Assessment Report

On the

Conservation Status, Management Practices, and Harvest Monitoring of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in the Choam Ksant District, Preah Vihear Province

Integrating the Development of Guidelines and Incentives for Piloting the Establishment of Small-scale Private *Dalbergia* Plantations with the Determination of a Non-detriment Findings Report in Preah Vihear Province, Cambodia

Forestry Administration

July 2021

Assessment Report

The Conservation Status, Management Practices, and Harvest Monitoring of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in the Choam Ksant District, Preah Vihear Province

---

Forestry Administration (FA)
#40 Preah Norodom Blvd.
Phnom Penh, Cambodia
Tel: (855-23) 214 651
Fax: (855-23) 212 201
Website: https://fa.maff.gov.kh/

CITES Tree Species Programme
Web Page: https://cites-tsp.org/

Financial support: The European Union and CITES Tree Species Programme

Authors: Say Sinly, Hort Sothea, Chheang Dany, Pang Phanit, and Lim Sopheap,

Cambodia Project Team and Contributors to the Technical Report:
Dennis J. Cengel, Kim Sobon, Neab Keng, Vann Vean, Phoung Sophea, Kong Kongkea, Buor Vuthy, Sin Chandara, As Brosden, Nuon Sithun, and Ouch Sineth

Editors: Dennis J. Cengel and Chheang Dany

Citation: Forestry Administration (2021). The Assessment Report on the Conservation Status, Management Practices, and Harvest Monitoring of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in the Choam Ksant District, Preah Vihear Province.

Acknowledgements

The Cambodia Project Team expresses its appreciation to everyone involved in conducting surveys and compiling the assessment report on the Conservation Status, Management Practices, and Harvest Monitoring of *Dalbergia cochinchinensis* and *Dalbergia oliveri* in the Choam Ksant District, Preah Vihear Province.

The production of this report was funded through the project on "Integrating the Development of Guidelines and Incentives for Piloting the Establishment of Small-scale Private Dalbergia Plantations with the Determination of a Non-detriment Findings Report in Preah Vihear Province, Cambodia." Financial support for the report was also received from the European Union. We acknowledge the support and encouragement that has been provided, as well, by Dr. Milena Sosa Schmidt, CITES Tree Species Programme Coordinator and Mr. Thang Hooi Chiew, CITES Tree Species Programme Regional Coordinator for Asia.

This report would not have been possible without the support and encouragement of the Forestry Administration in Phnom Penh, especially H.E. Dr. Keo Omaliss, Delegate of the Royal Government of Cambodia, Director General of Forestry Administration, as well as other senior officials of the Forestry Administration. It would also be remiss not to recognize the Governor of Preah Vihear Province, as well as the provincial military and police commanders, and other relevant authorities for their assistance and cooperation, including the many local people who assisted the project team in organizing and implementing field activities during the course of this phase of the project.

We also recognize the active participation of the local Forestry Administration officers of the Preah Vihear Forestry Administration Cantonment; Choam Ksant Forestry Administration Division; and the Forestry Administration Triage, especially Mr. Nuon Sokhom and Mr. Kim Chethavy.

The collective efforts of the Cambodia Project Team in preparing this assessment report on the *"Conservation Status, Management Practices, and Harvest Monitoring of Dalbergia cochinchinensis and Dalbergia oliveri in Choam Ksant District, Preah Vihear Province,"* including those of Dr. Chheang Dany, Dr. Dennis J. Cengel, Mr. Hort Sothea, Ms. Lim Sopheap, Mr. Kim Sobon, Mr. Pang Phanit, Mr. Neab Keng, Mr. Vann Vean, Mr. Phoung Sophea, Mr. Kong Kongkea, Mr. Buor Vuthy, Mr. Sin Chandara, Mr. As Brosden, Mr. Nuon Sithun, and Ms. Ouch Sineth, must also be recognized.

We express our appreciation, too, to all of the other specialists who took their time to advise, review, and comment on the various aspects that were associated with producing this report.

Executive Summary

The purpose of this report is to summarize the results of the assessment of the current conservation status, harvesting practices, including monitoring and control, trade impacts, and management measures in Choam Ksant management district required to support the process of preparing a non-detriment findings report on *Dalbergia cochinchinensis* and *Dalbergia oliveri*.

There are three economic land concessions (ELCs) and several social land concessions (SLCs) that have been authorized to develop investment projects on forestland in Choam Ksant district. The overall area of these concessions, in which timber harvesting is considered to be legal, is approximately 30,707 ha, accounting for 8.1% of the district's total land area.

There was a comparative assessment conducted to compare population densities and wood volumes of the target species groups derived from the concessions' harvested areas using periodic data associated with various forest inventories. The population densities and wood volumes in both semi-evergreen and deciduous forests during the period from 2014-2016 were relatively high compared to those recorded in 2020. The average population density in 2014-2016 in semi-evergreen forests was 1,207 trees/ha with a volume of 110 m^3/ha, while the survey that was conducted in 2020 recorded only 190 trees/ha with a volume of 55 m^3/ha. The results were indicative of declines of about 6.4 times in population density and 2.0 times in wood volume.

In deciduous forests, the average population density was initially 493 trees/ha with a wood volume of 79 m^3/ha, while in the survey that was conducted in 2020 there were only 165 trees/ha with a wood volume of 32 m^3/ha, reflecting declines of about 3.0 times in population density and 2.5 times in wood volume.

The declines in population density and wood volume of the target species in both semi-evergreen and deciduous forests paralleled those of other species and corresponded to interview results obtained from the local Forestry Administration officers and other relevant authorities that illegal selective logging and forestland encroachment occurred relatively extensively throughout Choam Ksant District during the transition of the Protected Forest to a Protected Area initiated in 2016.

Since the timber harvesting system used in ELCs and SLCs involves clear cutting with no associations with logging rotations or annual allowable cuts because the forestlands in those concessions will be converted either into intensive agricultural or residential land, the impacts on harvested populations were considered to be high.

The impacts of harvesting on national and sub-national populations of the target species were also considered to be high. The forest inventories conducted between 2014-2016 had indicated that the average population density of the target species with dbh ≥ 5 cm was 86.4 trees/ha with an average wood volume of 3.21 m^3/ha in semi-evergreen forests and 25.6 trees/ha with an average wood volume of 1.86 m^3/ha in deciduous forests. These measures were observed to have declined considerably at the time of the inventory that was conducted in 2020. The average population density of the target species with dbh ≥ 5 cm that was recorded during the inventory was 11.6 trees/ha with an average wood volume of 1.84 m^3/ha in semi-evergreen forests and 18.4 trees/ha with an average wood volume of 0.81 m^3/ha.

The harvesting impacts on ecosystems were also considered to be high. In the ELCs and SLCs, the harvesting system predicated on the complete removal of timber would have a higher negative effect on the non-target, as well as target, species of the ecosystems, which would reduce the available resources of numerous species.

Since the actual harvested amount of wood of the target species was considered to be only about 40% of the volume of the wood that was available prior to harvesting, estimates of the total volume

of wood that would have been available to be harvested in concessions would have ranged from 1,197.55 to 2,685.95 m^3.

The actual quantity recorded in the permits approved for sawnwood by the Choam Ksant Forestry Administration Division from 2013-2019 was 913 m^3, which was about 24% less than the lower estimate of total wood volume harvested in the concessions. The assessment of the impacts on the level of trade in relation to the harvested production area was, therefore, considered to be medium.

The magnitude and trend associated with the legal trade of target species were considered to be high, as well, since the local transportation of processed forest products and by-products for domestic use is considered to be legal under the Forestry Law.

Despite the unavailability of data related to market demand, it was reported that a very large volume of the processed forest products and by-products have been transported out of the district. The surge of new settlements has prompted the conversion of forestland in the district, which has increased the harvesting of the target species, but the results of the survey that was conducted in 2020 suggests that the small numbers of large trees that were recorded during the inventory of both *Dalbergia* species in the Choam Ksant District were primarily attributable to the illegal logging that was occurring during much of the past several years.

It was reported that after 2016 the volume of the trade of processed forest products and by-products originating in the concessions seemed to substantially decrease in parallel with declines in the target timber species, as well as other timber species, which reflected the increasingly limited availability of wood resources.

The lack of effectiveness of some of the measures of management seems to correspond with the decline in cases of illegal forest offenses in which intensive law enforcement and patrolling is conducted across the district's forestlands, although the results of the inventories revealed the already low population densities of *D. cochinchinensis* and *D. oliveri.* Those declining populations were caused to a considerable extent by (1) illegal selective logging during the transition of the forestland management system in combination with a lack of transparency associated with the control and monitoring of the trade of the target species; and (2) a limited number of Protected Area rangers and foresters available to conduct patrolling more extensively.

Irrespective of the shortcomings leading to the high impact severity and low population densities of the target species in natural habitats, the distribution of tree seedlings of these species could conceivably recover their genetic conservation through artificial propagation. That means that management measures should have, at a minimum, the appropriate level of rigor required to reduce the severity of identified concerns, risks, and impacts and should be implemented assiduously. It is recommended that the genetic conservation of the two *Dalbergia* species should be further concentrated through restoration, planting, and the maintenance of natural populations.

Table of Contents

List of Tables

List of Figures

Acronyms

asl	Above sea level
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DBH/dbh	Diameter at Breast Height
ELC	Economic Land Concession
EIA	Environmental Impact Assessment
IUCN	The International Union for the Conservation of Nature
FA	Forestry Administration
FEIA	Full Environmental Impact Assessment
IEIA	Initial Environmental Impact Assessment
ITTO	International Tropical Timber Organization
LP	License Permission
MAFF	Ministry of Agriculture, Forestry and Fisheries
MoE	Ministry of Environment
NDF	non-detriment finding
NTFPs	Non-Timber Forest Products
PVPF	Preah Vihear Protected Forest
PVA	Preah Vihear Authority
PRWS	Preah Rokar Wildlife Sanctuary
RIL	Reduced Impact Logging
SLC	Social Land Concession

.

1. Introduction

1.1 Background

Rosewood, which in international markets includes *Dalbergia cochinchinensis* and *Dalbergia oliveri* (considered to be synonymous with *Dalbergia bariensis*), as well as several other species of *Dalbergia* and a number of other genera, has become the world's most trafficked wild product. In reaction to that trafficking, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) has listed the 300 species that are referred to as rosewood under trade restrictions.

In the past several decades, the illegal trafficking and trading of high-commercial timber species in Cambodia has increased the vulnerability and reduced the populations of some indigenous timber species, including rosewood. There is nevertheless still remarkably limited documentation about the current status of *Dalbergia* species in the country. In reacting to the recognized declines of both *D. cochinchinensis* and *D. oliveri* and to determine the current status of those and other endangered tree species listed in the CITES Appendix II, the project for "Integrating the Development of Guidelines and Incentives for Piloting the Establishment of Small-scale Private *Dalbergia* Plantations with the Determination of a Non-detriment Findings Report in Preah Vihear Province in Cambodia" was envisaged to hasten the establishment of small-scale private plantations of *D. cochinchinensis*.

Choam Ksant District in the Preah Vihear Province was selected to conduct the assessment of district harvest levels and their impacts, as well as current management strategies, associated with both of the *Dalbergia* species. It is understood that one of the most critical consequences of the heavy logging and harvesting of both of the species has been the dramatic decline in the populations of each of the species. Unregulated logging, combined with forest degradation and the loss of habitat, is severely threatening the existence of both *D. cochinchinensis* and *D. oliveri* throughout the project area. In conformance with the CITES Guidelines on preparing a Non-detriment Findings (NDF) report for timber species (Deniel Wolf *et al*., 2018), several critical steps were assessed to assure that the decision regarding the NDF would be predicated on findings that would be science-based.

1.2 Objective

The overarching objective of this report is to summarize the results of the assessment of the current conservation status, harvesting practices, including monitoring and control, trade impacts, and management measures associated with the targeted species in the Choam Ksant management district that are required to support the process of preparing a non-detriment findings (NDF) report on *D. cochinchinensis* and *D. oliveri*.

2. Methods

2.1 Scope and Limitations

Since the documentation on approved permits for timber resources legally collected in the Choam Ksant District are restricted to domestic uses, some wide-ranging considerations were not able to be considered in this assessment. Those included quotas for harvest and export and the impacts of harvests and trade on national populations of the native *Dalbergia* species.

In the assessment, target species refer to *D. cochinchinensis* and *D. oliveri*, as well as to a few other species that consist primarily of *Pterocarpus pedatus* and *Afzelia xylocarpa* (Kurz). The target species may be defined as a group of important luxury timber species that are considered to be the principal targets of illegal selective logging in the district.

2.2 Reviews and Meetings

Several reviews were conducted that incorporated various reports, procedures, and sources, which included the following:

- Relevant laws and regulations;
- The annual reports of forest resource management collected from the Choam Ksant Forestry Administration Division and Protected Area managers;
- Forestry Administration-International Tropical Timber Organization (ITTO) reports (2016a,b,c) from the project that was implemented in Cambodia from 2008 to 2015 along the Dangrek Mountains range in the Emerald Triangle trans-boundary region between Cambodia, Thailand, and Laos;
- Systematic Survey Report of *Dalbergia cochinchinensis* and *Dalbergia oliveri* for Piloting Assessment of Sustainable Genetic Conservation in Choam Ksant District, Preah Vihear Province (Forestry Administration, 2021a);
- A 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 (Forestry Administration, 2021b); and
- Research that was conducted between 2014 and 2016 by students of the Royal University of Agriculture in an area that was formerly administered as the Preah Vihear Protected Forest.

Several meetings to discuss various aspects associated with forest resources management and jurisdiction were organized, as well as with the Chief of the Choam Ksant Forestry Administration Division and the ranger sub-station managers of Protected Areas. Forestland uses and timber-harvest monitoring and control procedures were also examined from the perspective of the severity of the impacts on ecosystems resulting from timber harvesting operations and land use changes, especially involving the exploitation of both of the *Dalbergia* species within the project area.

2.3 Assessments

The following guidelines were applied in conducting the report's assessments:

- The CITES Guidelines on preparing a science-based NDF for timber species (Daniel Wolf *et al*., 2018);
- Guidance for CITES Scientific Authorities: Checklist to assist in making non-detriment findings for Appendix II exports (Rosser and Haywood, 2002);
- The Indonesian Guidelines for non-detriment findings assessment for *Ramin Gonystylus* spp. (2010).

Many of the parameters that were extracted from the Indonesian Guidelines for the non-detrimental findings assessment for Ramin (*Gonystylus* spp). and the CITES Guidelines on preparing a science-based NDF for timber species were incorporated into the assessments.

Comparative evaluations of the target species with respect to production area in concessions and impacts on forest ecosystems in terms of other species were included in the assessments as well. Those evaluations reflect the situation in the Choam Ksant District.

3. Management Measures

3.1 Management History

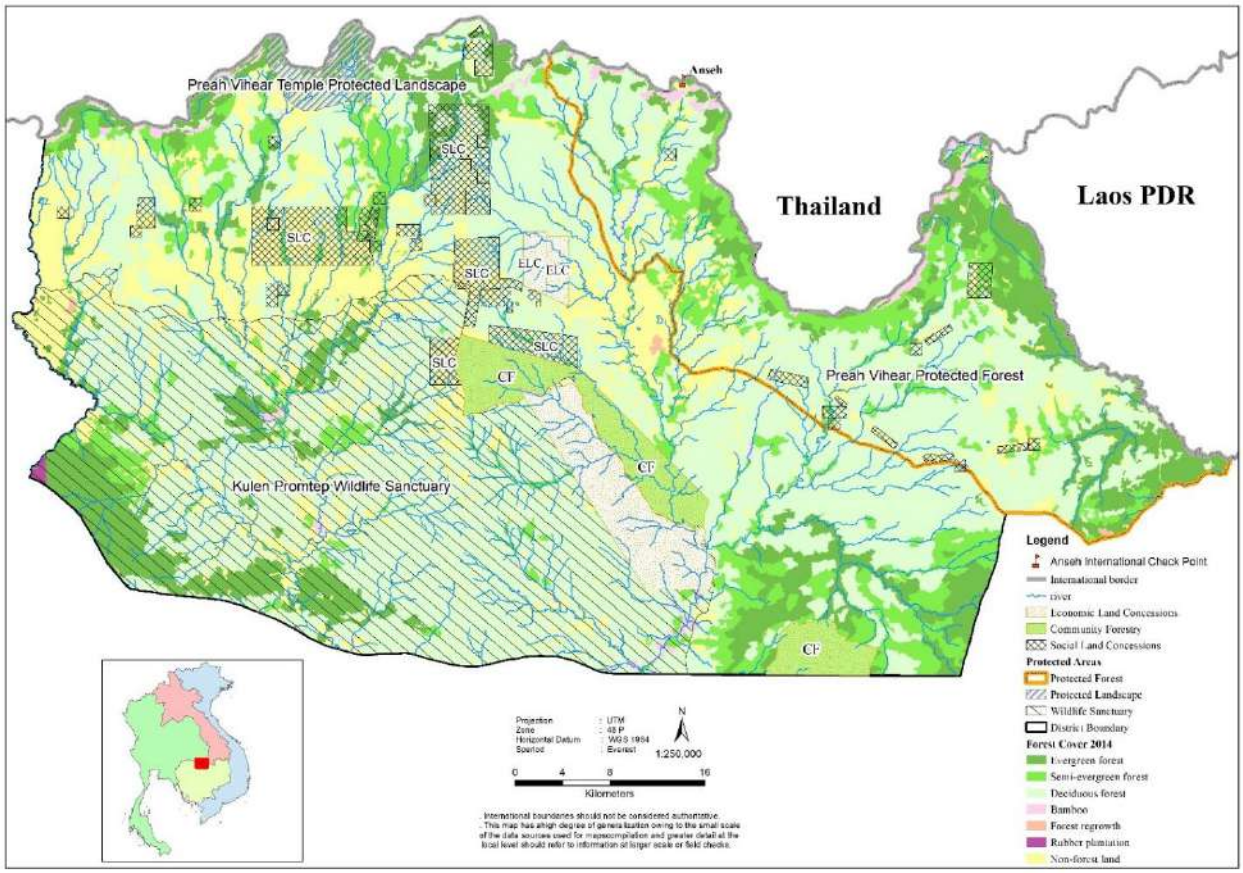
3.1.1 Forest Management Systems

The Choam Ksant District extends across 103 km in the northeastern part of Preah Vihear Province. It is situated in the Dang Rek Mountain range along the trans-boundary area between Cambodia, Laos and Thailand. It has an elevation that ranges between 46 and 802 m above sea level (asl) with slopes ranging between 0 and 132%.

The Royal Government of Cambodia (RGC) granted the eastern part of Preah Vihear Province as a Forest Concession to the BLP Import Export Company of Thailand in 1991, but the concession was cancelled seven years later as a result of the company's inability to comply with management procedures stipulated in the Concession Agreement.

Meanwhile, the Royal Decree on the Establishment of Protected Areas in Cambodia had been promulgated in 1993 to protect ecologically and culturally important areas and soon thereafter the Kulen Promtep Wildlife Sanctuary and Preah Vihear Protected Landscape, both of which cover parts of the Choam Ksant District, were established (Figure 1).

Figure 1. Map illustrating land uses in the Preah Vihear Province prior to 2016.



The RGC also issued Sub-decree No. 76 in 2002 to establish the Preah Vihear Protected Forest for Plant and Wildlife Genetic Resources Conservation (PVPF) under the jurisdiction of the Forestry Administration in the Ministry of Agriculture, Forestry and Fisheries (MAFF). The Forestry Administration, in cooperation with the Wildlife Conservation Society, was responsible for the management of the area for several years through the Landscape Management in the Northern Plains of Cambodia project.

In more recent years, the Forestry Administration, in cooperation with the International Tropical Timber Organization (ITTO), as well as Thailand and Laos, implemented the seminal project for the Management of the Emerald Triangle Protected Forests Complex to Promote Cooperation for Transboundary Biodiversity Conservation between Thailand, Cambodia and Laos (Forestry Administration, 2016a).

3.1.2 Authorized Harvesting Areas

The land area of the Choam Ksant District consists of 376,941 ha under three jurisdictional management systems. Those include Production Forest which is under the jurisdiction of the Forestry Administration, the Preah Vihear Temple Protected Landscape which is under the jurisdiction of the Preah Vihear Authority, and Protected Areas which are under the jurisdiction of the Ministry of Environment. Each of these systems emphasizes distinguishable land use priorities.

The social land concessions (SLCs) that belong to military families and that are scattered throughout the district (Figure 1) cover 19,505 ha. Since 2011, the military infantry Brigade No. 9 has established 42 SLCs for its military families and Brigade offices. The Brigade has assumed responsibility for land management in all of the blocks of the SLCs in which timber has been collected or harvested and that the forest area is no longer under the management of the Forestry Administration.

There are three economic land concessions (ELCs) that are authorized to develop investment projects on forestland in the Choam Ksant District. The cumulative land area of these three concessions, the first of which initiated its investment project in 2013 is 11,203 ha. The overall area of concessions, inclusive of SLCs and ELCs, in which timber harvesting is considered legal, is approximately 30,707 ha, accounting for 8.1% of the district's total land area.

3.1.3 Trends in Harvesting and Trade

During the period from 2013 to 2019, the volume of wood of the luxury timber group, including the target species, that was harvested from forest concessions, including ELCs and SLCs, was reported to be 913 m^3 (Table 1). That wood was measured at sawmills prior to issuing the legal permits for processed forest products and by-products that were to be transported out of the district. According to the conventional practice of measuring the sawnwood at sawmills, a conversion ratio of 1 m^3 of log is equal to 0.6 m^3 of sawnwood or 0.5 m^3 of processed wood for export was used.

The amount of the wood that was harvested for processing accounted for about 40% of the volume of the wood of the standing roundwood that was inventoried prior to harvesting. The difference was due to approximately 30% of the total wood volume being damaged that was categorized as fuelwood, while another 30% was considered to be small trees with dbh between 5 and 30 cm that were categorized as poles.

Table 1. Sawnwood volume reported as legally harvested in the Choam Ksant District, 2013-2019.

Wood volume (m^3)								
Wood Class	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**Total**
Luxury Grade	172.77	436.98	109.76	80.28	59.10	47.80	6.54	913.2265
Grade 1	991.49	516.80	2,053.08	2,384.27	1,867.49	222.35	254.19	8,289.666
Grade 2	1,731.07	1,886.02	5,731.57	8,986.56	2,846.02	391.21	276.80	21,849.251
Grade 3	9.00	34.65	239.80	1,924.43	13.59	-	15.11	2,236.588
Ungraded	10.34	-	-	-	59.71	-	-	70.049
Total	**2,914.67**	**2,874.45**	**8,134.21**	**13,375.55**	**4,845.92**	**661.35**	**552.65**	**33,358.78**

Source: Choam Ksant Forestry Administration Division.

3.1.4 Management Plans

In economic land concessions, a master plan comprised of an annual management plan which is part of a long-term investment project is required on the signing of the Concession Agreement

(RGC, 2005). The annual harvesting of timber in an ELC is defined by the area of forestland within which a permit for harvesting timber is requested by a concessionaire. There is no quota established for the volume of timber to be harvested since it is the area requested for harvesting which is verified through the annual management plan that determines the size of forestland to be cleared and planted with crops.

In social land concessions, an annual work plan for harvesting timber is required that then should be followed by a request for clearing forestland in the SLC. The management plan, or annual work plan does not mitigate the impacts associated with harvesting timber by clearing the land.

3.1.5 Illegal Harvesting and Trade

During the reference period between 2013 and 2019, the total wood volume associated with the illegal logging of *D. cochinchinensis* and *D. oliveri* was 31 m^3 and 27 m^3 respectively, as reported by the Choam Ksant Forestry Administration Division (Table 2). Notwithstanding these volumes, local villagers claimed that the actual wood volume associated with the illegal logging of both of the *Dalbergia* species that escaped detection by law enforcement was much larger than that which was officially reported. The documentation of the extent of illegal logging activities in the Protected Areas in the district also appears to have been underestimated.

Table 2. Wood volume of *D. cochinchinensis* and *D. oliveri* reported as illegally harvested and/or traded in the Choam Ksant District, 2013-2019.

Wood volume (m^3)								
D. cochinchinensis	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**Total**
Sawnwood	6.193	1.356	0.202	0	0	0	0	7.751
Hardwood (logs)	2.494	1.761	6.207	2.796	9.229	0.604	0	23.091
Sub-total	***8.687***	***3.117***	***6.409***	***2.796***	***9.229***	***0.604***	***0***	***30.842***
D. oliveri	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**Total**
Sawnwood	2.36	24.956	0	0	0	0		27.316
Hardwood (logs)	0	0	0	0	0	0		0
Sub-total	***2.36***	***24.956***	***0***	***0***	***0***	***0***	***0***	***27.316***
Total	**11.047**	**28.073**	**6.409**	**2.796**	**9.229**	**0.604**	**0**	**58.158**

Source: Choam Ksant Forestry Administration Division.

3.2 Harvest Monitoring

3.2.1 Harvest Regime

There are several recognizable similarities in management between forest concessions and economic and social land concessions in that in each of these concession types there are no specified target species, the legal and technical requirements and procedures, including zoning and operational plans, are comparable, and an Environmental Impact Assessment (EIA) report must be prepared (RGC, 1999). There are significant recognizable differences, as well, especially with respect to the required incorporation of logging rotations or cycles, minimum cutting diameters, and annual allowable cuts in forest concession harvesting operations.

Unlike in forest concessions, the timber harvesting systems used in ELCs and SLCs involve clear cutting and there is no reason to define a logging rotation or annual allowable cut since the principal objective in these types of concessions is to convert forestland into intensive agricultural or residential land. The riparian forests along the main streams defined on an approved map in an

economic or social land Concession Agreement, however, must be protected as agreed between the government, through its representative ministry and the concessionaire.

In this context, the authorized ELC or SLC concessionaires would only be allowed to harvest timber on forestlands that had been approved for development projects as stipulated in the Concession Agreements and in individual contracts between the concession companies and the respective government agencies. The companies would be expected to clear the forestland, divide it into sub-zones within the approved development area in ELCs, and collect the timber and pay the taxes on the timber, either through a tax on standing trees or on the basis of the volume of processed wood determined through the forest inventory guidelines specified by the Forestry Administration on behalf of the government.

3.2.2 Methods of Monitoring Harvests

Once approval has been received from the government for the requested area to designate as an ELC or SLC, it is recommended that the feasibility study and initial environmental impact assessment (IEIA[1]) be conducted concurrently. In implementing the pre-investment requirements, the evaluation of the effects on the social environment and the area's natural resources is used to determine the extent of the possible impacts of the investment. This might include overlapping areas with local villagers' lands or damages that might potentially trigger the depletion of biodiversity resources. If mitigation measures are able to be introduced to avoid the potential degradation resulting from the project's implementation, the evaluation of the investment could proceed to the next step. If the impacts would not be able to be mitigated then the projected investment in that area might fail to be approved, in which case another area would have to be chosen for undertaking the proposed investment.

At the time an ELC or SLC has been authorized to commence implementation, the process of demarcating the project area and registering the land is initiated to avoid land conflicts with local villagers and a full environmental impact assessment (FEIA[2]) that employs a more detailed methodology incorporating a forest inventory is required. The total area of sampling plots commonly applied in the forest inventory is about 1% relative to the total project forestland area. The assessment of forest resources during this stage of the process is directed to providing baseline information about the forest resources in the project area. The FEIA should be employed for harvest monitoring and control, but, in practice, that is difficult to accomplish since the forestland is assessed with limited accuracy

While an annual allowable cut is not applied in an ELC or SLC, the effects of the zoning or division of the concession land in an ELC into smaller sub-zones, or blocks, for harvesting timber are comparable with those undertaken in a forest concession. That division allows the concession landholder to harvest timber by clear cutting the forestland in each sub-zone according to a mutually-approved schedule referenced in the master plan. The request for permission to conduct the annual clear cutting must be submitted to the Ministry of Agriculture, Forestry and Fisheries after the forest inventory has been completed and its report has been mutually approved and released. A representative ELC with 5,000 ha of forestland in its project area might be conveniently subdivided into 5 sub-zones, or blocks, of 1,000 ha each. If the ELC owner were to commence its timber harvesting in sub-zone 1, the approval request to the MAFF would have to be submitted relatively early in the process and a comprehensive forest inventory, which according to

[1] **Initial Environmental Impact Assessment (IEIA):** Initial study on physical environmental resources, the biological environments, and socio-economic resources that is based, in general, on secondary data available within and around the project area to determine, predict, and analyze possible environmental and social impacts caused by project activities in order to develop measures to minimize negative impacts and maximize positive impacts.

[2] **Full Environmental Impact Assessment (FEIA):** Detailed study on physical environmental resources, the biological environments, and socio-economic resources that is based, in general on primary data available within and around the project area to determine, predict, and analyze potential and combined environmental and social impacts caused by project activities in order to develop measures to minimize negative impacts and maximize positive impacts and to analyze environmental damage and economic gains of a development project.

regulations is compulsory, would have to be undertaken prior to harvesting the timber or clearing the forestland.

Each sub-zone of forestland that is allowed to be cleared annually is commonly about 1,000 ha. The concession companies must apply to MAFF to clear the sub-zones every year until all of the sub-zones have been cleared and planted with other crops or trees as stipulated and agreed in the Concession Agreement. There is usually no limitation on the volume of timber removed, but the forest inventory must be completed prior to the clearing of the sub-zones. The total area of sampling plots is at least 10% of the ELC's project forestland. This level of sampling intensity is always used for estimating flora species and wood volume with relatively high accuracy and in the monitoring and control of the timber harvest. This practice ensures that timber is not collected outside of the allowed forestland to be harvested.

Unlike operations in an ELC, the forestland in an SLC is not subdivided into sub-zones and the forest inventory is conducted only once with stratified samples that represent the entire forestland of all of the SLCs in the Choam Ksant District. In 2010, the establishment of each of the current social land concessions in the district was requested by the military during the violent clashes that were occurring along the border with Thailand for which a resolution was sought and which was ultimately achieved.

The timber harvested from the forestland of an ELC or SLC is stored at a sawmill or forest products and by-products processing facility near its forestland that has received a permit for processing the wood prior to transporting the resultant products to the market for which a permit for transporting wood (License Permission: LP) is required. Sometimes, another company (a third party) through its successful participation in a competitive bidding process would be selected to conduct the timber harvesting and wood processing operations.

According to the Forestry Law, activities related to the permanent forest estate and forest products and by-products shall require permits to (1) set annual harvesting quotas for forest products and by-products; (2) set harvest and transport quotas for forest products and by-products; (3) transport forest products and by-products without quotas; (4) establish through a Prakas a forest industry, sawmill, or other forest products and by-products processing facility; (5) establish a stock place to sell and distribute forest products and by-products; (6) establish all types of kilns that use forest products and by-products as raw material; and (7) establish other permits for other activities.

The Forestry Administration is the only authority that is allowed to certify the logs or volume of timber removed within the SLC and ELC development areas. That allows timber harvests to be monitored and controlled through the annual reports, or logbooks, of the local Forestry Administration Division.

3.2.3 Confidence in Harvest Monitoring

The permanent plots of the national forest inventory would have been used under ideal conditions to extrapolate the growth of tree species in natural habitats as a part of the process of monitoring timber harvests in the ELCs and SLCs. Since neither data nor detailed records of wood volumes of specific species were available in the inventory, however, a comparative evaluation was conducted to investigate whether the wood volume of those species categorized as luxury grade timber was exceeding the volume of harvested wood recorded in harvest permits. The assessment was based on detecting changes of forestland in the concessions compared to previous forest inventories.

Detected Changes of Forestland in Concessions

Considering the unavailability of forest inventory data related to Environmental Impact Assessments (EIA), some extrapolation of existing data, especially those that were collected

during the systematic survey which was conducted in 2020 and the assessments of national forest cover that were implemented in 2014 and 2020 were used to estimate harvest levels.

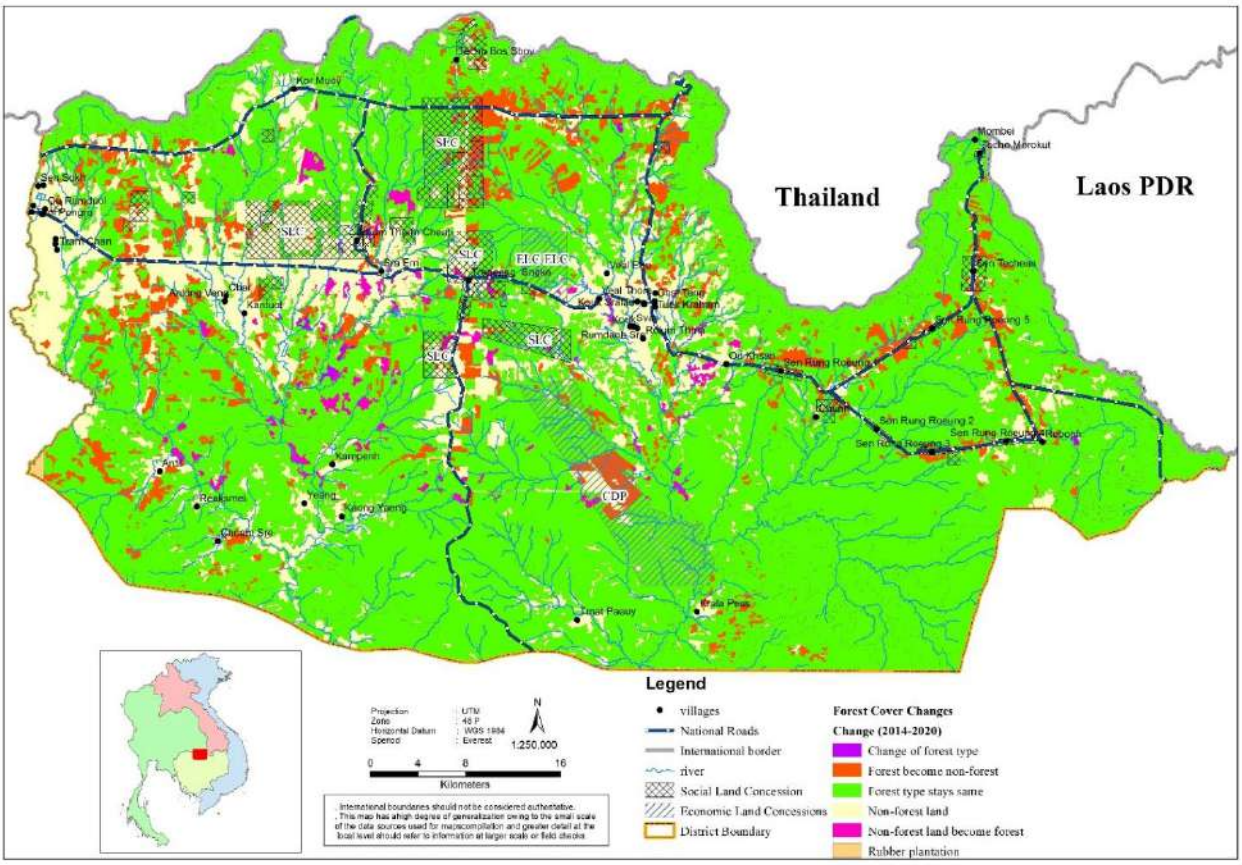
During the period from 2014 to 2020, at least 3,107 ha of the forestlands of ELCs and SLCs in the Choam Ksant District were cleared. The regrowth forest that was primarily situated in deciduous forests in ELCs revealed that 316.7 ha had also been cleared during that period, although that area was restored as the result of natural regrowth (Table 3). During those six years, approximately 3,424 ha of timber were harvested in the clearing of forestlands of ELCs and SLCs.

Table 3. Forest cover changes between 2014 and 2020 in ELCs and SLCs in the Choam Ksant District.

Forest Cover	*2014 (ha)*	*2020 (ha)*	*Change (ha)*
Bamboo	281.1	281.0	0.1
Deciduous Forest	18,062.0	15,358.0	2,703.9
Evergreen Forest	1,283.9	1,000.6	283.3
Semi-Evergreen Forest	2,764.8	2,328.0	436.8
Regrowth Forest		316.7	(316.7)
Total forestland	**22,391.7**	**19,284.4**	**3,107.3**
Non-Forestland	8,131.2	11,238.5	(3,107.3)

During the timber harvesting that occurred during 2014 to 2020 in the concessions, there was no targeting of the species that were to be harvested since every tree species was removed with the exception of *D. cochinchinensis*, the logging of which had previously been banned under the Prime Minister's Order 02.

Figure 2. Map illustrating forest cover changes (2014-2020) in the Choam Ksant District.



The map provided in Figure 2 indicates that there were several detected changes in the extent of forestland that was converted to non-forestland throughout the Chom Ksant District between 2014

and 2020, especially along the main road and in areas where forest roads were accessible outside of the concession areas. There were also changes in forest types where patches of forestland was exposed to regular disturbances, especially as the result of selective logging and forest clearing, that destroyed the structure of some forest canopies and led to changes in the classifications of forest types during the assessment of forest cover changes.

Comparative Assessment of Target Species

There was a comparative assessment conducted to compare population densities and wood volumes of the target species group derived from the concessions' harvested areas over the six years from 2014 to 2020 using periodic data associated with the forest inventories.

Table 4. Forest Inventories conducted between 2014 and 2020 used to detect changes in population density and wood volume of target species.

Sampling design	FA-ITTO[3]	Phoung Sopea[4]	Heng Soriya[5]	Chea Kearath[6]	ELC-CDP[7]	Average (2014-2016)	Systematic Survey[8]
Primary purpose	Carbon Stocks	Carbon Stocks	Carbon Stocks	Carbon Stocks	ESIA		*Dalbergia* species
Period	2014-2015	2015	2015	2016	2015		2020
# plots sampled	89	33	12	20	36		86
Sampled plot shape	Rectangle	Rectangle	Circle	Circle	Rectangle		Rectangle
Sampled plot area (m^2)	1500	1500	314	314	1500		1500
Sampling method	Random	Random	Random	Random	Random		Systematic
Locations of sample plots	PVPF*	PVPF*	PVPF*	PVPF*	ELC-CDP		Choam Ksant**
Results							
Semi-evergreen forest (SF)							
Density (trees/ha)	2,839	1,900	335	305	658	**1,207.4**	189.87
Wood Volume (m^3/ha)	217.18	NA	NA	52.15	59.91	**109.75**	55.19
Target species group in SF							
Luxury Grade Density (trees/ha)	NA	117	NA	0	40.5	**52.5**	11.6
Luxury Grade Volume (m^3/ha)	NA	6.02	NA	0	3.69	**3.24**	1.84
Deciduous forest (DF)							
Density (trees/ha)	764	764	225	279.6	434	**493.32**	165
Wood Volume (m^3/ha)	169.92	NA	NA	19.4	48.29	**79.20**	32.199
Target species group in DF							
Luxury Grade Density (trees/ha)	NA	13	NA	12.7	26.7	**17.5**	16.4
Luxury Grade Volume (m^3/ha)	NA	2.41	NA	0.49	2.97	**1.96**	0.81

Note: NA = Not Available; * PVPF = Preah Vihear Protected Forest (Chheb Wildlife Sanctuary); ** throughout Choam Ksant forestland.

[3] Forestry Administration (2016b). Integrating Forest Biodiversity Resource Management and Sustainable Community Livelihood Development in the Preah Vihear Protected Forest: Preliminary Assessment of Carbon Stocks. The forest inventories were conducted between 2014-2015.
[4] Phoung Sophea (2015). Estimation of Aboveground Wood Biomass in Preah Vihear Protected Forest, Chhaep District, Preah Vihear Province.
[5] Heng Soiya (2015).Estimation of Above Ground Biomass through Evaluation of Stand Structure in Preah Vihear Protected Forest, Choam Khsan District, Preah Vihear Province.
[6] Chea Kearath (2016).Forest Inventory Implementation for Biomass Estimation and Understory Species Study in the Preah Vihear Protected Forest, Choam Ksant Diatrict, Preah Vihear Province.
[7] ELC managed by CDP (2015). Personal contact for sharing inventory data in January 2021.
[8] Systematic survey of *Dalbergia cochinchinensis and Dalbergia oliveri* for Piloting Assessment on Sustainable Genetic Conservation conducted in 2020.

The population densities and wood volumes in both semi-evergreen and deciduous forests in 2014-2016 were relatively high compared to those recorded in 2020 (Table 4). The average population density in 2014-2016 in semi-evergreen forests was 1,207 trees/ha with a volume of 110 m^3/ha, while the systematic survey conducted in 2020 recorded only 190 trees/ha with a volume of 55m^3/ha. These results were indicative of declines of about 6.4 times in population density and 2.0 times in wood volume.

In deciduous forests, the average population density was initially 493 trees/ha with a wood volume of 79 m^3/ha, while in the systematic survey conducted in 2020 there were only 165 trees/ha with a wood volume of 32 m^3/ha, reflecting declines of about 3.0 times in population density and 2.5 times in wood volume.

The declines in population density and wood volume of the target species in both semi-evergreen and deciduous forests paralleled those of other species and corresponded to interview results obtained from the local Forestry Administration officers and other relevant authorities that illegal selective logging and forestland encroachment occurred relatively extensively throughout the Choam Ksant District during the transition of the Protected Forest to a Protected Area initiated in 2016. These results are consistent with the perception that the reported harvest volumes and volumes of illegally logged target species were considerably less than those that occurred during the period from 2014 to 2016.

3.2.4 Mortality Rate and Maturity

The mortality rate of *D. cochinchinensis* and *D. oliveri* in natural forest habitats is still not completely known, although several threats and ecological restraints are commonly considered to be the underlying causes of severe impacts on these species' survival. The size class at maturity of the target species was recorded for quite a few *D. cochinchinensis* trees, but the information on *D. oliveri* was not available in the study area in the Choam Ksant District.

The illegal selective logging in the district was reported to be one of the major threats affecting target species that consisted primarily of *D. cochinchinensis* and *D. oliveri*. So, too was the indiscriminate burning of forests.

The forestlands in the Choam Ksant District are covered extensively by open dry deciduous forest and in the dry season a large part of that forest becomes desiccated, particularly the grass undergrowth and the understory plants. Field observations recorded the prevalence of widespread forest fires in the dry season occurring more often at places that were adjacent to settlement areas, agriculture areas, and newly cleared forests. These forests are prone to burning every year, which has a deleterious effect on the survival rate of *D. cochinchinensis* seedlings and saplings from the stump (Figure 3).

Figure 3. View of an understory forest fire occurring in deciduous forest in the Choam Ksant District. Photo Credits: Source from Mr. Nuon Sithun, a member of the project team, came across this forest fire in February 2021

The surge of new settlements has increased the threat of the rate of forestland conversion in the district, as well. According to a report of the FA-ITTO project in the Preah Vihear Protected Forest, forests would be affected by future land use demands from agriculture associated with changes occurring in habitats and biodiversity (Forestry Administration, 2016b). Forest fragmentation in the Choam Ksant District occurs after a large area of contiguous forest has been subdivided into smaller forest patches by roads, agricultural practices, urbanization, and other developments. This was apparent with the harvesting of the target species since the harvesters of these species did not only clear forestland for agriculture or residential land, but also entered the forests near their homes searching for high-value commercial timber species.

It is now recognized that genetic traits also pose a threat to survival by introducing a biological risk that can affect the reproductive rates of the target species throughout the district. The systematic survey conducted in 2020 revealed considerable information about the maturity of some of these species. Some local villagers reported that their planted tree species of *D. cochinchinensis* with diameters ranging from 13-15 cm had started to flower 3 years previously, at 5 years old, and that this was most probably due to the fact that they had collected seedlings of the species regrown naturally from stumps and roots embedded in the ground to plant. It may be inferred as a result of the discussions with the villagers that the flowering of *D. cochinchinensis* occurs in early stages of maturity every year in natural forests in the study area.

Similar to the assessment conducted for *D. cochinchinensis,* the threats and biological risks associated with *D. oliveri* refer to all of the disturbances and biological vulnerabilities that have the ability to affect the reproduction, resilience capacities, and natural growth of *D. oliveri,* which could culminate in either mortality or increased vulnerability. The observations on the maturity of *D. oliveri* are supported by reports of local villagers that *D. oliveri* generally only flowers and fruits every few years after initial flowering. This reproductive pattern may be highly influenced by its genetic characteristics growing in these habitat types. The result is that the seeds of *D. oliveri* are year-by-year becoming less-and-less available for collection which threatens the species' genetic resources.

3.2.5 Legal Framework

A. Forestry Law (2002)

- Article 30 of the Forestry Law implies that it is prohibited to process forest products and by-products or establish and operate a forest industry, including a sawmill or a forest products and by-products' processing facility, as well as all types of kilns in the domains of Permanent Forest Reserves.
- Article 76 of the Forestry Law stipulates that forest offenses are criminal offenses, which are specially defined in that law. The Forestry Administration officials who are qualified as judicial police officials have jurisdiction to investigate forest offenses and file such cases and documents in the court. Every level of the Forestry Administration shall have the duty to investigate, control and suppress forest offenses within their assigned territory. The operation of Forestry Administration officials qualified as judicial police officials shall be implemented consistent with the Law on Criminal Procedures.
- Articles 96, 97, 98, and 99 of the Forestry Law are related to punishing and penalizing of forest offenders who violate the provision of the Forestry Law according to the degree of forest offense.

B. Protected Area Law (2008)

- Article 11 of the Protected Area Law stipulates that each Protected Area shall be divided into four management zones, including a Core zone, Conservation zone, Sustainable use

zone, and Community zone. That management system does not apply, however, to the Apsara Authority, Preah Vihear Authority, or other designated authorities or management area(s) to which the Royal Government has specifically allocated the tasks.

- Articles 41, 42, and 43 of the Protected Area Law indicate that all of the activities harmful to natural resources in the Projected Areas are prohibited.
- Chapter IX, inclusive of Articles 45-52, of the Protected Area Law is related to the implementation of law enforcement and procedures for resolving offenses.
- Chapter X, inclusive of Articles 53-64, of the Protected Area Law concerns natural resource offenses and penalties.

C. Other Relevant Legislation

- Regulation No. 601, dated 24 April 2014, issued by the Council of Ministers of the Royal Government of Cambodia, suspended the exporting of all forest products and forest by-products derived from luxury grade timber species until it would be informed by means of a more recent regulation with the aim of improving sustainable forest resource management and use.
- Sub-Decree 53, dated 29 May 2006, issued by the Royal Government of Cambodia, is concerned with the Trading of Endangered Flora and Fauna species listed in CITES Appendices. Every species listed in CITES Appendix I is highly restricted with regard to cross-border trading, with the exception of some instances that are prescribed in the CITES Convention, while those listed in Appendix II are also under similar restrictions.
- The Prime Minister's Order 02, dated 22 February 2013, initiated measures and controls on the cutting, transporting, collecting, storing, and exporting of *D. cochinchinesis* throughout the country.
- The Ministry of Agriculture, Forestry and Fisheries issued Prakas 89 on Prohibited Forest Products and Non-timber Forest Products for harvesting from Reserved Permanent Forests in Cambodia in 2005. The announcement also regulates minimum felling limits based on the diameter at breast height (DBH) of *D. cochinchinensis* and *D. oliveri*, which are categorized as luxury species with the minimum DBH for the allowable cut established as 0.45 m.

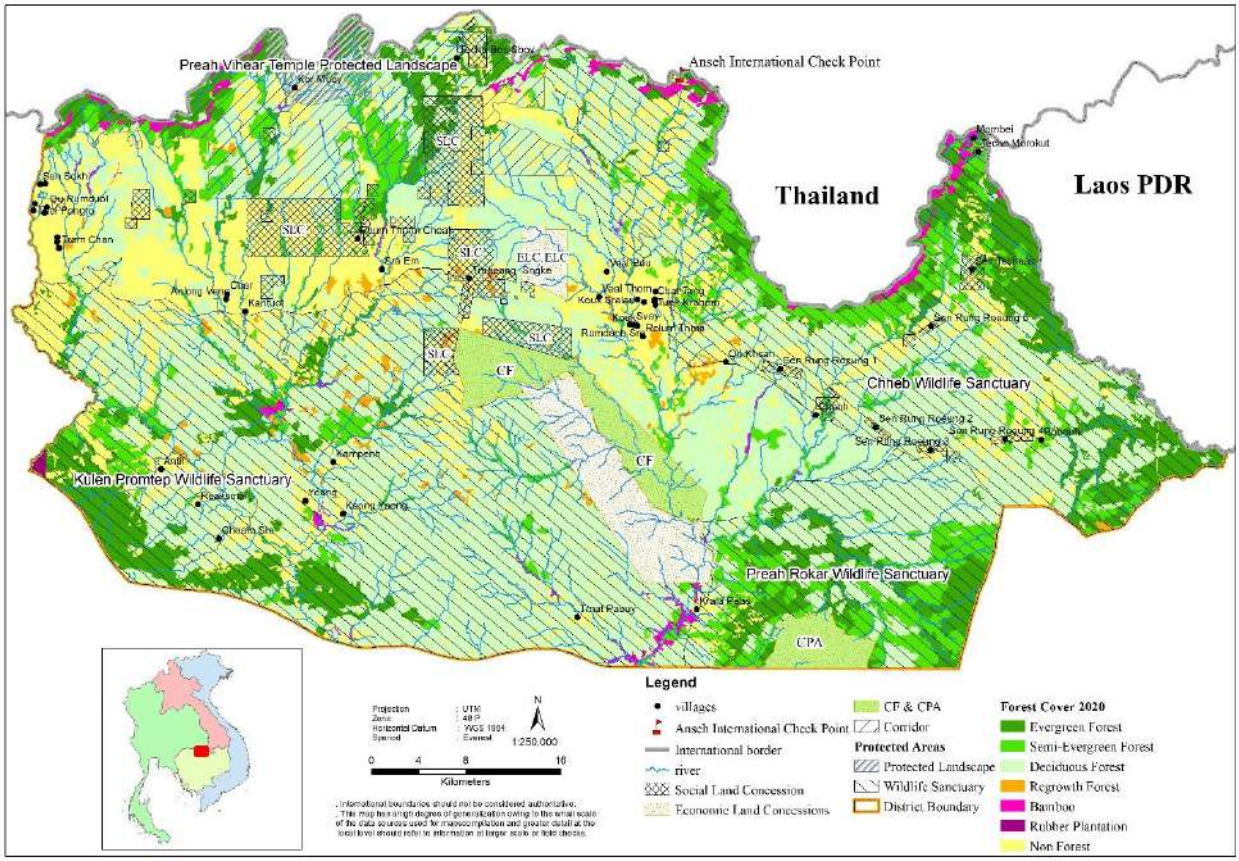
3.3 New Forestland Management System

3.3.1 Reformed Forestland Zoning and Management

The management of forestland in the Choam Ksant District has been under the jurisdiction of three primary institutions since 2016. These institutions include the Ministry of Agriculture, Forestry, and Fisheries, the Ministry of Environment (MoE), and the Preah Vihear Authority (PVA). There are currently 105,746 ha of land under the jurisdiction of the Forestry Administration; 4,042 ha of land under the jurisdiction of the Preah Vihear Authority; and 267,153 ha of land managed as Protected Areas (Figure 4) (Table 5).

The harvesting of timber in any area outside the ELCs and SLCs is currently not allowed for commercial purposes, except for the harvesting associated with traditional uses of local communities and unless permission is given by the Royal Government of Cambodia in connection with some legal arrangements.

Figure 4. Map of current distinguished land uses and forest management systems in the Choam Ksant District.



In such a legal context, only the harvesting of *D. oliveri* from source areas that are under the management of the Forestry Administration as economic land concessions or social land concessions is considered to be legal sources of harvesting since these entities have received their legal rights through sub-decrees granting permission for the uses of forestland. Local communities, as well as community forestry members, also have rights either for traditional uses, through which they are allowed to collect Non-Timber Forest Products (NTFPs) for their domestic use or for commercial purposes.

Table 5. Land uses and forestland management under respective authorities in the Choam Ksant District.

Land Uses and Forestland Jurisdiction Management	Area (ha)	%	Strategic Functions	Remarks
Forestry Administration (MAFF)	***105,746***	***28.1%***		
Community Forests (CF)	8,349	2.2%	Conservation and traditional uses based on community forest management plans	The minimum DBH for the allowable cut is applied
Economic Land Concessions (ELCs)	11,203	3.0%	Economic development	Forestland conversion; clear cutting; EIA report (forest inventory); the Premier's Order is still applied
Social Land Concessions (SLC)	19,505	5.2%	Socio-economic development	
The remaining forestland (Non-Protected Area forestland)	66,690	17.7%	Protection, reservation, production; traditional uses	The minimum DBH for the allowable cut is applied; Restrictions with law enforcement
Preah Vihear Authority (PVA)	***4,042***	***1.1%***		

Land Uses and Forestland Jurisdiction Management	Area (ha)	%	Strategic Functions	Remarks
Preah Vihear Temple Protected Landscape	4,042	1.1%	Conservation, forest restoration, and traditional uses (Zone III)	Restrictions with law enforcement
Protected Areas (MoE)	***267,153***	***70.9%***		
Chheb Wildlife Sanctuary	81,403	21.6%	Conservation, forest restoration, and traditional uses (Community zone)	Restrictions with law enforcement; compromise for Community zone
Kulen Promtep Wildlife Sanctuary	118,530	31.4%		
Preah Rokar Wildlife Sanctuary (plus CPA)	37,692	10.0%		
Corridor	29,528	7.8%		
Total	**376,941**	**100%**		

Forestland use planning in the Choam Ksant District is premised on the Forestry Law and the Protected Area Law. According to the Protected Area Law, each Protected Area shall be divided into the following four management zones:

- **Core zone**: management area(s) of high conservation values containing threatened and critically endangered species and fragile ecosystems. Access to the Core zone is prohibited except to Nature Conservation and Protection Administration officials and researchers who, with prior permission from the Ministry of Environment, conduct nature and scientific studies for the purpose of the preservation and protection of biological resources and the natural environment, and national security and defense personnel.
- **Conservation zone**: management area(s) of high conservation values containing natural resources, ecosystems, watershed areas, and natural landscapes located adjacent to the Core zone. Access to the Conservation zone is allowed only with prior consent of the Nature Conservation and Protection Administration with the exception of national security and the defense sector. Small-scale community uses of NTFPs to support local ethnic minorities' livelihoods may be allowed under strict control provided that they do not have serious adverse impacts on the biodiversity within the zone.
- **Sustainable Use zone**: management area(s) of high economic values for national economic development and management and conservation of the Protected Area that contribute to the local communities and indigenous ethnic minorities' livelihoods improvement. Subsequent to consulting with relevant ministries and institutions, local authorities, and local communities, in accordance with relevant laws and procedures, the Royal Government of Cambodia may permit development and investment activities in this zone in response to requests from the Ministry of Environment.
- **Community zone**: management area(s) for socio-economic development of the local communities and indigenous ethnic minorities that may contain existing residential lands, paddy fields, and field gardens or swidden (Chamkar).

3.3.2 Law Enforcement

There are more than 50 rangers conducting regular patrolling duties daily in the Protected Areas in the Choam Ksant District and at least 5 sub-camp sites are strategically situated on different forest access roads. The enforcement is highly restrictive in the Core and Conservation zones and most of the illegally logged wood is destroyed immediately when discovered while rangers are patrolling. The illegal loggers are arrested and dispatched to prison. In a similar manner, Forestry Administration foresters conduct their patrolling and confiscation operations in several locations and bring illegal trafficking cases to the provincial court. It is nevertheless recognized that there

are many perpetrators of illegal logging that escape apprehension because of the limited number of foresters in the district.

In recognition of the loss of some of its biodiversity and land conflicts in the country, the Royal Government of Cambodia, in mid-2020, commenced implementation of a campaign to increase private and state land registration on long-term, temporarily-occupied forestland used by local villagers. That measure, which is still in the initial stage of data collection, is ultimately expected to reduce land conflicts, forestland encroachment, and forest offenses throughout the country.

3.3.3 Species Restoration

No enrichment planting has been applied in Protected Areas by the Ministry of Environment nor on forestland by the Forestry Administration, but some forest restoration has been accomplished in forest plantations or by planting trees on public land. There is a considerable number of *D. cochinchinensis* trees that has been planted on public land along fences, in open yards to provide shade, and in gardens of schools, pagodas, local military offices, and commune offices (Figure 5). There are about seven hundred trees planted along the road to Preah Vihear Temple by the local Forestry Administration units and some of these were reported to have regrown naturally and are now protected by the Preah Vihear Authority. The Forestry Administration Division and sub-governmental district authorities have also shared opportunities for local people to participate in planting trees during annual Arbor Day ceremonies which contribute to genetic conservation, especially of the target species.

Figure 5. Plantation of *D. cochinchinensis* established to restore forest cover and conserve this species in an area of the Preah Vihear Temple Protected Landscape.

3.3.4 Promotion of the Establishment of Forest Plantations

There have been more than 85,000 seedlings of *D. cochinchinensis* that have been distributed to local villagers, monks, and public institutions to plant on their land or that have been planted as forest plantations in the district since 2013 (Table 6; Figure 6). While there are no available data on the number of seedlings of *D. oliveri* that were distributed during those years, it was reported that a smaller number of less than 3,000 seedlings of the species were planted in the district.

The number of seedlings of *D. cochinchinensis* that were distributed for planting by different institutions and projects includes 4,500 seedlings distributed by the local Forestry Administration Division between 2013 and 2014; 11,420 seedlings distributed by the FA-ITTO project between 2015 and 2016; 18,000 seedlings distributed for planting and replanting by the Preah Vihear Authority between 2017 and 2020; and 50,000 seedlings distributed to at least 650 local people, including monks, police, military units, and other public institutions, in 24 villages of 7 communes in the district by the CITES Tree Species Programme (Figure 6).

Table 6. Distribution of seedlings of *D. cochinchinensis* in the Choam Ksant District.

Institutions/Projects	2013	2014	2015	2016	2017	2018	2019	2020	Total
FA Division	2,900	1,600							4,500
FA-ITTO project			7,700	3,720					11,420
Preah Vihear Authority					3,000	5,000	5,000	5,000	18,000
CITES Tree Species Programme								50,000	50,000
	2,900	**1,600**	**7,700**	**3,720**	**3,000**	**5,000**	**5,000**	**55,000**	**83,920**

Source: Choam Ksant Forestry Administration Division (2016c); CITES Tree Species Programme (2021).

The survival rate of the more than 85,000 seedlings of *D. cochinchinensis* that were distributed and planted was not able to be ascertained, but it was observed that there were only about 2,000-5,000 seedlings, or about 7-17% of the 28,920 trees that were planted and observed prior to 2020 that survived. That is not a good survival rate in either plantations or natural habitats, especially since the causes of these dead seedlings were reported to be attributed to human-induced factors that included carelessness and the planting of the seedlings under unsuitable conditions.

Figure 6. The distribution of tree seedlings of *D. cochinchinensis* to monks and local communities by a project team of the CITES Tree Species Programme.

3.3.5 Private Forest Plantation Certification

Small- and medium-scale investment in forest plantations was initially promoted at the national level through incentives provided in public-private partnerships. The purpose of the Declaration on Private Forest Rules that was promulgated in 2017 was to provide legal support for private forest registration and to encourage private sector involvement, especially on legal private land. The Guidelines for Private Forest Registration further elaborated the procedures and legal requirements, as well as benefits that would be associated with investments to facilitate the establishment and development of forest plantations on private land.

To complement the implementation of the Private Forest Rules and to promote the registration of private forest plantations, several practical procedures which included the use of efficient application, verification and evaluation forms, registration certificate, and logbook were developed to facilitate and inform individuals, local communities, legal entities and the private sector on how and where to register their private forest plantations.

The principal beneficiaries of these initiatives include local communities, small- and medium-scale farmers, landowners, private sector companies, forest resource and land use management practitioners, and planners involved in planting trees in plantations.

4. Assessments of Harvesting, Trade, and Management Measures

4.1 Assessment of Harvesting Impacts

The assessments of harvesting impacts were evaluated against indicators specified in the CITES Guidelines on preparing a science-based NDF for timber species (Daniel Wolf *et al.*, 2018) in determining whether the levels of those impacts were low, medium, high, or unknown.

4.1.1 Impacts on Harvested Populations

Since the timber harvesting system used in ELCs and SLCs involves clear cutting with no associations with either logging rotations or cycles or annual allowable cuts because the forestlands in these concessions will be converted either into intensive agricultural or residential land, the impacts on harvested populations were considered to be high.

Table 7. Estimation of timber resources harvested and collected in concessions.

Forest types and target species	Total converted forestland 2014-2020 (ha)	Estimation based on average wood volume (2014-2016)		Estimation based on average wood volume (Systematic Inventory 2020)		Differences (m^3)
		Average wood volume (m^3/ha)	Total (m^3)	Average wood volume (m^3/ha)	Total (m^3)	
Semi-evergreen forest (SF)	436.8	109.75	47,938.80	55.19	24,106.99	23,831.81
Target species in SF		3.24	1,415.24	1.84	803.71	611.52
Deciduous forest (DF)	2,703.9	79.2	214,148.88	32.20	87,065.58	127,083.30
Target species in DF		1.96	5,299.64	0.81	2,190.16	3,109.49
Total volume of target species			**6,714.88**		**2,993.87**	

During the period from 2014 to 2020, the total wood volume of the target species that was estimated to be removed from the concessions was between 2,993.87 and 6,714.88 m^3 (Table 7). This rather large differential suggests that the harvesting of timber, most probably as the result of illegal logging, must have been conducted throughout the forestlands of the Choam Ksant District rather than only in the concessions, notwithstanding that the harvesting of *D. cochinchinensis* had previously been banned throughout the country.

More specifically, although the systematic survey that was conducted in 2020 revealed that < 1 m^3/ha was the average annual growth rate of *D. cochinchinensis*, the practice of clear cutting used in the concessions would tend to ensure that all the volume of the target species, or even of the expanded target species group, would be harvested, while the remainder of the trees would be damaged and used as fuelwood or considered to be too small and would be categorized as poles, making it very unlikely that the growth rate in those areas would be able to be resumed.

In the ELC and SLC concessions, the logging system, moreover, does not appear to consider regeneration. Since there is no reason to attempt to apply a minimum dbh harvesting limit or an allowable cut, seed trees are logged with no reservation of these trees. Seed production of the target species may be conceivably available outside of the concessions, but there would no longer be a remnant stand for seed production in the concessions which would impart a negative influence on both the quantities and the spatial coverage of the target species. The systematic survey indicated, nevertheless, that there were still some trees of primarily *D. cochinchinensis* used as living fence on some local villagers' residential land.

Some of those *D. cochinchinensis* trees that were observed in the yards of local homes were reported to have been planted and quite a few of these trees were within the primary reproducing ages and/or size classes. Still, most of the *D. oliveri* trees were reported to have been logged, while those of *D. cochinchinensis* were believed to have been illegally harvested.

In the Choam Ksant District, outside of the concessions, the population density of seed trees is very low and no enrichment planting has been applied for restoration on lands administered by either the Forestry Administration or the Ministry of Environment. The maximum average dbh that was recorded for *D. cochinchinensis* and *D. oliveri* in natural habitats was about 20 cm with population densities of seed trees only at 0.155 trees/ha in semi-evergreen forests for *D. cochinchinensis* and 0.42 trees/ha in deciduous forests and 0.58 trees/ha in semi-evergreen forests for *D. oliveri.* These measures underscore the realization that the distances between reproducing individuals are higher than the moving distances of pollination and dispersal vectors.

4.1.2 Impacts on National and Sub-national Populations of the Target Species

The impacts of harvesting on national and sub-national populations of the target species were considered to be high. The forest inventories conducted between 2014-2016 had indicated that the average population density of the target species with dbh ≥ 5 cm was 86.4 trees/ha with an average wood volume of 3.21m^3/ha in semi-evergreen forests and 25.6 trees/ha with an average wood volume of 1.86 m^3/ha in deciduous forests. These measures were observed to have declined considerably at the time of the inventory that was conducted in 2020. The average population density of the target species with dbh ≥ 5 cm that was recorded during that inventory was 11.6 trees/ha with an average wood volume of 1.84 m^3/ha in semi-evergreen forests and 18.4 trees/ha with an average wood volume of 0.81m^3/ha in deciduous forests.

In the ELCs and SLCs, the same management principles currently in place have been applied for one cutting cycle. They are characterized by the use of clear cutting with no reduced impact logging rule, except only for the rare species and resin trees that indigenous people tap to collect resin for which there is a mutually agreed price.

While the sizes of the populations of *D. cochinchinensis and D. oliveri* in Cambodia are still relatively unknown and there are no systematic population estimates that exist, both of the populations are considered to be 'severely depleted.' Mature trees of both the species are reported to be 'very rare' even in protected areas and the two species were regarded to be "critically endangered" in a 2012 report by Cambodia's Forestry Administration (UNEP-WCMC, 2018).

4.1.3 Harvesting Impacts on Ecosystems

The harvesting impacts on ecosystems were also considered to be high. Responses in interviews with loggers indicated that many were initially confused between *Dalbergia cultrata*, another *Dalbergia* species occurring in Southeast Asia, and *D. cochinchinensis* and, as a result, there were many trees of *Dalbergia cultrata* were harvested. Once the loggers recognized the differences relating to species traits, wood colors, and market prices, they were able to differentiate between the two species.

The timber collected from either inside or outside of the concessions was concentrated primarily on the target species group that encompassed not only *D. cochinchinensis* and *D. oliveri,* but *Pterocarpus pedatus* and *Afzelia xylocarpa* (Kurz) as well. Each of the species was selectively

illegally logged throughout the forest ecosystems in the district. Since each of the timber species has similar traits of hard wood and high value, there was limited indiscriminate harvesting of target species that included other luxury timber species. In the concessions, however, the harvesting system predicated on the complete removal of timber would have a higher negative effect on the non-target, as well as target, species of the ecosystems, which would reduce the available resources of numerous species.

4.2 Trade Impacts

The assessment of trade impacts was evaluated against indicators specified in the CITES Guidelines on preparing a science-based NDF for timber species (Daniel Wolf *et al*., 2018). Despite the presence of an international check point at Anseh, the official trading of wood crossing the border with Thailand through the Choam Ksant District is not allowed.

4.2.1 Trade Level in Relation to the Harvested Production

Since the actual harvested amount of wood of the target species was considered to be only about 40% of the volume of the wood that was available prior to harvesting, estimates of the total volume of wood that would have been available to be harvested or collected in concessions would have ranged from 1,197.55 to 2,685.95 m^3. These estimates were obtained from the inventories that were conducted in 2014 and 2020 to determine changes in forest cover.

The actual quantity recorded in the permits approved for sawnwood by the Choam Ksant Forestry Administration Division from 2013-2019 was 913 m^3, which was about 24% less than the lower estimate of total wood volume harvested in the concessions. The assessment of the impacts on the level of trade in relation to the harvested production was, therefore, considered to be medium.

4.2.2 Magnitude and Trend of the Legal Trade

The magnitude and trend associated with the legal trade of the target species are considered to be high since the local transportation of processed forest products and by-products for domestic use is considered to be legal under the Forestry Law. The transporting of the products and by-products from the district to Phnom Penh and domestic city centers in other provinces has become a common route for trade.

There are some small-scale household wood processors, as well as several outlets, that sell wood furniture in the district and most of them have bought wood in the form of logs or roundwood from local villagers who have illegally logged forestland in the Choam Ksant District. The target timber species are of high-value and have been used in the processing of various forest products and by-products. There is indication of multiple uses of the species that are traded and that they are in high demand in the markets. Figure 7 provides one of many of the examples of small-scale household outlets that sell processed forest products and by-products.

Figure 7. Small-scale household outlets in the Choam Ksant District that sell wooden furniture made of target timber species.

Despite the unavailability of data related to market demand, it was reported that a very large volume of processed forest products and by-products have been transported out of the district. The surge of new settlements has prompted the conversion of forestland in the district which has increased the harvesting of the target species. However, the results of the systematic survey conducted in 2020 suggest that the small numbers of large trees recorded during the inventory of both the *Dalbergia* species in the Choam Ksant District were primarily attributable to the illegal logging that occurred in the last several years.

It was reported that after 2016 the volume of the trade of processed forest products and by-products originating in the concessions seemed to have substantially decreased in combination with declines in the target timber species, as well as other timber species, which reflected the increasingly limited availability of wood resources.

4.2.3 Magnitude of the Illegal Trade

Since wood production in the district has been reserved for domestic uses, there are no data that are related to legal wood exported to other countries. The district could, nevertheless, be considered to be one of the principal crossings through which timber has been illegally transported to other areas throughout the country or even exported to Vietnam.

There are no commercial plantations of *D. cochinchinensis* or *D. oliveri* in the district and a ban on the cutting and trading of *D. cochinchinensis* had been imposed by the Prime Minister's Order 02. It is apparent, nevertheless, that there has been much illegal harvesting, transporting, and trading of *D. cochinchinensis* and *D. oliveri* in forests throughout the district, which has even extended to border crossings.

The realization that the local transportation of processed forest products and by-products for domestic uses is considered to be a legal activity actually appears to contradict approved processes and procedures. That is, establishing a sawmill or a wood processing facility requires requesting a permit although the harvesting of timber outside of concession areas is illegal. When those products are brought to household outlets from illegal wood processors, they could readily be transported outside the district without a permit or further certification of the sources from which the wood originated. The procedures are not transparent, as well as ineffective, for monitoring the illegal timber trade.

Figure 8 illustrates the downward trend in the illegal logging and trading of *D. cochinchinensis* which fell from 8.687 m^3 in 2013 to less than 1 m^3 in 2018.

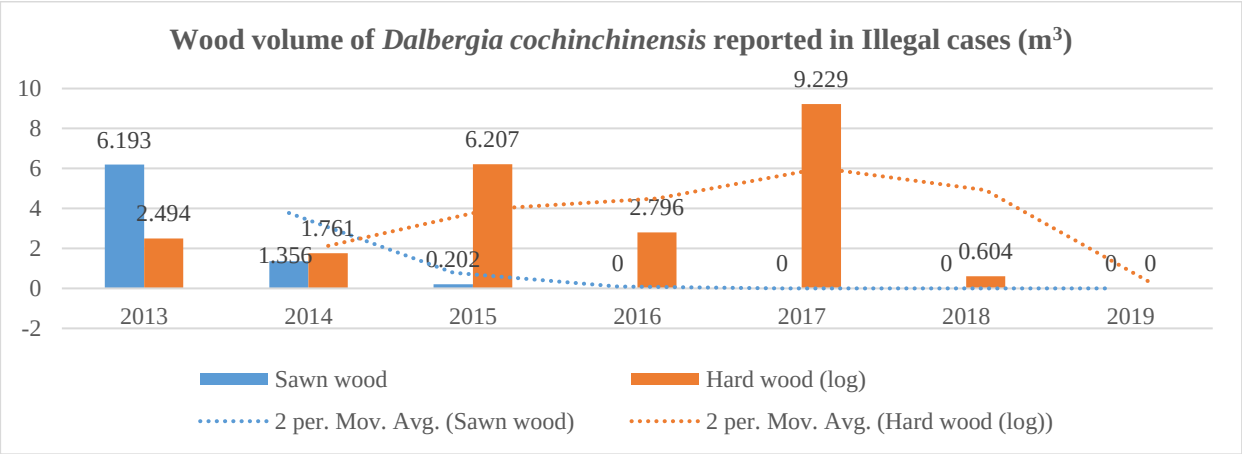


Figure 8. Number of reported cases involving the illegal trading of *D. cochinchinensis* in the Choam Ksant District.

There are no available data related to the illegal logging and trafficking of *D. cochinchinensis* or *D. oliveri* at the national level. There are reports, however, that Vietnam had imported sawnwood of *D. cochinchinensis* from Cambodia of about 8,700 m^3, 5,700 m^3, and 419 m^3 in 2013, 2014, and 2015, respectively. These imports fell in value from USD 17.5 million to USD 15.8 million to USD 1.2 million during those same years (Phuc et al., 2016). It appears that the accepted quantities, both illegally and legally exported, are significantly smaller than the quantities reported by importing countries.

Figure 9. Confiscation of illegally transported wood of *D. cochinchinensis* in the area of the Choam Ksant District.

It was also reported that the local authorities recognized the illegal trading of the primary target species that were collected in Thailand and Laos and transported through the Choam Ksant District to Phnom Penh or illegally exported to Vietnam (Figure 9). The magnitude of the illegal trade was, therefore, considered to be high for those reasons.

5. Conclusions

The ELC and SLC concessions where timber is able to be legally harvested cover approximately 30,707 ha and account for 8.1% of the district's total land area. The illegal selective logging and

the burning of forests in the district were reported to be the primary threats to the target species' conservation. The assessments that were conducted based on indicators provided in the CITES NDF Guidelines indicate that the levels of impact severity associated with the harvesting and trade of those species are mostly considered to be high.

The lack of effectiveness of some of the measures of management seems to correspond with the decline in reported cases of illegal forest offenses in which intensive law enforcement and patrolling is conducted across the district's forestlands, although the results of inventories revealed the already low population densities of *D. cochinchinensis* and *D. oliveri.* The declining populations were caused to a considerable extent by (1) illegal selective logging during the transition of the forestland management system in combination with a lack of transparency associated with the control and monitoring of trade of the target species; and (2) a limited number of Protected Area rangers and foresters available to conduct patrolling more extensively.

Despite the shortcomings leading to the high impact severity and low population densities of the target species in the natural habitats, the distribution of tree seedlings of these species could conceivably recover their genetic conservation through artificial propagation. That means that management measures should, at a minimum, have the appropriate level of rigor required to reduce the severity of identified concerns, risks, and impacts and should be implemented assiduously. It is recommended that the genetic conservation of the two *Dalbergia* species should be further concentrated through restoration, planting, and the maintenance of natural populations.

References

Chea Kearath (2016). Forest Inventory Implementation for Biomass Estimation and Understory Species Study in The Preah Vihear Protected Forest, Choam Ksant District, Preah Vihear Province.

CITES Tree Species Programme (CTSP) (2021). Updated Project Progress Report through Additional No-cost Project Extension "Integrating the Development of Guidelines and Incentives for Piloting the Establishment of Small-scale Private *Dalbergia* Plantations with the Determination of a Non-detriment Findings Report in Preah Vihear Province in Cambodia.

Daniel Wolf et al., 2018. CITES Non-Detrimental Findings for Timber: A nine-step process to support CITES Scientific Authority making science-based non-detrimental findings (NDFs) for timber/tree species listed in CITES Appendix II (version 3.0).

Indonesian (2010). Guideline for non-detrimental finding assessment for Ramin Gonystylus spp.

Forestry Administration. (2016a). The Management Plan 2016-2019 of the Preah Vihear Protected Forest for Plant and Wildlife Genetic Resources Conservation.

Forestry Administration. (2016b). FA-ITTO Project's Technical Report: Integrating Forest Biodiversity Resource Management and Sustainable Community Livelihood Development in the Preah Vihear Protected Forest.

Forestry Administration. (2016c). FA-ITTO Project's completion Report: "Management of the Emerald Triangle Protected Forests Complex to Promote Cooperation for Trans-boundary Biodiversity Conservation between Thailand, Cambodia and Laos (Phase III)".

Forestry Administration. (2021a). Systematic Survey Report of *Dalbergia cochinchinensis* and *Dalbergia oliveri* for a Piloting Assessment of Sustainable Genetic Conservation in Choam Ksant District, Preah Vihear Province.

Forestry Administration. (2021b). A 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.

Heng Soiya (2015). Estimation of Above Ground Biomass through Evaluation of Stand Structure in Preah Vihear Protected Forest, Choam Khsan District, Preah Vihear Province.

Phoung Sophea (2015). Estimation of Aboveground Wood Biomass in Preah Vihear Protected Forest, Chhaep District, Preah Vihear Province.

Phuc, X., Quyen, N.T., Hanh, H. V., Huy, T.L. and Cam, C.T. (2016). Vietnam's Imports of Cambodian Logs and Sawnwood from Natural Forests: 2013-2015. Forest Trends, Washington D. C. 20 pp.

Rosser, A.R. and Haywood, M.J. (Compilers). (2002). *Guidance For CITES Scientific Authorities: Checklist to assist in making non-detriment findings for Appendix II exports*. IUCN, Gland, Switzerland and Cambridge, UK. xi + 146pp.

UNEP-WCMC. (2018). Report on species/country combinations selected for review by the Plants Committee following CoP17. UNEP-WCMC, Cambridge.

Laws and regulations:

Forestry Law (2002)

Law on Protected Area (2008)

MAFF, (2005). A Promulgation on Prohibited Forest Products and Non-timber Forest Products for harvesting from Reserved Permanent Forests in Cambodia.

RGC, (1999). Sub-Decree 72 on Environmental Impact Assessment Process.

RGC, (2005). Sub-Decree 146 on Economic Land Concession.

RGC, (2006). Sub-Decree 53 on Trading of Endangered Flora and Fauna species listed in CITES's Appendix.

RGC, (2013). Premier's Order 02, dated 22 February 2013, on Controls and Crackdown on Cutting, Trafficking, Collecting, Storing, and Exporting *Dalbergia cochinchinesis* in the Country.

RGC, (2014). A regulation No. 601, dated 24 April 2014, issued by the Council of Minister of the Royal Government of Cambodia suspended its exporting of all forest products and forest by-products derived from luxury grade timber species until it is informed via a new regulation. This aims to improve sustainable forest resource management and usages.