Dalbergia cochinchinensis* and *Dalbergia oliveri* trees.
- Strengthen management and utilization of timbers in commercial activities to avoid the rotation and legalization of illegally harvested timbers.

#### 5.4. Quotas

Since *Dalbergia cochinchinensis* and *Dalbergia oliveri* have never been completely banned from trade, legal harvests might have happened. Unfortunately, there was no record of quotas for the harvest of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in Vietnam. Probably, Vietnam has not yet tried quotas for *Dalbergia cochinchinensis* and *Dalbergia oliveri*.

## VI. CONTROL OF HARVEST

### 6.1. Harvest in protected areas

There is no harvest of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in the protected areas in Vietnam. According to Article 52 of the Forest Law 2017, harvest in the strictly protected and rehabilitation zones of protected areas is not allowed. Moreover, *Dalbergia cochinchinensis* and *Dalbergia oliveri* are listed in group 1 of Decision 2198-CNR (see section 5.2.1) and group IIA of Decree 84/2021/ND-CP (see section 5.2.2) which require permit for exploitation. Thus, if the harvest of *Dalbergia cochinchinensis* and *Dalbergia oliveri* happened in the administrative zone of the protected areas, harvest permits were needed and recorded. However, as mentioned in section 5.4, there were no records of harvest quota set for *Dalbergia cochinchinensis* and *Dalbergia oliveri* in the past.

For other State-controlled forest areas such as watershed protection forests, the exploitation of *Dalbergia cochinchinensis* and *Dalbergia oliveri* timbers is also prohibited because the Prime Minister of Vietnam stated that the Government of Vietnam declared to close its natural forests in a meeting in 2016 when discussing solutions for sustainable forest rehabilitation in the Central Highlands to respond to climate change in the period of 2016 – 2020, and this statement was institutionalized in 2017 Forestry Law of Vietnam (Law No. 16/2017/QH14), which regulates principles for closing and re-opening natural forests in Articles 29, 30, 31 and 32 (MARD, 2018).

### 6.2. Harvesting in areas with strong resource tenure or open access

There may have harvest of *Dalbergia cochinchinensis* timber trees in the areas such as forest gardens and field crops under ownership of local villagers for household consumption (see section 4.1.1) but quantities might be small and not documented.

### **6.3. Confidence in harvest management**

Although the management plan has not been developed and put in use, there have been legal regulations on harvest control. For example, the Article 58 of Forestry Law said the condition for forest owners to exploit timbers in forest plantations is to have a sustainable forest management proposal approved by a State competent agency. The problem may come from lack of human resource to enforcement regulations.

## **VII. MONITORING SYSTEM**

### **7.1. Methods used to monitor harvest**

Except for forests in the core zones of protected areas and species listed in group IA of Decree 06/2019 and Decree 84/2021, the legislations of Vietnam regulate that if harvest of timber is undertaken, a harvest and sustainable management proposal is needed and approved by a State competent agency. The rationale for harvesting is based on direct population estimates of the harvested species.

### **7.2. Confidence in harvest monitoring**

Considering to the method used to monitor harvested species above. There may be a shortage of financial and human resources to count the population, especially in large protected areas or forests.

## **VIII. INCENTIVES AND BENEFITS FROM HARVESTING**

### **8.1. Utilization compared to other threats**

As the population trends of *Dalbergia cochinchinensis* and *Dalbergia oliveri* decrease (see section 4.3), harvest will be harmful factor. Any current harvest activity either legal or illegal will be detrimental to the small, fragmented, endangered populations of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in Vietnam.

### **8.2. Incentives for species conservation**

Although timbers of *Dalbergia cochinchinensis* and *Dalbergia oliveri* are of high value, quantities of big trees (especially in *Dalbergia cochinchinensis*) are not many and their distributions concentrate in some provinces. Therefore, there are incentives for species conservation at local level for certain provinces, but these incentives are very low at the national level.

### **8.3. Incentives for habitat conservation**

*Dalbergia cochinchinensis* and *Dalbergia oliveri* play important roles in food chain of protected areas because leaves of small trees, seedlings and saplings are food of ungulate species that mainly distribute in the central highland and south-central regions (see section 3.1.3). Furthermore, they are species of the family Fabaceae, which has ability of fixing atmosphere nitrogen in soil as fertilizer to help the trees of nearby plant species growing. Thus, they bring incentives for rehabilitation of degraded forest ecosystem.

## **IX. PROTECTION FROM HARVEST**

### **9.1. Protection status**

#### **9.1.1. Global protection status**

*Dalbergia cochinchinensis* was firstly listed in Appendix II of CITES in 2016. Later that year, CITES gave a notification to the parties (No. 2016/064) about the new Appendices I, II and III, which was valid from 2 January 2017, that all species of *Dalbergia* genus (except for *Dalbergia nigra* listed in the Appendix I) are in the Appendix II. This means that the 2017 Appendix II included *Dalbergia oliveri*. Both species are now listed in the CITES's Appendix II valid from 22 June 2021.

According to IUCN, the conservation status of *Dalbergia cochinchinensis* is Vulnerable (Asian Regional Workshop (Conservation & Sustainable Management of Trees in Viet Nam), 1998) and *Dalbergia oliveri* is Endangered (Nghia, 1998).

### **9.1.2. National protection status**

According to the Vietnam Red Data Book, *Dalbergia cochinchinensis* and *Dalbergia oliveri* are listed as endangered (MOST & VAST, 2007).

Both *Dalbergia cochinchinensis* and *Dalbergia oliveri* are the subject to indirect protection of Vietnam Forestry Law (Law No. 16/2017/QH14), which regulates the closure of natural forest (Articles 29, 30, 31 and 32) and the Decree 156/2018/ND-CP (Article 33) on enforcing articles of the Forestry Law.

In Decision 523/QĐ-TTg of the Prime Minister dated on 1 April 2021 on approving the Vietnam Forestry Development Strategy for the period of 2021 - 2030, with a vision to 2050, the Central Highland – where both *Dalbergia cochinchinensis* and *Dalbergia oliveri* distribute in many places – is planned to strictly protect the existing natural forest areas; stop illegal exploitation and destruction of forests, and gradually restore and rehabilitate forests. Meanwhile, the southeast region, where Cat Tien national park and Bu Gia Map national park located, is oriented towards strengthening protection and conservation of biodiversity.

*Dalbergia cochinchinensis* and *Dalbergia oliveri* are listed in group IIA of the Decree 06/2019/ND-CP on management of endangered, precious and rare species of forest fauna and flora and observation of Convention on international trade in endangered species of wild fauna and flora. The group IIA including species of forest flora that currently not threatened with extinction but may become so without strict control of exploitation and use for commercial purpose and species specified in CITES Appendix II naturally inhabiting Vietnam.

*Dalbergia cochinchinensis* and *Dalbergia oliveri* are also protected by the Decree 102/2020/NĐ-CP on Vietnam timber legality assurance system. The article 6 of the Decree said imported timbers are considered high risk if i) the species are listed in any of the Appendices of CITES; ii) The species are critically endangered precious and rare species in Category IA and Category IIA of Decree 06/2019. The timber legality assurance system of Vietnam will help management and traceability of origins of forestry products to apply for harvest, transport, trade and processing of timber. This will strengthen the management of imported timbers is to prevent, discover, stop and deal with violations of law.

### **9.2. Proportion strictly protected**

As said above, most of viable populations of *Dalbergia cochinchinensis* and *Dalbergia oliveri* occur in protected areas and watershed protection forests, which are about 5.2 million ha, spreading from central to southern regions. It is estimated that populations of *Dalbergia cochinchinensis* and *Dalbergia oliveri* are being protected in the range of 260,000 ha (5%) – 780,000 ha (15%) of the total 5.2 million ha.

### **9.3. Effectiveness of strict protection**

Based on the illegal harvest data (see section 5.1) and national population size data (see section 4.2.1 for *Dalbergia cochinchinensis* and section 4.2.2 for *Dalbergia oliveri*), protection measures are very effective for *Dalbergia oliveri* and rather effective for *Dalbergia cochinchinensis*.

### **9.4. Regulation of harvest effort**

There are regulations of harvest in protected areas and watershed protection forests in Vietnam. In protected areas, point b, Clause 1, Article 52 of Forestry Law stimulates that salvage harvest of dead timber trees and broken trees in the service and administration zones is allowed. Point c, Clause 1, Article 52 of Forestry Law says salvage harvest of wood within the boundary of a site cleared for construction of work that is approved by State competent agencies is allowed. Article 12 of Decree 156/2018/ND-CP of the government of Vietnam dated on 16 November 2018 provides the enforcement of point b of Clause 1, Article 52 of Forestry Law that salvage harvest of dead trees and broken trees is permitted if there is a plan for full utilization of wood as prescribed by MARD, and point c of Clause 1, Article 52 of Forestry Law that salvage harvest of wood is permitted if there is a Decision on forest repurposing for other purposes. In watershed protection forests, Clause 1, Article 55 of Forestry Law stimulates that harvest of dead trees, broken trees, and disease-affected trees and standing trees where the density is higher than the prescribed one is allowed. Article 20 of Decree 156/2018/ND-CP instructs Clause 1, Article 55 of Forestry Law that harvest is permitted if there is a plan for full utilization of woods as regulated by the Ministry of Agriculture and Rural Development. In case of harvesting standing trees in places where the density is higher than the prescribed one, the harvest

is only conducted in time of re-opening natural forests. The modality of harvesting standing trees is followed by selection harvest system with intensity shall not exceed 20% of wood volume and crown cover of the post-logging forests must be greater than 0.6.

## X. TRADE DATA

### 10.1. Legal trade levels

#### 10.1.1. *Dalbergia cochinchinensis*

Direct trade in *Dalbergia cochinchinensis* from Vietnam in the period of 2018 – 2020 comprised of pre-Convention and wild-sourced timber, logs, sawn wood, wood products and roots (hereinafter referred to as timber) that all imported from Laos for commercial purposes. Exports of *Dalbergia cochinchinensis* in this period included 1,413.72 m<sup>3</sup> and 9,227 kg wild-sourced timber and 96.19 m<sup>3</sup> pre-Convention timber for trading purpose (as reported by Vietnam), and 1,314.40 m<sup>3</sup> wild-sourced timber (as reported by China and Laos). Almost all quantities of *Dalbergia cochinchinensis* timber (1,489.91 m<sup>3</sup> accounting for 98.68%) from Vietnam were exported to China, except for a small number of 20 m<sup>3</sup> wild-sourced timber to Laos (as reported by Vietnam).

The majority of *Dalbergia cochinchinensis* trade was reported in 2018, comprising 878.40 m<sup>3</sup> wild-sourced timber (see **Table 2**). No direct export of *Dalbergia cochinchinensis* from Vietnam were reported in 2020.

**Table 2.** Direct exports of *Dalbergia cochinchinensis* from Vietnam.

Term	Unit	Purpose	Source	Reported by	2018	2019	2020	Total
Logs	m <sup>3</sup>	T	W	Exporter	350.81	-	-	<b>350.81</b>
				Importer	434.26	59.31	-	<b>493.57</b>
Sawn wood	m <sup>3</sup>	T	W	Exporter	70.77	-	-	<b>70.77</b>
				Importer	58.77	-	-	<b>58.77</b>
	m <sup>3</sup>		O	Exporter	20.02	-	-	<b>20.02</b>
				Importer	-	-	-	-
Timber	m <sup>3</sup>	T	W	Exporter	878.40	31.20	-	<b>909.60</b>
				Importer	-	-	-	-
	Kg	T	W	Exporter	9,227.00	-	-	<b>9,227.00</b>
				Importer	-	-	-	-
Wood products	m <sup>3</sup>	T	W	Exporter	82.54	-	-	<b>82.54</b>
				Importer	468.99	73.75	-	<b>542.74</b>
	m <sup>3</sup>	T	O	Exporter	76.17	-	-	<b>76.17</b>
				Importer	-	-	-	-
Roots	m <sup>3</sup>	T	W	Exporter	-	-	-	-
				Importer	219.32	-	-	<b>219.32</b>

Source: CITES Trade Database. Downloaded 7 September 2021. (O = pre-Convention; W = wild-sourced; T = Trade).

#### 10.1.2. *Dalbergia oliveri*

Direct trade in *Dalbergia oliveri* from Vietnam in the period of 2018 – 2020 also comprised of pre-Convention and wild-sourced timber, imported from Laos for commercial purposes. Exports of *Dalbergia oliveri* in this period included 148,717.83 m<sup>3</sup> pre-Convention and 60.22 m<sup>3</sup> wild-sourced timber for commercial purpose (as reported by Vietnam), and 2,304.41 m<sup>3</sup> pre-Convention and 374.07 m<sup>3</sup> wild-sourced timber (as reported by Laos and China). Almost all quantities of *Dalbergia oliveri* timber (147,838 m<sup>3</sup> timber, accounting for 99.37%) from Vietnam were exported to Laos; the rest of 940.05 m<sup>3</sup> were exported to China (as reported by Vietnam).

The majority of *Dalbergia oliveri* trade was reported in 2019, comprising 145,743 m<sup>3</sup> pre-Convention timber (see **Table 3**). No direct export of *Dalbergia oliveri* from Vietnam were reported in 2020.

**Table 3.** Direct exports of *Dalbergia oliveri* from Vietnam.

Term	Unit	Purpose	Source	Reported by	2018	2019	2020	Total
<b>Logs</b>	m <sup>3</sup>	T	O	Exporter	124.96	-	-	<b>124.96</b>
				Importer	302.63	468.55	-	<b>771.18</b>
	m <sup>3</sup>		W	Exporter	-	-	-	-
				Importer	229.93	74.15	-	<b>304.07</b>
<b>Sawn wood</b>	m <sup>3</sup>	T	O	Exporter	2,582.44	145,743.00	-	<b>148,325.44</b>
				Importer	977.15	493.48	-	<b>1,470.63</b>
<b>Timber</b>	m <sup>3</sup>	T	O	Exporter	70.00	-	-	<b>70.00</b>
				Importer	-	-	-	-
<b>Wood product</b>	m <sup>3</sup>	T	O	Exporter	197.43	-	-	<b>197.43</b>
				Importer	62.60	-	-	<b>62.60</b>
	m <sup>3</sup>	T	W	Exporter	60.22	-	-	<b>60.22</b>
				Importer	-	-	-	-
<b>Roots</b>	m <sup>3</sup>	T	W	Exporter	-	-	-	-
				Importer	70.00	-	-	<b>70.00</b>

Source: CITES Trade Database. Downloaded 7 September 2021. (O = pre-Convention; W = wild-sourced; T = Trade).

## 10.2. Illegal trade levels:

Not much data on illegal trade of *Dalbergia cochinchinensis* and *Dalbergia oliveri* timber was collected from 2017 to June 2021. In 2017, there was one case of importing 0.36 m<sup>3</sup> of *Dalbergia oliveri* timber and 13.4 tons of *Dalbergia cochinchinensis* timber and roots and branches of *Dalbergia oliveri* without permits from Laos through Bo Y border gate of Kon Tum province. In 2018, a quantity of 5.794 m<sup>3</sup> of *Dalbergia oliveri* timber was illegally imported from Laos via La Hay border gate of Quang Tri province.

## XI. OTHER INDICATORS

### 11.1. Restoration or alleviation measures

In 2018, the forest ranger force of Kon Tum provincial FPD planted 4,500 seedlings of *Dalbergia cochinchinensis* in Dak Uy SUF. Center for Biodiversity Conservation and Ecotourism planted 6,000 *Dalbergia cochinchinensis* seedlings at Chu Mom Ray national park. The 10 Army Corps also planted 600 seedlings of *Dalbergia cochinchinensis* in Dak To district, Kon Tum province. In 2019, Cat Tien national park grew 100 seedlings of *Dalbergia cochinchinensis*.

No record of planting *Dalbergia oliveri* in Vietnam, however, seedlings were seen in the nursery of Bu Gia Map national park and reported to be in households' nurseries in Trang Bom district, Dong Nai province. These seedlings were reported to sell to anyone from individuals to firms for their needs.

## XII. CONCLUSION AND RECOMMENDATIONS

### 12.1. Conclusion

*Dalbergia cochinchinensis* and *Dalbergia oliveri* are valuable, hard rosewood species. They are restricted to Cambodia, Myanmar, Laos, Thailand, and Vietnam. In Vietnam, they mainly distribute in central and south-central regions. Global conservation status of *Dalbergia cochinchinensis* is VU and *Dalbergia oliveri* is EN; both are EN for national conservation status; and they are listed in the Appendix II of CITES. Like other endangered species in Vietnam, *Dalbergia cochinchinensis* and *Dalbergia oliveri* are strictly protected by various legal legislations. According to the laws, they can be used under the certain circumstance with the provision of licenses. In general, harvest and trade of *Dalbergia cochinchinensis* and *Dalbergia oliveri* without the permit is prohibited.

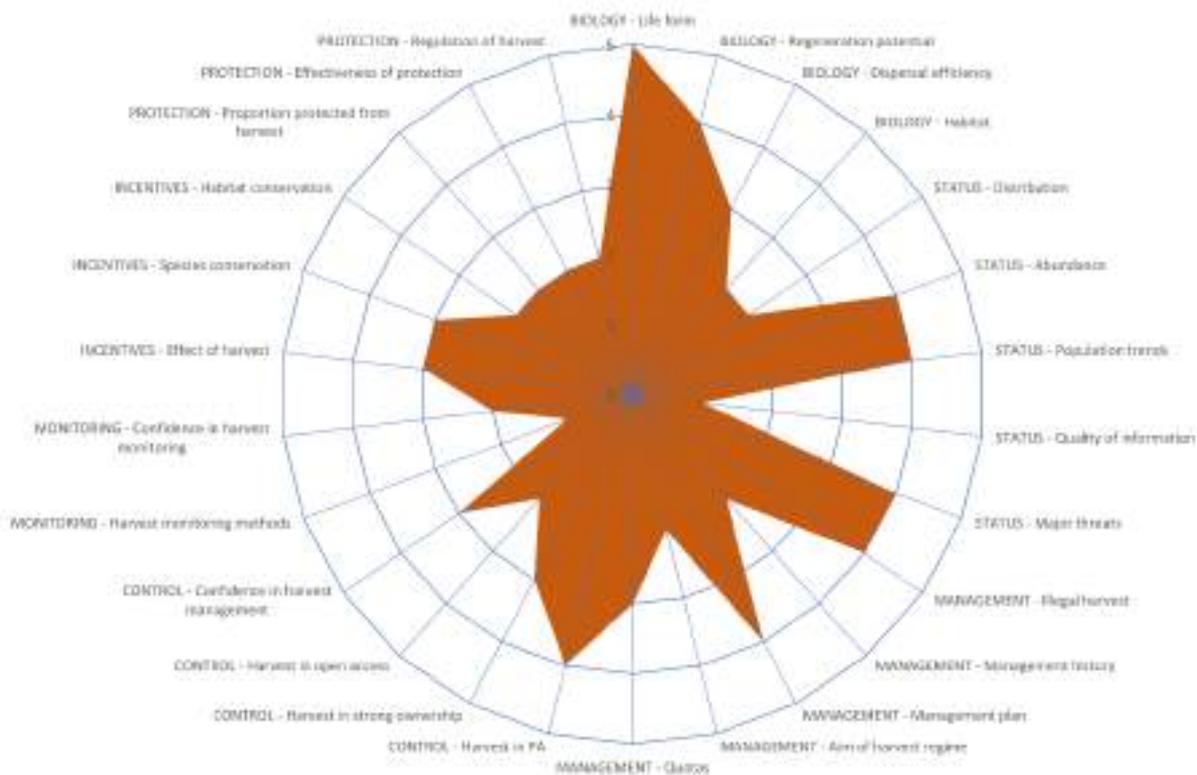
Their wild populations have been seriously declined and are now small and fragmented, especially *Dalbergia cochinchinensis*. Main threats to these species are illegal logging and trade, and habitat loss. The majority of legal trade of *Dalbergia cochinchinensis* was wild-sourced in 2018, while *Dalbergia oliveri* was pre-Convention in 2019. Illegal trade is not significant. Neither of these species is completely banned from trade but no quotas for the harvest were recorded.

A number of small populations of *Dalbergia cochinchinensis* timber trees with DBH greater than 20 cm remaining in plantations, gardens and/or field crops of local households in Chu Pah, Ayun Pa and Mang Yang districts of Gia Lai province were reported but not surveyed. This could be a good seed source for local propagation and afforestation with low cost.

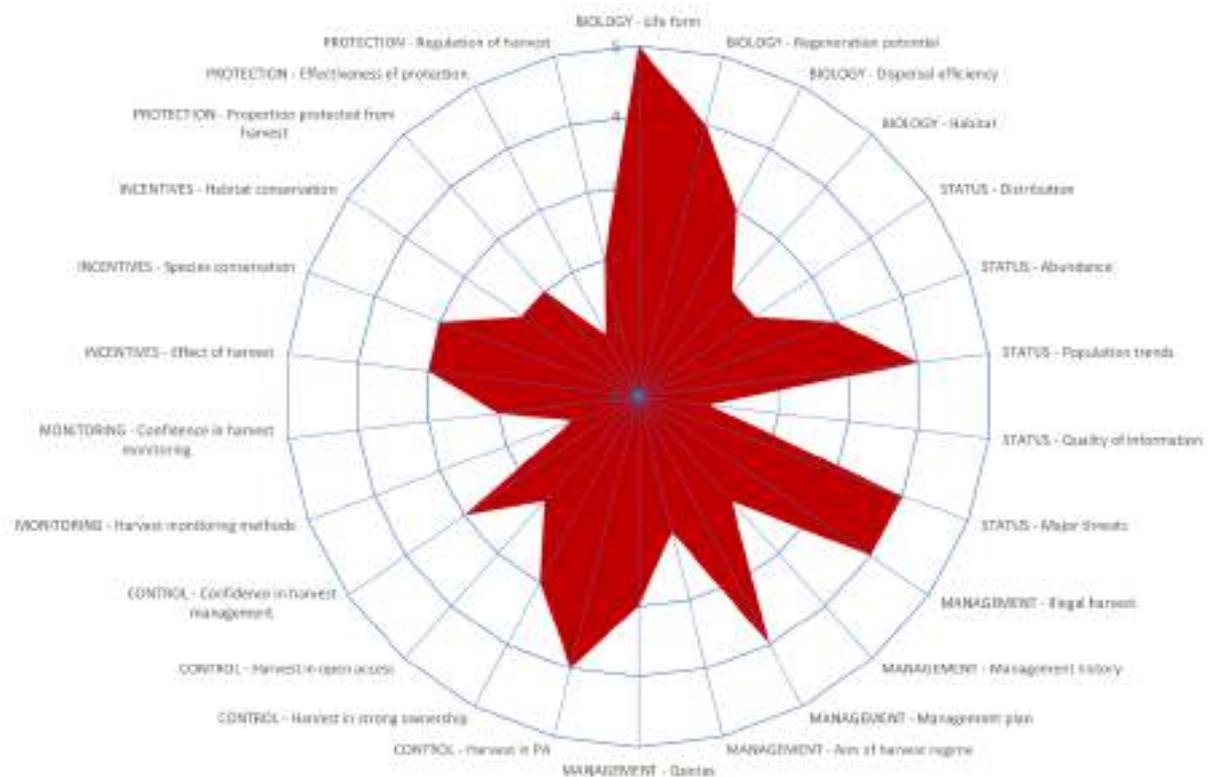
Although there is no single management plan for *Dalbergia cochinchinensis* or *Dalbergia oliveri* in place, forest owners (for organizations) are developing sustainable forest management plans for managing their forests. The CTSP project for Vietnam (2019 – 2022) is developing a conservation and management plan for these two species to mainstream into the sustainable forest management plan of protected areas.

For ease of reference, a radar plot describing factors affecting the management of *Dalbergia cochinchinensis* (see **Figure 10**) and *Dalbergia oliveri* (see **Figure 11**) in Vietnam was graphed. As seen below, both *Dalbergia cochinchinensis* and *Dalbergia oliveri* received five score as highest risk or the most negative in biological parameter of life form. This may be common problem to slow growth large-size timber trees. Risks of status (decreased population trends and major threats), management (large illegal or unmanaged harvest and no management plan), and control (no legal harvest in State-controlled protected areas) are rather high to both *Dalbergia cochinchinensis* and *Dalbergia oliveri*. Information on national status indicates sensitivity to given levels of harvest. In addition, risk of population abundance to *Dalbergia cochinchinensis* is pretty high because they are rare (see section 4.2.1). Factors of status (quality of information) and monitoring (methods of harvest monitoring) received lowest score as lowest risk.

As the populations of *Dalbergia cochinchinensis* and *Dalbergia oliveri* are small and fragmented, and they are facing at major threats of illegal logging and trade and habitat loss, and no management plan in place, the CITES Vietnam Scientific Authorities have seen that the harvest for export of *Dalbergia cochinchinensis* and *Dalbergia oliveri* timbers will be detrimental to the current vulnerable populations. Thus, the NDF is negative.



**Figure 10.** Radar plot of factors affecting the management of *D. cochinchinensis* in Vietnam.



**Figure 11.** Radar plot of factors affecting the management of *D. oliveri* in Vietnam.

## 12.2. Recommendations

Completely develop and implement a management and conservation plan for *Dalbergia cochinchinensis* or *Dalbergia oliveri* at key distribution areas of Dak Uy SUF; Cat Tien, Bu Gia Map, Yok Don, Chu Mom Ray and Kon Ka Kinh national parks; Ea So, Kon Chu Rang and Dong Nai nature reserves; Tan Phu, Ham Thuan-Da Mi, Ia Grai, Duc Co, Chu Mo and Nam Song Ba watershed protection forests.

Conduct population density and volume surveys of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in the remaining areas (except for Dak Uy SUF, Yok Don national park, Cat Tien national park and Bu Gia Map national parks) to generate baseline data and establish monitoring regimes to help the evaluation of population trend in the future.

Provide NDF training courses to representatives of key management and enforcement agencies to update conservation status, current harvest, threats, harvest management requirements and monitoring of *Dalbergia cochinchinensis* and *Dalbergia oliveri* to ensure that the wild populations will not be detrimental.

Strengthen forest patrolling operations to stop illegal harvesting and stockpile leakage.

Prohibit the harvest of *Dalbergia cochinchinensis* and *Dalbergia oliveri* timber from the wild as current populations are small and fragmented.

Apply zero quota for the harvest and export of wild-taken timbers of these two species in the period of 2022 – 2027.

## REFERENCES

- Asian Regional Workshop (Conservation & Sustainable Management of Trees in Viet Nam). (1998). *Dalbergia cochinchinensis*. *The IUCN Red List of Threatened Species 1998*: e.T32625A9719096. <https://dx.doi.org/10.2305/IUCN.UK.1998.RLTS.T32625A9719096.en>.
- Bui, X. T., Nguyen, T. M., & Hoang, T. T. (2018). Characteristics of forest structure and natural regeneration of *Dalbergia cochinchinensis* Pierre in Di Linh district, Lam Dong province, Vietnam (in Vietnamese). *Vietnam Journal of Forest Science*, 4, 64–74. <http://vafs.gov.vn/en/2019/01/vietnam-journal-of-forest-science-number-4-2018/>
- Dinh, T. K. Van, La, Q. T., Ta, Q. T., Hoang, T. S., & Nguyen, M. H. (2021). *Report on the systematic field survey of the population distribution, abundance and stocking of Dalbergia cochinchinensis and Dalbergia oliveri in four key protected areas of Dak Uy, Bu Gia Map, Yok Don and Cat Tien in Vietnam*.
- EIA. (2014). *Myanmar's Rosewood Crisis: Why key species and forests must be protected through CITES*. <https://eia-international.org/wp-content/uploads/Myanmars-rosewood-crisis-FINAL.pdf>
- EIA. (2017). *Repeat offender: Vietnam's persistent trade in illegal timber*. 2–4. <https://eia-international.org/wp-content/uploads/Repeat-Offender.pdf>
- La, Q. T., Bui, T. T., Nguyen, M. H., Dinh, T. K. Van, & Nguyen, H. N. (2021). *Development of distribution maps for Dalbergia cochichinensi and Dalbergia oliveri in Vietnam*.
- Loc, P. K., Yen, M. D., & Averyanov, L. (2018). Biodiversity in Vietnam. In *Global Biodiversity*. <https://doi.org/10.1201/9780429487743-14>
- MARD. (2018). *Law on forestry: Key contents*. Hanoi Publishing House. [https://data.vietnam.opendevlopmentmekong.net/laws\\_record/vietnam-law-on-forestry-2017/resource/0da9b964-93ce-4de4-819f-3b8e6fee376b](https://data.vietnam.opendevlopmentmekong.net/laws_record/vietnam-law-on-forestry-2017/resource/0da9b964-93ce-4de4-819f-3b8e6fee376b)
- MOST. (2019). *TCVN 12619-2:2019. Wood classification - Part 2: Classification by wood physical and mechanical properties*.
- MOST, & VAST. (2007). *Vietnam Red Data Book: Part II. Plants (in Vietnamese)* (T. B. Nguyen, D. L. Tran, & K. K. Nguyen (eds.)). Natural Science and Technology.
- Nghia, N. H. (1998). *Dalbergia oliveri*. *The IUCN Red List of Threatened Species 1998*: e.T32306A9693932. <https://dx.doi.org/10.2305/IUCN.UK.1998.RLTS.T32306A9693932.en>
- Nguyen, M. H., La, Q. T., Dinh, T. K. Van, Do, V. B., & Nguyen, T. H. (2021). *Manual on identification of Dalbergia cochinchinensis and Dalbergia oliveri (in Vietnamese)*. Dong Nai Publishing House.
- Nguyen, N. C., Cao, T. C., Vu, V. C., Nguyen, X. D., Vu, V. D., Nguyen, K. D., Tran, H., Tran, T. O., Nguyen, B. Q., & Nguyen, N. T. (1996). *Vietnam Forest Trees*. Agricultural Publishing House.
- Nguyen, T. H., Nguyen, M. H., & La, Q. T. (2019a). *Review on the taxonomy, biology, ecology, and the status, trend and population structure and dynamics of Dalbergia cochinchinensis in Vietnam*. [https://cites-tsp.org/wp-content/uploads/2020/11/Review-taxonomy...-of-Dalbergia-cochinchinensis\\_revised\\_compressed.pdf](https://cites-tsp.org/wp-content/uploads/2020/11/Review-taxonomy...-of-Dalbergia-cochinchinensis_revised_compressed.pdf)
- Nguyen, T. H., Nguyen, M. H., & La, Q. T. (2019b). *Review on the taxonomy, biology, ecology, and the status, trend and population structure and dynamics of Dalbergia oliveri in Vietnam*. [https://cites-tsp.org/wp-content/uploads/2020/11/Review-taxonomy...-of-Dalbergia-oliveri\\_compressed.pdf](https://cites-tsp.org/wp-content/uploads/2020/11/Review-taxonomy...-of-Dalbergia-oliveri_compressed.pdf)
- Nyi, N. K. (2014). *Myanmar timber trade and rosewood trade policies [PowerPoint slides]*. Ministry of Environmental Conservation and Forestry. <https://www.forest-trends.org/wp-content/uploads/imported/8myanmar-ppt-pdf.pdf>
- Pham, T. L., Tran, H. T., & Pham, V. K. (2013). Preliminary research results on ability of sexual propagation and the growth of *Dalbergia oliveri* (In Vietnamese). *The 5th National Scientific Conference on Ecology and Biological Resources*, 1147–1151. <http://iebr.ac.vn/database/HNTQ5/1147.pdf>
- Pham, T. L., Tran, H. T., & Tran, T. B. (2011). Some biological, ecological characteristics and bioactivity of some species of *Dalbergia* genus in Vietnam (in Vietnamese). *The 4th National Scientific Conference on Ecology and Biological Resources*, 1201 – 1206. <http://www.iebr.ac.vn/database/HNTQ4/1201.pdf>
- Rose, M. (2014). *Non-detriment Findings in CITES (NDFs)*. (Version 1.). Austrian Federal Ministry of

Agriculture, Forestry, Environment and Water Management.  
<https://cites.unia.es/cites/file.php/1/files/guide-CITES-NDFs-en.pdf>

Rosser, A., & Haywood, M. (2002). *Guidance for CITES Scientific Authorities: Checklist to assist in making non-detriment findings for Appendix II exports* (Issue 27). IUCN, Gland, Switzerland and Cambridge, UK. <https://portals.iucn.org/library/sites/library/files/documents/SSC-OP-027.pdf>

Say, S., Chheang, D., Hort, S., Kim, S., Pang, P., & Sopheap, L. (2021a). *Review of the taxonomy, biology, ecology, and the status, trend, and population structure, of D. cochinchinensis and D. oliveri in Choam Ksant district, Preah Vihear province, Cambodia*. [https://cites-tsp.org/wp-content/uploads/2021/07/CITES\\_KH\\_Dalbergia\\_cochinchinensis\\_Taxonomy-Review\\_20210712A.pdf](https://cites-tsp.org/wp-content/uploads/2021/07/CITES_KH_Dalbergia_cochinchinensis_Taxonomy-Review_20210712A.pdf)

Say, S., Chheang, D., Kim, S., Pang, P., Hort, S., & Sopheap, L. (2021b). *Systematic Survey Report of Dalbergia cochinchinensis and Dalbergia oliveri for Piloting Assessment on Sustainable Genetic Conservation in Choam Ksant district, Preah Vihear Province*. [https://cites-tsp.org/wp-content/uploads/2021/07/CITES\\_KH\\_Systema\\_Inventory\\_D\\_Cochichinensis\\_D\\_Oliveri\\_Report\\_20210712.pdf](https://cites-tsp.org/wp-content/uploads/2021/07/CITES_KH_Systema_Inventory_D_Cochichinensis_D_Oliveri_Report_20210712.pdf)

UNEP-WCMC. (2018). *Report on species/country combinations selected for review by the Plants Committee following CoP17*. UNEP-WCMC, Cambridge.  
<https://cites.org/sites/default/files/eng/com/pc/24/E-PC24-13-02-A2.pdf>