



**A REVIEW OF THE CURRENT HARVEST CONTROL AND MONITORING OF
DALBERGIA COCHINCHINENSIS AND *DALBERGIA OLIVERI* IN VIETNAM**



A round log of *Dalbergia oliveri* in the Cat Tien national park. Photo: Nguyen Manh Ha – 2020.

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Cover illustration: A *Dalbergia oliveri* round log with a heartwood of size 130 cm x 23 cm was illegally logged in the Cat Tien national park and confiscated by the park's forest rangers. The name of the logger and the confiscation date were recorded on the surface of the log. Photo: Nguyen Manh Ha – 2020.

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CONTENTS

ACKNOWLEDGEMENTS	4
ACRONYMS AND ABBREVIATIONS.....	5
1. INTRODUCTION.....	6
2. OBJECTIVES	6
3. METHODS	7
4. RESULTS.....	7
4.1. National population sizes	7
4.1.1. <i>Dalbergia cochinchinensis</i>	7
4.1.2. <i>Dalbergia oliveri</i>	8
4.2. Population trend	8
4.2.1. <i>Dalbergia cochinchinensis</i>	8
4.2.2. <i>Dalbergia oliveri</i>	9
4.3. Main threats	10
4.4. Harvest and trade.....	11
4.4.1. Illegal harvest	11
4.4.2. Legal harvest.....	12
4.4.3. Illegal trade.....	12
4.4.4. Legal trade	12
4.5. Harvest control and monitoring	14
4.6. Legal framework for harvest control and monitoring.....	14
5. CONCLUSIONS.....	16
6. REFERENCES.....	17

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On behalf of the project team.

Nguyen Manh Ha

ACRONYMS AND ABBREVIATIONS

CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
cm	centimeter
<i>D.</i>	<i>Dalbergia</i>
DBH	diameter at breast height
EIA	Environmental Investigation Agency
FPD	Forest Protection Department
MA	Management authority
MARD	Ministry of Agriculture and Rural Development
m	meter
m ³	cubic meter
ND-CP	Decree of the government
NP	National Park
PDR	People's Democratic Republic
SUFs	Special-Use Forests, known as Protected Areas, are mainly used to conserve natural forest ecosystems and 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.
UNEP	UN Environment Programme
WCMC	World Conservation Monitoring Centre

1. INTRODUCTION

“Rosewood is an informal term referring to a group of hardwood species that are red in color and widely used in furniture processing in China” (Wenbin & Xiufang, 2013, p. 2). Rosewood species are one of the most traded plant species that have been used to produce high-end furniture and handicrafts. They have richly hued durable heartwoods that make them valuable in international trade with a price of up to US\$ 6,000/m³ (EIA, 2012). Some studies indicated that top-class and high-end species such as *Dalbergia tonkinensis* and *D. cochinchinensis* have market prices of US\$ 2 million/m³ and US\$ 20,000/m³ respectively (Wenbin & Xiufang, 2013). The price of *D. cochinchinensis* was even recorded much higher of up to US\$ 93,000/m³ and *D. oliveri* was at US\$ 9,200 per cubic meter¹. Rosewood species were often smuggled from Lao PDR, Myanmar, Thailand and Cambodia; and Vietnam was considered to be the significant transit hub before being exported to China (UNEP-WCMC, 2014). Amongst traded rosewood species, *D. cochinchinensis* and *D. oliveri* are the most sought-after trees for making luxury furniture and decorative products in Vietnam. Although there are no specific logging and trade data on *D. cochinchinensis* and *D. oliveri* in Vietnam, illicit exploitation during the 1990s and 2000s has made them increasingly scarce in Vietnam. The populations of *D. cochinchinensis* and *D. oliveri* in Vietnam have heavily declined due to threats from deforestation, illegal logging, and urbanization (Nguyen et al., 2019a, 2019b). The current wild populations of *D. cochinchinensis* and *D. oliveri* are small and fragmented, and together with the lack of population protection, conservation and restoration measures are posing high threats to these species. Without understanding the current status, harvest control and monitoring methods, small populations of *D. cochinchinensis* and *D. oliveri* can face high risks of extinction in many parts of Vietnam.

D. cochinchinensis and *D. oliveri* are specified as Endangered (EN) in the Vietnam Red Data Book (MOST & VAST, 2007). They are listed as Vulnerable (VU) and Endangered (EN) respectively in the IUCN Red List of Threatened Species (Asian Regional Workshop (Conservation & Sustainable Management of Trees in Viet Nam), 1998; Nghia, 1998). They are classified in Appendix II of CITES. *D. cochinchinensis* and *D. oliveri* are listed in group IIA of Decree 06/2019/ND-CP on the management of endangered, precious and rare species of forest fauna and flora and observation of CITES, and the Decree 84/2021/ND-CP which amended and supplemented some articles of Decree 06/2019/ND-CP. The Vietnamese Government has issued some regulations to protect these species from logging and trade.

This review summarizes the population status and trends, trade and violation, legal protection, harvest control, and monitoring and management of *D. cochinchinensis* and *D. oliveri* in Vietnam.

2. OBJECTIVES

The review aims to collect information and data on the management history, harvest control, monitoring measures, trade and the legal framework for *D. cochinchinensis* and *D. oliveri* in Vietnam, as well as to provide inputs for the preparation of the non-detriment findings report.

The specific objectives include:

- Assessment of population size and trend of *D. cochinchinensis* and *D. oliveri* in Vietnam.
- Assessment of management measures, harvest control, monitoring system, and violation cases relating to *D. cochinchinensis* and *D. oliveri*.
- Review national and local Vietnam regulations and legislation to control and manage the harvest and trade of the two species.

¹ <https://www.unodc.org/documents/wwcr/Rosewood.pdf>

3. METHODS

The project team collected legal and technical documents and even undertook personal communication to review the management regulations, rosewood distribution, timber volume, illegal logging, harvest, and trade in Vietnam with the focus on *D. cochinchinensis* and *D. oliveri*.

The project team then worked with the Vietnam Administration of Forestry, the Vietnam CITES MA, local Forest Protection Departments (FPDs) and management boards of the five identified protected areas, including the Dak Uy Special-Use Forest, the Yok Don NP, Cat Tien NP, and the Bu Gia Map NP, as well as the Ham Thuan-Da Mi watershed protection forest, to collect legal trade data and logging information. Documents on management regulations of *D. cochinchinensis* and *D. oliveri* in Vietnam were also collected.

The project team also worked with Vietnamese timber and forest resource experts to collect trade and harvest information on rosewood.

In September and October 2019, field trips were conducted in six provinces to meet with six provincial FPDs (Binh Thuan, Gia Lai, Kon Tum, Binh Phuoc, Dong Nai, and Dak Lak), six district FPDs and five management boards of protected areas to collect information on current harvest controls, monitoring and illegal logging of *D. cochinchinensis* and *D. oliveri*.

From March to June 2020, field surveys were conducted in four key protected areas of the Dak Uy SUF, and the Yok Don, Bu Gia Map and Cat Tien NPs to assess the population density, stocking and abundance of *D. cochinchinensis* and *D. oliveri*.

Trade data in *D. cochinchinensis* and *D. oliveri* for the period from 2018 to 2020 were also collected and extracted from the CITES Trade Database for review.

4. RESULTS

4.1. National population sizes

4.1.1. *Dalbergia cochinchinensis*

D. cochinchinensis was mainly recorded in the central and southern provinces (La et al., 2021; Nguyen et al., 2019a). The most concentrated population of this species is recorded in the Dak Uy SUF (Dinh et al., 2021). The field surveys in the four key protected areas recorded about 8,000 trees of *D. cochinchinensis* with a diameter at breast height (DBH) above 6 cm (called timber trees) in the Dak Uy SUF, and 8,000 to 10,000 trees in the Yok Don national park (Dinh et al., 2021). The surveys did not record any *D. cochinchinensis* in the Bu Gia Map national park and the southern part of the Cat Tien national park. According to personal communication with plant experts, there is a population of about 8,000 trees of *D. cochinchinensis* in the Kon Ka Kinh national park, equivalent to the number of *D. cochinchinensis* trees recorded in the Dak Uy SUF, but the number of large trees is few (Hoang Thanh Son, personal communication, August 31, 2020). Another population of about 1,000 trees of *D. cochinchinensis* which can serve as a good seed source was reported in the Tan Phu watershed protection forest (Le Viet Dung, personal communication, October 10, 2019). Many other small populations of *D. cochinchinensis* were also reported to be sparsely distributed in many places, such as in the Chu Mom Ray national park, the Watershed Protection Forests of Nam Song Ba, Ia Rсай and Ham Thuan – Da Mi, and plantations, especially in forest gardens, production forests and/or crop fields of local villagers in the central provinces (Figure 1). Unfortunately, no detailed surveys were undertaken to document the number of timber trees (La et al., 2021; Nguyen et al., 2019a). A *D. cochinchinensis* population with mainly 6 – 10 cm in diameter was also reported to exist in the Di Linh district of Lam Dong province (Bui et al., 2018).



Figure 1. Some mature *D. cochinchinensis* trees remain in the Headquarters of the Ham Thuan - Da Mi watershed protection forest. Photo: La Quang Trung/CCD – 2019.

4.1.2. *Dalbergia oliveri*

D. oliveri was mainly recorded in the central provinces and some southeast provinces of Vietnam (La et al., 2021; Nguyen et al., 2019b). The field surveys in the four key protected areas recorded about 70,000 to 80,000 *D. oliveri* trees of DBH 6 cm and above in the Bu Gia Map national park, 140,000 to 160,000 trees in the Cat Tien national park, 50,000 to 60,000 trees in the Yok Don national park, and no *D. oliveri* trees was recorded in the Dak Uy SUF (Dinh et al., 2021). A large natural regenerating population of *D. oliveri* was seen in the watershed protection forest of the Ham Thuan – Da Mi hydropower plant in the Ham Thuan Bac district of Binh Thuan province (Nguyen et al., 2019b). *D. oliveri* was reported to be abundant and well regenerated in the Dong Nai cultural nature reserve and the Tan Phu watershed protection forests (Nguyen et al., 2019b).

4.2. Population trend

4.2.1. *Dalbergia cochinchinensis*

Wild *D. cochinchinensis* populations have been decreasing in Vietnam, especially the significant decline of mature individuals. Deforestation has seriously compromised the distribution of the species. In the past, *D. cochinchinensis* was recorded in the Ben Cat of Binh Duong province, the Trang Bom district of Dong Nai province, and the Thu Duc district of Ho Chi Minh City. However, these wild populations may be extinct now due to urbanization (Nguyen et al., 2019a).

Surveys conducted by the Forest Inventory and Planning Institute in the five protected areas, namely, the Easo Nature Reserve, the Yok Don NP, Chu Mom Ray NP, Kon Ka Kinh NP, and the Cat Tien NP, had

recorded an average density ranging from 1 to 10 trees/ha (Pham et al., 2010). The populations of *D. cochinchinensis* were estimated to decline by 50 to 60% over 5 to 10 years, from 2,000 trees in 2005 to between 1,000 to 800 trees in 2010 (Pham et al., 2010).

Though the density of *D. cochinchinensis* in the existing populations is decreasing, it is believed that new populations are increasing through afforestation and forest restoration programs. For example, in 2018, 4,500 seedlings of *D. cochinchinensis* were planted in the Dak Uy SUF and 6,600 seedlings were planted in other places in the Kon Tum province (Nguyen et al., 2019a). It is important that local people in some places such as the Song Ba village of Chu Rcam commune, Krong Pa district, Gia Lai province, are protecting *D. cochinchinensis* regenerating trees in their home gardens.

4.2.2. *Dalbergia oliveri*

Similar to the status of *D. cochinchinensis*, the *D. oliveri* population trend is decreasing in Vietnam. The number of mature individuals has significantly declined. Over-exploitation and habitat destruction have seriously compromised the distribution of the species. In fact, wild populations of *D. oliveri* in previous distribution locations, such as in the Trang Bom district (Dong Nai province) and the Ca Na commune (Ninh Thuan province) may now be extinct due to urbanization (Nguyen et al., 2019b).

In the light of the wild population decline in many distribution areas, some areas such as the Bu Gia Map, Cat Tien and the Yok Don NPs, the Tan Phu watershed protection forest, the Dong Nai culture nature reserve, and the Ham Thuan – Da Mi watershed protection forest are holding viable populations with large-sized trees that can serve as good seed sources and regenerants (Nguyen et al., 2019b) (Figure 2).



Figure 2. A mature *D. oliveri* tree recorded in the Yok Don national park. Photo: La Quang Trung/CCD - 2020.

4.3. Main threats

Both *D. cochinchinensis* and *D. oliveri* have been facing the main threats of illegal logging and trade, and habitat loss for a long time, thus causing fragmented populations and severe decline of mature individuals.

Depending on the specific areas, the main threats may vary. For example, *D. oliveri* in the Yok Don NP suffers not only from illegal logging (Figure 3), but also from fire due to human-induced pre-burning activity to prevent forest fires. Observations had shown that many young trees, even regenerants, with a height of less than two meters that were burnt in the dry season of the previous year were regenerating in the next year (Figure 4). These regenerants could avoid mortality if the park's personnel can carefully control pre-burning activity. This process is repeated for years, and many seedlings and saplings, however, could not overcome the fire risks to become mature trees.

Currently, most of the *D. cochinchinensis* and *D. oliveri* trees that can yield heartwood are found in protected areas.



Figure 3. A deep hole made on a *D. oliveri* stem by illegal loggers to check if heartwood is available for extraction. Photo: La Quang Trung/CCD – 2020.



Figure 4. A *D. oliveri* coppice growing from a burnt stump by pre-burning activity in the Yok Don NP. Photo: La Quang Trung/CCD – 2020.

4.4. Harvest and trade

4.4.1. Illegal harvest

Illegal logging of *D. cochinchinensis* and *D. oliveri* are still happening in Vietnam, even in the most strictly protected forest like the Dak Uy SUF. There is a severe shortage of personnel to manage and protect *D. cochinchinensis* in the Dak Uy SUF. The total area of the Dak Uy SUF is only 546.24 ha, and in 2019 the management board had only 27 permanent staff and 12 to 16 mobilized personnel from the surrounding district FPDs and provincial FPDs who are involved in the protection of *D. cochinchinensis*. Meanwhile, the government had only one forest ranger in charge of managing and protecting 500 ha of forest. However, illegal logging in the Dak Uy SUF is still prevalent. The number of *D. cochinchinensis* and *D. oliveri* violation cases in the four key protected areas in Vietnam is as in Table 1.

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

Taxon	Violation cases	Location	Lost (m ³)	Year
<i>D. cochinchinensis</i>	26 cases of timber logging and 2 cases of timber transportation	Dak Uy SUF, Kon Tum province	4.4	2017
	7 cases of digging remaining roots from the previous logging	Dak Uy SUF, Kon Tum province	0	2018
	1 case of timber logging	Yok Don NP, Dak Lak province	0.048	2021

Taxon	Violation cases	Location	Lost (m ³)	Year
	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 Teh district, Lam Dong province (*)	0.508	2020
	1 case of keeping timber at home	Da Teh 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
	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 the Dak Uy SUF were collected in September 2019, in the Cat Tien NP were to June 2020, and in the Bu Gia Map NP and the Yok Don NP were to June 2021.

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

4.4.2. Legal harvest

No data on the legal harvest of *D. cochinchinensis* and *D. oliveri* was recorded.

4.4.3. Illegal trade

In 2017, there was one case of importing 0.36 m³ of *D. oliveri* timber and 13.4 tons of *D. cochinchinensis* timber and roots and branches of *D. oliveri* without permits from Lao PDR through the Bo Y border gate of Kon Tum province. In 2018, a quantity of 5.794 m³ of *D. oliveri* timber was illegally imported from Lao PDR via the La Hay border gate of Quang Tri province.

4.4.4. Legal trade

Dalbergia cochinchinensis

Direct trade in *D. cochinchinensis* from Vietnam from 2018 to 2020 comprised of pre-Convention and wild-sourced timber, logs, sawn wood, wood products and roots that were all imported from Lao PDR for commercial purposes. Exports of *D. cochinchinensis* during this period included 1,413.72 m³ and 9,227 kg of wild-sourced timber and 96.19 m³ pre-Convention timber for trade purposes (as reported by Vietnam), and 1,314.40 m³ of wild-sourced timber (as reported by China and Lao PDR). Almost all the *D. cochinchinensis* timber (1,489.91 m³ accounting for 98.68%) from Vietnam was exported to China, except for a small volume of 20 m³ wild-sourced timber to Lao PDR (as reported by Vietnam).

The majority of the *D. cochinchinensis* trade was reported in 2018, comprising 878.40 m³ of wild-sourced timber (Table 2). No direct export of *D. cochinchinensis* from Vietnam was reported in 2020.

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

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

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

Dalbergia oliveri

Direct trade in *D. oliveri* from Vietnam during the period 2018 to 2020 also comprised of pre-Convention and wild-sourced timber, imported from Lao PDR for commercial purposes. Exports of *D. oliveri* during this period included 148,717.83 m³ pre-Convention and 60.22 m³ wild-sourced timber for commercial purposes (as reported by Vietnam), and 2,304.41 m³ pre-Convention and 374.07 m³ wild-sourced timber (as reported by Lao PDR and China). Almost all the *D. oliveri* timber (147,838 m³ timber, accounting for 99.37%) from Vietnam was exported to Lao PDR with the rest of 940.05 m³ exported to China (as reported by Vietnam).

The majority of the *D. oliveri* trade was reported in 2019, comprising 145,743 m³ pre-Convention timber (Table 3). No direct export of *D. oliveri* from Vietnam was reported in 2020.

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

Term	Unit	Purpose	Source	Reported by	2018	2019	2020	Total
Logs	m ³	T	O	Exporter	124.96	-	-	124.96
				Importer	302.63	468.55	-	771.18
	m ³		W	Exporter	-	-	-	-
				Importer	229.93	74.15	-	304.08
Sawn wood	m ³	T	O	Exporter	2,582.44	145,743.00	-	148,325.44
				Importer	977.15	493.48	-	1,470.63
Timber	m ³	T	O	Exporter	70.00	-	-	70.00
				Importer	-	-	-	-
	m ³	T	O	Exporter	197.43	-	-	197.43

Term	Unit	Purpose	Source	Reported by	2018	2019	2020	Total
Wood product				Importer	62.60	-	-	62.60
	m ³	T	W	Exporter	60.22	-	-	60.22
				Importer	-	-	-	-
Roots	m ³	T	W	Exporter	-	-	-	-
				Importer	70.00	-	-	70.00

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

4.5. Harvest control and monitoring

In special-use forests (protected areas), Article 52 of the 2017 Forest Law stipulates that the harvest of live, dead and fallen trees in strictly protected and rehabilitation zones is prohibited and the salvage of dead or fallen trees in the service-administrative zones is allowed. In the protection forests, Article 55 of the 2017 Forest Law stipulates that dead timber trees, fallen trees, diseased trees and trees in areas with a density higher than the prescribed level may be harvested. Therefore, *D. cochinchinensis* and *D. oliveri*, distributed in the core and ecological restoration zones of protected areas are strictly protected and are not allowed to be harvested. In contrast, *D. cochinchinensis* and *D. oliveri* distributed in the administrative zone of protected areas and watershed protection forests can be harvested. However, it needs a harvest permit. Both *D. cochinchinensis* and *D. oliveri* are listed in group 1 of Decision 2198-CNR dated 26 November 1977 on the temporary classification table of timber species for their heavy, naturally durable, high economic value timbers and group IIA of Decree 06/2019/ND-CP dated 22 January 2019, as well as in the revised Decree 84/2021/ND-CP dated 22 September 2021 on the management of endangered, precious and rare species of forest fauna and flora and observation of CITES, which require a permit for exploitation.

In recent years, the Government of Vietnam declared to close its natural forests in a meeting held in 2016 when discussing solutions for sustainable forest rehabilitation in the Central Highlands to respond to climate change in the period of 2016 to 2020, and this statement was institutionalized in the 2017 Forestry Law of Vietnam (Law No. 16/2017/QH14), which regulates the principles for closing and re-opening natural forests in Articles 29, 30, 31 and 32 (MARD, 2018). For this reason, *D. cochinchinensis* and *D. oliveri* found in all natural forests, including protected areas, protection forests and other State-controlled forests, will not be harvested.

Harvest of *D. cochinchinensis* and *D. oliveri* timbers in some areas owned by households or communities such as forest gardens and field crops (Nguyen et al., 2019a) might be undertaken with small quantities which are not documented.

Harvest monitoring is applied for legal exploitation but there is no data on the legal harvest of *D. cochinchinensis* and/or *D. oliveri* in Vietnam. Therefore, the assessment of harvest monitoring of *D. cochinchinensis* and/or *D. oliveri* is not possible. In case of having a legal harvest, a harvest and sustainable management proposal is developed by the forest owners and approved by a State competent agency. The rationale for harvesting is based on direct population estimates of the harvested species.

4.6. Legal framework for harvest control and monitoring

There are regulations on harvest in protected areas and watershed protection forests in Vietnam. In protected areas, point b, Clause 1, Article 52 of the Forestry Law stipulates that salvage harvest of dead timber trees and damaged trees in the service and administration zones is allowed. Point c, Clause 1, Article 52 of the Forestry Law stipulates that salvage harvest of wood within the boundary of a site cleared for construction work that is approved by State competent agencies is allowed, as well as when there is a Decision on forest repurposing for other purposes. Article 12 of Decree 156/2018/ND-CP of the Government of Vietnam dated 16 November 2018 provides the enforcement of point b of Clause 1. Article 52 of the Forestry Law further stipulates that salvage harvest of dead trees and damaged trees is permitted

if there is a plan for full utilization of the wood as prescribed by the Ministry of Agriculture and Rural Development (MARD).

In the watershed protection forests, Clause 1, Article 55 of the Forestry Law stipulates that harvest of dead trees, damaged trees, disease-affected trees, and standing trees where the density is higher than the prescribed volume is allowed. Article 20 of Decree 156/2018/ND-CP instructs Clause 1, Article 55 of the Forestry Law that harvest is permitted if there is a plan for full utilization of woods as regulated by MARD. In the case of harvesting standing trees in places where the density is higher than the prescribed volume, the harvest is only conducted at the time of re-opening natural forests. The modality of harvesting standing trees follows a selection harvest system where the intensity should not exceed 20% of the wood volume and the crown cover of the post-logging forests must be greater than 0.6 or 60%.

D. cochinchinensis and *D. oliveri* were listed in Group IIA of Decree 32/2006/ND-CP dated 30 March 2006, Decree 06/2019/ND-CP dated 22 January 2019, and the most recent Decree 84/2021/ND-CP dated 22 September 2021 by the Government of Vietnam on the management of endangered, precious and rare species of wild fauna and flora and in the implementation of CITES (Government of Vietnam, 2006, 2019, 2021). This limited the exploitation, dispatch, or storage of *D. cochinchinensis* and *D. oliveri* wood and restricted export to finished products. According to Articles 12 and 13 of the Decree 06/2019/ND-CP, the exploitation of species in Group IA and IIA should be treated as species in Appendix I and II of CITES. This indicated that the two species are under strict control for exploitation and use only for commercial purposes. The district management agency of forestry is in charge of controlling and monitoring the implementation of exploitation plans approved by MARD (Government of Vietnam, 2019).

The Decree 187/2013/ND-CP dated 20 November 2013 issued by the Government of Vietnam elaborates on the implementation of the Commercial Law regarding international goods sale and purchase, processing and transit agency activities with foreign countries, and the prohibition of the export of log and sawn wood that was harvested from Vietnamese natural forests, including *D. cochinchinensis* and *D. oliveri* (Government of Vietnam, 2013). In addition, in 2014, Vietnam enforced a logging ban in natural forests, but exempted subsistence uses and certified forest companies. In 2016, the scope of the logging ban was extended to all forest users in the Central Highlands. Later in 2017, logging in natural forests was prohibited for all forest users nationwide (Braun et al., 2017). Both *D. cochinchinensis* and *D. oliveri* are subject to indirect protection by the Vietnam Forestry Law (Law No. 16/2017/QH14), which regulates the closure of natural forests (Articles 29, 30, 31 and 32) and Decree 156/2018/ND-CP (Article 33) on enforcing articles of the Forestry Law.

D. cochinchinensis and *D. oliveri* are also protected by Decree 102/2020/ND-CP on Vietnam's timber legality assurance system. Article 6 of the Decree states that imported timbers are considered high risk if (i) the species are listed in any of the Appendices of CITES; and (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 to trace the origins of forestry products from harvest, transport, and trade to processed timber. This will strengthen the management of imported timber and address any violations of the laws and regulations enforced in Vietnam.

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

The above legislation has led Vietnam to shift from producer to exporter that now produces little raw material from its own forest (Treanor, 2015). Nevertheless, Vietnam's rosewood imports are considered at high-risk as imports are mostly sourced from the Mekong countries where harvesting, trade and export are of questionable legality (EIA, 2018; Treanor, 2015).

5. CONCLUSIONS

Wild populations of *D. cochinchinensis* and *D. oliveri* remain in decline despite efforts to protect and restore their populations in many places.

Viable populations of *D. cochinchinensis* and *D. oliveri* are now mainly found in protected areas and some protection forests that must apply strict protection measures to enhance the supply of seeds for the restoration of the populations in deforested areas and their historical distribution areas.

D. cochinchinensis and *D. oliveri* are economically valuable species in national and international trade markets. The trade in the two species was mostly in the international market with materials sourced from the Mekong region countries where Vietnam plays the role of a transit country before shipping them to China, Hong Kong, and Japan. However, the trafficked timber originating from Lao PDR, Cambodia or the other Mekong region countries might pose a high risk of illegal trade.

Despite the available control and management legislation on harvesting and trade in *D. cochinchinensis* and *D. oliveri*, illegal logging and transportation have been occurring in protected areas where these areas are considered the only stronghold of the remaining populations.

The Vietnamese Government has issued laws, regulations, and decisions to protect the wild populations of endangered plants in general, and *D. cochinchinensis* and *D. oliveri* in particular. There is an urgent need to strictly enforce these laws, regulations, and decisions effectively.

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