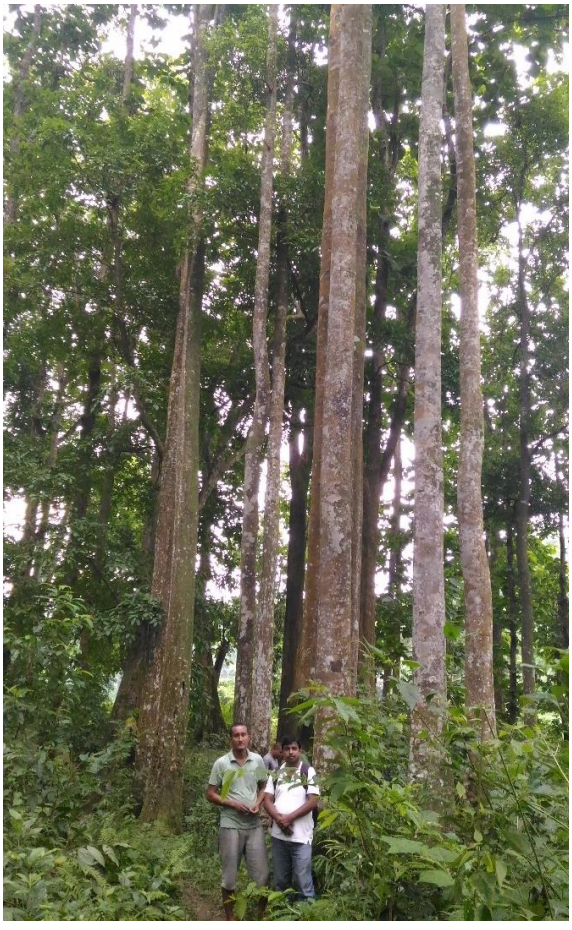
Report on Non-detriment Findings of *Aquilaria malaccensis* in India



Rain Forest Research Institute, Jorhat- 785 001, Assam

(Indian Council of Forestry Research and Education, Dehradun)

Ministry of Environment, Forest and Climate Change, Government of India

REPORT ON NON-DETRIMENT FINDINGS OF

***Aquilaria malaccensis* IN INDIA**

Executive Summary

Key words: ***NDF, agarwood, Aquilaria malaccensis, India***

INTRODUCTION

Aquilaria malaccensis Lam. syn. *A. agallocha* Roxb. is one of the fragrant resin-producing species in the genus *Aquilaria*, of family Thymelaeaceae commonly known as agarwood, and the species produces a dark coloured resinous aromatic compound in the heartwood of the tree upon infection by microbes. It is highly prized and used in perfumery, incense sticks and as a raw material in traditional and modern medicines. Owing to high demand, infected trees were harvested in an unsustainable manner in the past leading to local extinction in many areas. It is currently listed as Critically Endangered in the IUCN Red List and in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). India is home to only two species of *Aquilaria* namely *A. malaccensis* and *A. khasiana*.

Rain Forest Research Institute, Jorhat being one of the Scientific Authorities under the Convention, was requested by the Management Authority (Ministry of Environment, Forest and Climate Change, Government of India) to undertake a study called the Non-Detriment Findings (NDF) in order to examine the possibility of international trade and if so, the extent to which it can be allowed. The materials produced from the species and exported fall under the ITC- HS Code 12119080 (Agarwood- including chips and powder) and 33013010 (Agar oil). Besides chips & powder and agar oil it is also traded in other forms, such as, carvings, derivatives, extracts, live plants, timber, timber pieces, wood product, sawn wood, specimen, medicine and unspecified products (as found from the CITES Trade database) and these are mixed up with other similar products in the ITC-HS classification, and cannot be separated under the present system of classification and coding of products.

BIOLOGICAL DATA

Aquilaria malaccensis is found in Bangladesh, Bhutan, India, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, and Thailand. In India, it occurs naturally mostly in the foothills of North-Eastern states as well as West Bengal up to an altitude of 1000 m above mean sea level. In Assam, it is cultivated extensively in Upper Brahmaputra Valley. It is also cultivated along the Western ghats in Kerala and Karnataka, besides limited plantations in other States, such as, Tamil Nadu, Telengana, Andhra Pradesh, Goa, Maharashtra and Gujarat.

The plant grows between altitudes of 0-850 m and up to 1000 m in locations with average daily temperatures of 20-22 ^{o}C; it grows well in mean annual maximum temperature of 22-28 ^{o}C and a mean annual minimum temperature of 14-21 ^{o}C. Natural regeneration is usually poor. The tree is generally slow growing.

The diseased wood of the Agar tree which is formed as a result of fungus-host interaction is commercially termed as Agarwood. Plants above the age of seven years are vulnerable for infection by the fungus. Natural infection by the fungi occur in the wood when trunks of standing trees are bored by the larvae of *Neurozera conferta* (syn: *Zeuzera conferta*), a stem borer. Naturally the fungal infection takes long time to establish and trees of about 50 years old may produce highest concentration of agarwood. Only 7-10% of the trees are reported to get infected. Several techniques are practiced for artificial induction of agarwood in *Aquilaria*. Broadly they can be classified as physical, chemical and biological methods, where injury is made on the tree or chemicals and hormones injected into it or fungus itself is injected and allowed to spread within.

In natural stands, the regeneration is poor. The species produces seeds after 7-9 years and seed production peaks when the dbh (diameter at breast height) is approximately 40-50 cm, and individual trees can produce up to 19000 seeds per season. The seedling dispersal is limited, with more than 65% of seedlings occurring within 5 m of the mother tree. The seedling mortality is high and seedling population is reduced to 20% of the regeneration in just one year. However, *Aquilaria malaccensis* has been found to regenerate naturally in the homestead gardens of Upper Assam, where the species is maintained in a semi-natural state, at a very high density. Regeneration through coppice has also been noticed. In monoculture plantations of agarwood natural regeneration is not noticed, probably due to the weeding operations and agricultural activities that are undertaken in them, and harvest before the trees commence profuse seeding.

The natural population has been drastically reduced over the years due to over-exploitation and illicit felling. Now the remnant natural stands are found only in remote forest areas, protected areas (National Parks and Wildlife Sanctuaries) and some community forests in the hilly areas of Northeast India. These are also under threat due to land use changes, shifting cultivation and the associated forest fires, mining and other developmental activities that are reducing the area under natural forest cover in the Northeast region. In Assam it is already reported to be extinct from wild.

The present population of the species is largely found in cultivation in the native range as well as outside the native range. While the natural population is on the decline, the cultivated population is on the rise. Major populations are located in the States of Assam, Tripura, Kerala and Karnataka. Globally the species *Aquilaria malaccensis* is considered Critically Endangered. Earlier it was considered 'Vulnerable' as per the IUCN assessment in 1998, but the status has downgraded to 'Critically Endangered' in 2018 assessment due to the continued unsustainable exploitation of the species, leading to decline of the population by over 80% over the last three generations. The Botanical Survey of India lists *Aquilaria malaccensis* under the Rare, Endangered and Threatened (RET) taxa in India. It is listed in the Red Data Book of Indian plants and as a species facing genetic erosion. It is one among the 197 red-listed medicinal plants recorded by the Foundation for Revitalization of Health Traditions (FRLHT). National Biodiversity Authority has notified *Aquilaria khasiana* as a species on the verge of extinction in Meghalaya and *A. malaccensis* as a species on the verge of extinction in Mizoram under the provisions of Biological Diversity Act, 2002.

In its native range, the remnant populations harbour the genetic diversity within the species. Because of the diversity of the terrain in the native distribution range, and the barriers to gene flow, intraspecific diversity is high within *Aquilaria malaccensis*. As on date, fourteen provenances have been delimited in the distribution range of the species, by RFRI. These natural populations are suffering mainly from fragmentation, land use changes, shifting cultivation, mining and other developmental projects, leading to genetic erosion. The plantations also suffer from unsustainable harvest, as the harvestable size is steadily going down.

SPECIES MANAGEMENT IN INDIA

Agarwood was regularly exploited from the Northeast India, leading to complete depletion and the management of the species in its native range, has been one of gross mismanagement catering to the greed of the industry. Unscientific extraction and extensive exploitation have

decimated the species. Currently there are no management plans for agarwood in any of the Working plans of the states falling in the native range. The forest departments have been making sporadic attempts to raise plantations within the forest areas, but this is not with much enthusiasm, due to the fear of illicit felling. The population in the native range is now largely in the private plantations and homestead gardens in Assam and Tripura and the community forests of Nagaland, Meghalaya, Manipur and Mizoram. A systematic plan to raise plantations on a 10- 15 year rotation, providing for regular clear felling and replanting in annual coupes, will help in conservation of the species *ex-situ/ circa situ*. In the States outside the native range, such as, Kerala and Karnataka where substantial population is found, it is all on private land outside forests, and are therefore not covered by any management plan. In those areas where the plantations are managed under semi-natural conditions, with natural regeneration and selective harvesting, minimum diameter limit can be fixed for harvest, so that the young trees are not harvested.

As on date, there are no management plans for the species in place. However, if a management plan is prepared, it should provide for (a) establishment of nurseries of *Aquilaria malaccensis*, both with the government and the private sector, for production of quality planting stock, (b) establishment of seed production areas in plantations and seed orchards (both Seedling seed orchards and clonal seed orchards) using the superior germplasm, identified within the provenances, (c) establishment of Provenance Resource Stands, in order to conserve the intraspecific genetic diversity, (d) establishment of monospecific plantations, in a systematic manner, to allow for sustainable harvest every year on a perpetual basis, (e) provision for artificial induction of agarwood in those areas where natural infection does not occur, (f) improved methods of harvest, processing, value addition, distillation of oil, quality control, scientific grading of chips as well as oil, and (g) traceability of the material from the wild and cultivated sources, by proper documentation and registration of cultivated sources, which will facilitate obtaining of export permit and also future NDF studies for revision of export quota, if necessary, (h) development of protocols for product identification, and (i) awareness creation among the tree farmers and agarwood processing units, about improved methods of cultivation and harvest, processing, marketing and legal requirements. There is a need for the Management authority to get a Conservation and Utilization Plan prepared to be implemented by the States having natural distribution of the species. In the areas outside the natural range, the farmers are planting themselves, and they need to be provided the appropriate guidance on plantation management, pest and diseases, artificial induction of agarwood, extraction procedures, distillation methods, grading and quality control and export procedures.

In order to restore the species in its native habitat, enrichment planting of the species in the forest areas that were the original areas of distribution, using seeds from the remnant

populations, if any, of the same provenance (to avoid genetic pollution and loss of intraspecific genetic diversity) needs to be undertaken by the forest departments, with the assistance of the research organizations. In the community forests, as in the Northeast India, the communities can be involved in restoration of the populations.

Harvest of the species is happening in the States falling in the native range of the species, as natural infection occurs in these areas. Harvest is very much limited outside the native range (in States of Southern and Western India) due to the young age of the plantations, and lack of natural infection in those areas. Though the species is included in the Appendix II of CITES, and export of any material would require Certificate of Cultivation and Certificate of Legal Procurement from the Divisional Forest Officer, there is no system in place to register the plantations with the forest departments of any of the States that have these trees, except Tripura. Assam, which had the system in place has done away with the requirement for areas lesser than 5 ha in 2019 through an amendment, equating agarwood with Eucalyptus and Poplar, under the guise of promoting agarwood cultivation. The rules which were drafted for regulation of harvest and processing in 2017, are yet to be finalized and notified. This has led to a situation where the forest department does not know how much agarwood is under cultivation, and where, and is not in a position to provide the Certificates required under CITES. Though this step taken by the Government of Assam, might have helped in promoting cultivation and harvest, it has not helped in export of the material through legal means, conforming to the CITES regulations.

There is no monitoring at all by the forest departments regarding the cultivation or harvest of agarwood, except Tripura which has issued guidelines for this purpose in 2019. Though the CITES regulations require issue of Certificate of cultivation and Certificate of Legal Procurement from the Divisional Forest Officer, there is no system in place for registration of the plantations of the CITES-listed species, in the other States. Assam is in the process of formulating a policy for the purpose.

The legal framework presently governing the extraction and utilization of *Aquilaria malaccensis* is the Indian Forest Act, 1927 and the various State Forest Acts, and the rules framed thereunder, which regulate the harvest, transit, storage and trade of forest produce. There is no legal framework specific to Agarwood or even the other CITES listed species. However, there are certain policies framed with reference to agarwood. The Draft Policy for Sustainable Utilization of Agarwood, 2014 formulated by the Ministry of Environment, Forest and Climate Change, Government of India, is still in the draft stage. The Government of Assam has formulated a policy on agarwood, and is yet to be notified. Government of Tripura has notified certain guidelines for

"Sustainable extraction/ utilization of Agar trees available in private lands in Tripura". No other State has any policy or guidelines on this issue of agarwood cultivation or utilization.

The other legal provisions related to the management of *Aquilaria malaccensis* are the Wildlife (Protection) Act, 1972 in respect of those remnants of wild populations located within the Wildlife Sanctuaries and National Parks, and the Biological Diversity Act, 2002 which will apply in case any novel product or medicine is developed from any material sourced from the wild or the community forests.

The international trade is regulated by the EXIM Policy. For an Appendix II species such as *Aquilaria malaccensis*, foreign trade is regulated only to the extent that the exporter needs a Certificate of Legal Possession (CLP) issued by the jurisdictional Divisional Forest Officer. Currently export is allowed only through Mumbai, Kolkata, Kochi, Delhi, Chennai, Tuticorin and Amritsar. For obtaining the Certificate of Cultivation and also for annual revision of export quota through NDF, registration of plantations will be beneficial, and is also one of conditions imposed by the CoP decisions of CITES. The Guidelines for Felling and Transit Regulations for Tree Species Grown on Non-forest/ Private Lands, issued by the Ministry of Environment, Forest and Climate Change to all the States, recommends a transparent and simple methodology for maintenance of records of tree plantation on private lands, as it is important for creating and maintaining a dynamic resource inventory. Such records will help in decentralizing issuing of transit permits and facilitate harvesting of trees subsequently at village level. In case of agarwood, this exercise will facilitate estimation of growing stock by sampling and fixation of quota for exports, annually. Any revision of quota can be supported by these statistics of plantations, maintained by the State government. However, no such record of plantations in respect of agarwood was found to be maintained by any of the State governments.

UTILIZATION AND TRADE FOR INDIA

The main and traditional use of agarwood has been as incense, especially in the countries of the Middle East. The other major use is as a perfume or as a fixative for high quality perfumes, and is largely exported to the European countries for this purpose. The emerging use of agarwood is for medicinal purposes, especially in Chinese medicine. The market for agarwood and its products is mainly export oriented, and there is no significant local consumption. The major importers are the UAE, Saudi Arabia, UK and Bahrain. Since the locally harvested agarwood, even from cultivation in non-forest lands cannot be exported in the absence of export quota, which needs to be fixed after an NDF study, there is no legal export of any of the cultivated agarwood from

India at present. Since no NDF study was ever done, no quota for export exists. The traders import agarwood from Southeast Asian countries, process and re-export, which conforms to the requirements of CITES, and this serves as a mechanism to cover up the illegal exports of domestic agarwood.

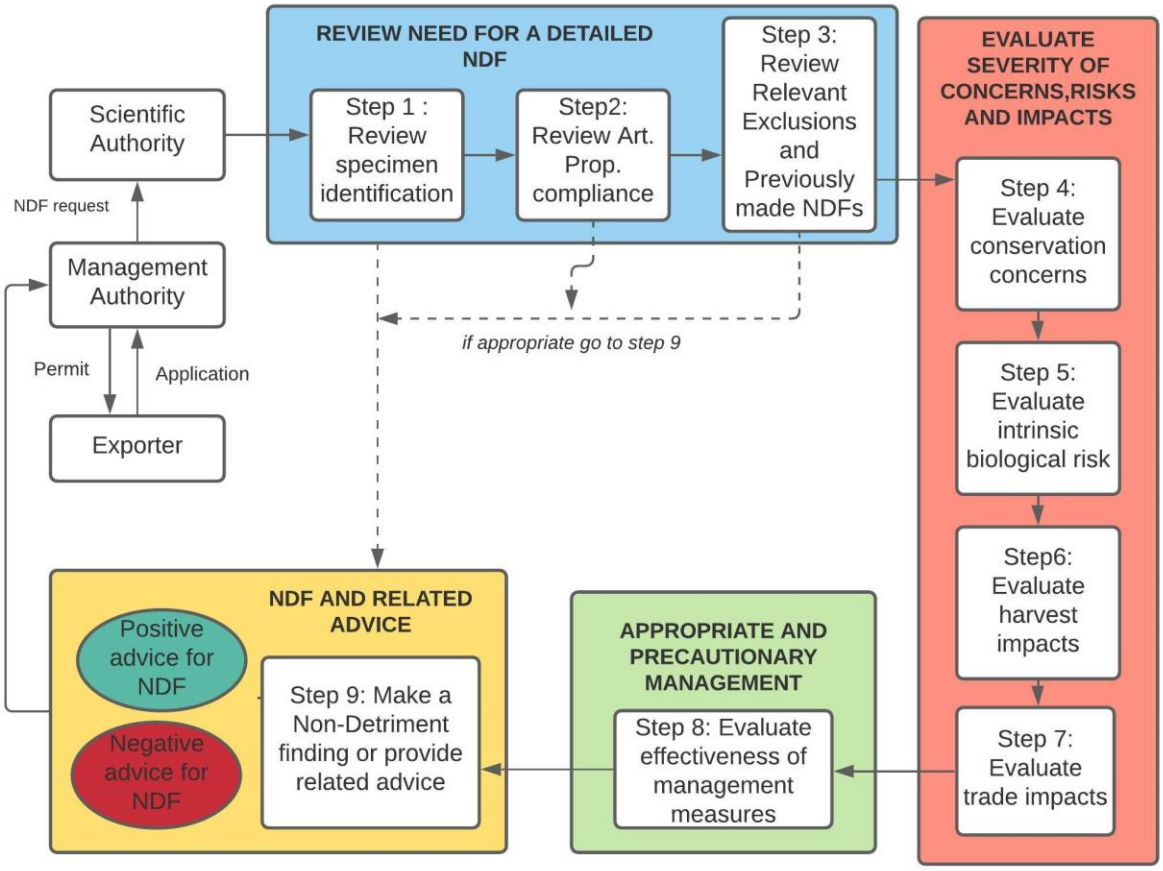
As observed by UNODC, India may also be serving as conduit for illegal wood harvested in the neighbouring countries. Smuggling of agarwood from Myanmar through Manipur has been cited in the study by TRAFFIC- India. There is great amount of secrecy maintained by most of the agarwood traders, indicating lack of transparency in the agarwood business.

Since most of the agarwood now coming into the market is from private lands or community forests, no management control of any kind exists. There are no quotas fixed for extraction, no season prescribed or permits issued. In the area of natural distribution, in the Northeast India, except for areas in the Brahmaputra valley, Imphal valley and parts of Tripura, no land tenure exists in favour of individuals. The land and the forests are community owned, and large areas of land are under the category of Unclassed Forests, and agarwood is found in such forests. Therefore, the Government is not in a position to impose any control over the harvest. There is a need for fixing a quota on harvest from each State, besides a quota on export of products required under the CITES. If all the plantations are registered, it would be possible by sampling to determine the growing stock and annual yield, and fix harvest quota on 10-year basis. This can be regulated by the forest departments of the States concerned or the Autonomous District Councils or the community organizations. Through such a quota, it can be ensured that the population does not go below certain level, and further the population trend can also be monitored.

There can be no legal international trade with locally cultivated material in the absence of any quota fixed so far by the Management authority. The only legal trade permitted is of the imported material that is processed in the country and re-exported, with which the local material gets mixed up. The details of the legal trade are available from the Export Import Databank of the Department of Commerce, Ministry of Commerce and Industry, Government of India. Only two commodities namely agarwood chips including dust and agar oil are clearly discernible in the said statistics through ITC-HS codes. Other products of agarwood are mixed up with similar products from other plants under Chapter 06 (as plants, plant portions of wild or cultivated origin, of species specified in Appendix II or III of CITES) or chapter 30 (as derivatives, extracts and formulations). On the levels of illegal trade, official statistics available are only from the CITES Annual Reports published by the Ministry of Environment, Forest and Climate Change, Government of India and the Annual Illegal Trade Reports being submitted to CITES from 2016 onwards. These reports are related only to CITES and Foreign Trade Policy violations. Offences related to illegal felling, transport, processing or trade within the country need to be collected from the forest departments.

NDF AND RELATED ADVICE TO THE MANAGEMENT AUTHORITY:

The NDF methodology was prescribed first by IUCN which was deliberated at Cancun NDF workshop in 2008 leading to the formulation of NDF guidance. At present there is a nine-step methodology for NDF studies, as illustrated below, and this was followed, in the present study.



The present growing stock is largely from cultivation on non-forest lands, and the seeds for artificial propagation are also sourced from existing plantations. As the cultivated specimens are permitted under the national legislation/ rules subject to certain conditions, a **POSITIVE ADVICE** is rendered for export of specimens from cultivated sources, in this NDF report. The wild populations are protected and no export of wild specimens is permitted. In fact, no export of any specimen from the range State is permitted at present in the absence of NDF report and fixation of quota. In view of the limited remnant population of the species in wild, the present NDF renders a **NEGATIVE ADVICE** for harvest of wild populations.

The existing management measures do not adequately mitigate harvest and trade impacts. Documentation of the cultivated sources is inadequate, and on the pretext of deregulating the restrictions and promoting cultivation, the need for registration is being dispensed with. Registration of plantations with any government agency, will help in easy assessment of growing stock and estimation of quota of products to be allowed for export, in the future revisions of quota. If details of age-wise growing stock are not maintained, it would be difficult to fix quota for export. Resolution Conf. 16.10 of CITES encourages range states to establish a registration system for the artificial propagation of agarwood producing trees and recommends exporting states to establish a registration system of exporters who export pure or mixed oil of agarwood. Samples of the labels used and the lists of relevant exporters should be communicated to the Secretariat by exporting states, and then be provided to all the parties through a notification. The industries processing the wood and extracting oil and other extracts are also not registered with any authority at present, and the quantum of extraction, price, grading is all kept secret. Without clear accounting of production of various products from agarwood, there can be unsustainable extraction and use of the timber, clearly threatening the species in cultivation, and subsequently can threaten whatever is left in wild, to meet the requirements of the market.

Under the above circumstances, the following NDF related advice is also rendered to the Management Authority:

1. Harvesting of *Aquilaria malaccensis* from wild needs to be discouraged and checked. The remnant stands need to be identified and protected as genetic conservation stands, as these are the last repositories of genetic variation within the species. Where they are located within the forest areas, the legislative protection afforded through the relevant sub-national laws would suffice. However, wherever these stands are located in community forests, as in the northeast region, they should be declared as Community Conservation Areas, and the communities should be given the responsibility of protecting those stands, with a clear understanding of the need to maintain the genetic diversity. The communities can be encouraged to collect seeds from such stands, raise nurseries and carry out enrichment planting in the forest areas.

2. Harvesting from plantations both homesteads maintained in semi-natural state and the monospecific plantations may be allowed, subject to the following conditions:

a) Registration of the plantations with any government department concerned, as may be decided by the sub-national legislations, is required to keep record of the growing stock, in order to fix and revise export quota in future. Registration with the forest department, preferably online, with simplified procedures is recommended. The management authority is advised to issue necessary advisory/ instructions in this regard to the subnational units (State governments).

b) The industries processing the timber need to be registered with the concerned government agency, preferably the Industries department, which should keep stock of the production of various products derived from agarwood, which would help in fixing and revising the export quota in future. The management authority is advised to issue necessary advisory/ instructions in this regard

to the subnational units (State governments).
c) These would be in conformity with the CoP decisions of CITES related to registration of plantations and traceability of the products.

3. Cultivation of *Aquilaria malaccensis* needs to be promoted incentivizing production of quality planting stock, raising of plantations in areas those are unfit or unremunerative for agriculture, raising of agarwood as a part of agroforestry system or as shade crop for tea. Cultivation must be undertaken with quality planting material. Exclusive seed sources in the form of Seed Production Areas (SPA), Seedling seed orchards (SSO) or Clonal seed orchards (CSO) need to be created at district level, in non-forest areas to serve as source of seeds for production of quality planting stock. These seed sources should be created keeping in view the intra-specific variations, and should be used exclusively for planting in non-forest areas, and not to be used for enrichment planting in forest areas, which may alter the provenance variations, causing what is called the "genetic pollution". For enrichment of the forest areas, which once supported the species, the local remnant populations must be used as seed source.

4. There is need for research on various aspects of the species, viz.,
(i) Intraspecific variation in phenology, morphology, physiology, biochemistry and genetics
(ii) Biochemistry of agarwood formation and the role of the host, pathogen and the insect borer in the composition of the resin and oil.
(iii) Development of agarwood based agroforestry systems, including introduction in the shifting cultivation areas.
(iv) Cultivation practices of the species, including silviculture (spacing, pruning, thinning, tending operations), integrated nutrient management, integrated pest and disease management, and fixation of rotation for harvest, both in the native range and the areas where the species is introduced.
(v) Artificial induction of agarwood in those areas where natural infection does not occur, including identification of effective strains of microbes, and development of formulations that can be easily used by the farmers on their own to induce infection.
(vi) Improving the method of extraction of oil, in order to enhance the quantity and quality of oil.
(vii) Scientific methods of grading of agarwood chips and oil, so that the farmer and the industry get the right price for the product.
(viii) Production of value-added products from the agarwood, viz., cosmetics, medicines, handicrafts, incense, in order to improve employment potential from the sector.
The management authority is advised to encourage and fund research on all those aspects through the Indian Council of Forestry Research and Education.

5. The management authority is advised to develop robust mechanisms for collection of statistics, as there is lot of discrepancy in the statistics of population of the species, which is the raw material, as well as the data on production, domestic trade and international trade. The CITES Trade Database has information as reported by the Importers as well as Exporters, and these statistics wherever India is either an importer or exporter, does not tally with the figures provided by the corresponding exporter or importer. Secondly, the CITES Trade Database maintains statistics of all possible products of agarwood, but the Trade Database of the Ministry of Commerce and Industry, Government of India provides data only on the agarwood chips (including dust) and agar oil. All the other products are included within broad classes of similar products. Management authority can make a complete list of products made from CITES-listed species, and examine possibilities of having them separated from the ITC-HS codes for similar products that are bulked together. This listing will also help in identification of any new product into the market, and examining its possibility for claim of Access and Benefit Sharing (ABS) under the Biological Diversity Act, 2002, as the new product will not be a Normally Traded Commodity, exempted under the said legislation.

6. The management authority is also advised to conduct awareness programmes on CITES among the various agencies involved in cultivation, processing, marketing and trade of various species listed in CITES Appendices, and also the regulatory agencies controlling the export, as there is total lack of understanding even among the agencies that are required to enforce CITES at subnational levels, this often leading to attempts to bypass the provisions of CITES. The management authority may get these programmes conducted through the Scientific authorities of CITES.

7. The export quota, is usually fixed under CITES annually from 1st January to 31st December. However, in order to align with the financial year of India, the following export quota is recommended at present for the financial year 2021-22, taking into consideration the growing stock available in non-forest lands, the number and capacity of the agarwood processing units, and the proportion normally used for production of agarwood chips and agar oil, and also the trend in the exports for the last 10 years:

Agarwood chips and powder (HS Code 12119080): 25000 Kg per annum

Agar oil (HS Code 33013010) : 1500 kg per annum

8. Though CoP15 has recommended annual revision, considering the need for proper registration and documentation of the cultivated sources, the registration of processing industries and traders/ exporters, development of traceability mechanism and product catalogue which is likely to take time, it is recommended that the quota suggested may be considered for revision after three years, in 2024.

9. For facilitating legal trade and ease of doing business, it is also recommended that the CITES export permits may be issued from all the Integrated Regional Offices of the Ministry of Environment, Forest and Climate Change, and the Guwahati airport may also be permitted for allowing exports, as it is the only international airport in the Northeast region, which has a substantial population of agarwood.

REPORT ON NON-DETRIMENT FINDINGS OF

***Aquilaria malaccensis* IN INDIA**

1. BACKGROUND

Aquilaria malaccensis Lam. syn. *A. agallocha* Roxb. is one of the fragrant resin-producing *Aquilaria* species in the Indo-Malayan genus *Aquilaria*, of family Thymelaeaceae (Lee and Mohamed, 2016). Commonly known as agarwood, the species produces a dark coloured resinous aromatic compound in the heartwood of the tree upon infection by microbes. The resinous compound is believed to be produced by the plant as a self defence mechanism against fungal infection, but there are also views that it is produced by the fungus drawing raw material from the plant. The infected plant heartwood is highly prized and used in perfumery, incense sticks and as a raw material in traditional and modern medicines. Owing to high demand for agarwood, infected trees were harvested in an unsustainable manner during the past leading to local extinction in many areas. Consequently, it is currently listed as Critically Endangered in the IUCN Red List (Harvey-Brown, 2018) and in Appendix II (potentially threatened species) of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 2010). In India, *A. malaccensis* is mainly found in the tropical evergreen forests of northeast India. Though there are 21 *Aquilaria* species recorded worldwide, only 13 are reported to produce fragrant resin (Lee and Mohamed, 2016). India is home to only two species of *Aquilaria* namely *A. malaccensis* and *A. khasiana*. *Aquilaria macrophylla* earlier reported from India is now transferred to the genus *Gonostylus* as *Gonostylus macrophyllus*.

Due to high medicinal and perfumery value, the species has a great demand in the national and international market, and hence attempts are now being made to cultivate the species in India and other places around the world. Currently, the species is mainly surviving in plantations, home gardens and in tea plantations of Assam and its adjoining areas of northeast India significantly contributing to the local economy of the region. Two distinct variants "Bhola sanchi" and "Jati sanchi" are cultivated in Assam, of which former is reported to grow faster and yield less agarwood than the latter variant which is slow growing and high yielder (Saikia and Khan, 2014).

For the purpose of international trade in the parts or products of the said species under Article IV (Appendix-II species) of CITES:

i) An export permit shall only be granted when … a Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species;

ii) A Scientific Authority in each Party shall monitor both the export permits granted by that State for specimens of species included in Appedix II and the actual export of such specimens. Whenever a Scientific Authority determines that the export of specimens of any such species

should be limited in order to maintain that species throughout its range at level consistent with its role in the ecosystems in which it occurs and well above the level at which this species might become eligible for inclusion in Appendix I, the Scientific Authority shall advise the appropriate Management Authority of suitable measures to be taken to limit the grant of export permits for specimens of that species; and

iii) A [introduction from the sea] certificate shall only be granted when … a Scientific Authority of the State of introduction advises that the introduction will not be detrimental to the survival of the species involved.

Rain Forest Research Institute, Jorhat being one of the Scientific Authorities under the Convention, has been directed by the Management Authority (Ministry of Environment, Forest and Climate Change, Government of India) to undertake a study called the Non-Detriment Findings (NDF) in order to examine the possibility of trade and if so, the extent to which it can be allowed.

The study required information on the utilization and trade, and actual or potential trade impact besides a host of biological parameters. The materials produced from the species and exported fall under the ITC- HS Code 12119080 (Agarwood- including chips and powder) and 33013010 (Agar oil). Besides chips & powder and agar oil it is also traded in other forms, such as, carvings, derivatives, extracts, live plants, timber, timber pieces, wood product, sawn wood, specimen, medicine and unspecified products (as found from the CITES Trade database) and these are mixed up with other similar products in the ITC-HS classification, and cannot be separated under the present system of classification and coding of products.

For estimation of growing stock and regeneration status, physical surveys could be conducted by the Scientific authority only in limited areas of Assam and Tripura, in view of the travel restrictions imposed due to the COVID-19 pandemic and for all the other areas of cultivation, data was collected through the assistance of the various associations of planters and traders, forest departments and research organizations. The major areas of cultivation could be covered by the collection of statistics, but certain areas where the cultivation is limited could not be included, due to poor response from the concerned departments and associations. There was no scope for the Scientific authority to verify the data in view of the limited time granted by the Management authority. The trade statistics (legal/ illegal) was sourced from the CITES Trade database, the database of the Director General of Foreign Trade (DGFT) and the CITES Annual reports. For estimation of growing stock, no volume/ biomass equation for the species was available from India, and whatever was available was from Bangladesh, which did not suit the requirements of the population in India, and therefore, by a rapid survey in Assam, the volume and biomass equations were developed for the species. The present report has been prepared with available data, and this needs to be improved after collection of further statistics and ground truthing, which can be done only during the next NDF study.

2. BIOLOGICAL DATA

2.1. Taxonomic classification

Kingdom : Plantae

Phylum : Tracheophyta

Class : Angiosperms

Order : Malvales

Family : Thymelaeaceae

Genus : *Aquilaria*

Species : *malaccensis*

2.2. Common names:

English: Agarwood, Aloeswood, Eaglewood, Lign-aloes (Biblical)

Indian languages : Ugoor, Agar (Hindi); Sasi (Assamese); Aghil (Tamil); Aguru (Sanskrit, Kannada, Telugu); Agor (Bengali)

Chinese: Chen xiang; French: Bois d'aigle; German: Adlerholz; Indonesia: Gaharu; Malaysia: Agaru, agur, alim, calambac, gaharu, halim, karas, kareh, kritsanaa, mai hom; Myanmar: Thit mhwae; Portuguese: madeira de agar; Spanish: madera de agar; Thai: mai kritsana; Vietnam: tram huong

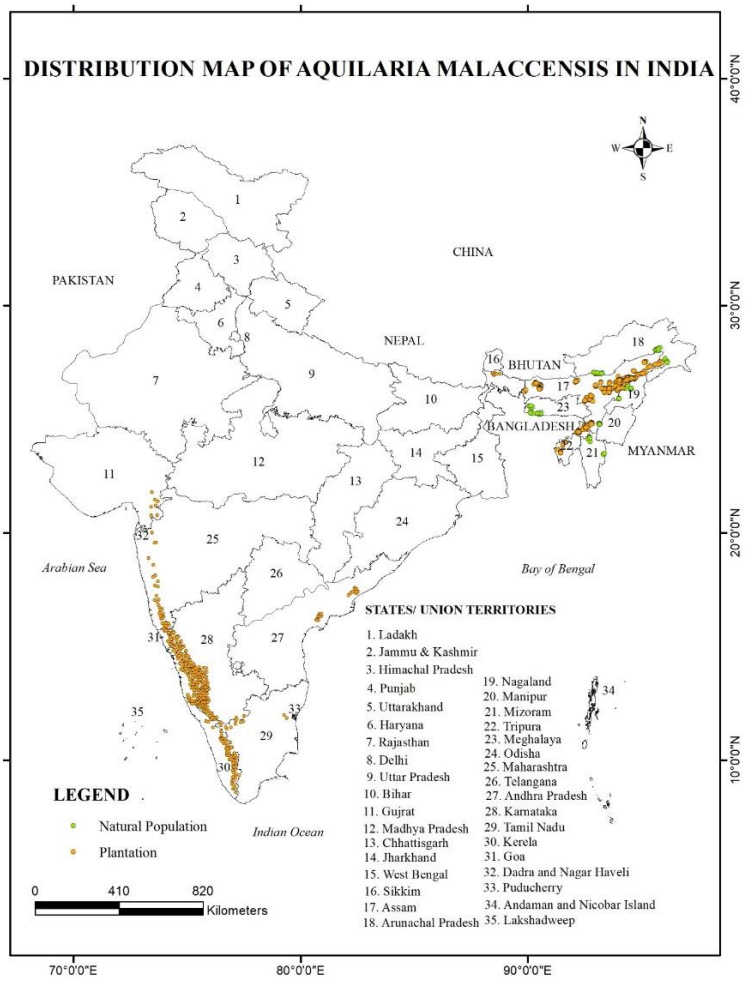
2.3. Systematics:

The genus *Aquilaria* was described by Lamarck (1783), with *Aquilaria malaccensis* as the type species of the genus. Robert Keith Dick the district judge of Sylhet sent some trees for plantation in the Calcutta Botanic Garden, and based on these specimens, William Roxburgh named the tree as *Aquilaria agallocha* in 1814 and published its short description in Flora Indica in 1832 and read a detailed description in 1851 before the Linnaean Society, published in the Transactions of the Linnaean Society in 1854 (Roxburgh, 1814, 1832; Roxburgh and Colebrooke, 1854). Hooker (1886) in his Flora of British India mentioned about two species of *Aquilaria*, viz., *A. malaccensis* and *A. agallocha*, but had doubt regarding the identity of the species. Subsequently Brandis (1906) also mentioned about both the species, but based only on the earlier literature. Kanjilal et al. (1940) in Flora of Assam mentioned of *A. agallocha* and another species, *A. khasiana* which is distributed in Khasi hills of Meghalaya and in Bhutan. Ding Hou (1964) while preparing Flora Malesiana, examined the collections of Wallich, Hamilton and Royle from Sylhet and Assam, and reduced *A.*

agallocha to a synonym of *A. malaccensis*. This is the presently accepted position, and thus there are only two species of *Aquilaria* in India, viz., *A. malaccensis* (syn. *A. agallocha*) and *A. khasiana* (Hajra, 2000).

2.4. Distribution

Aquilaria malaccensis is found in Bangladesh, Bhutan, India, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, and Thailand. The World List of Threatened Trees (Oldfield *et al.*, 1998) listed Iran as one of the countries with a population of *A. malaccensis*, but an exploratory review in 2002 by CITES confirmed that Iran has no record of the species (CITES, 2003). In India, it occurs naturally mostly in the foothills of North-Eastern states as well as West Bengal up to an altitude of 1000 m above mean sea level. In Assam, it is cultivated extensively in Upper Brahmaputra Valley (Beniwal, 1989). It is also cultivated along the Western ghats in Kerala and Karnataka, besides limited plantations in other States, such as, Tamil Nadu, Telengana, Andhra Pradesh, Goa, Maharashtra and Gujarat.



2.5. Botanical Description

Aquilaria malaccensis Lamk. is a shade-tolerant, medium to large sized tree, 20 to 40 m tall, usually with a straight bole, sometimes fluted with thick buttresses up to 2 m high, bole up to 60 cm in diameter, with thin, smooth, ash coloured tough bark. Wood is light, soft and porous. Branchlets are slender, pale brown, pubescent, and glabrescent. Leaves are simple, alternate; petiole 4-6 mm long; blade elliptical-oblong to oblong-lanceolate, 7.5-12 cm × 2.5-5.5 cm, chartaceous to subcoriaceous, glabrous, sometimes pubescent and glabrescent beneath, shiny on both surfaces, base acute, attenuate or obtuse, apex acuminate, acumen up to 2 cm long; veins in 12-16 pairs, rather irregular, often branched, elevated and distinct beneath, curving upward to the margin, plane or obscure above. Inflorescence is terminal, axillary or supra-axillary, sometimes internodal umbel, usually branched into 2-3 umbels, each with about 10 flowers; peduncle 5-15 mm long; pedicel slender, 3-6 mm long; flowers 5-merous, campanulate, 5-6 mm long, green or dirty-yellow, scattered puberulous outside; floral tube nearly glabrous inside, distinctly 10-ribbed, persistent in fruit; calyx lobes 5, ovate oblong, 2-3 mm long, almost as long as the tube, reflexed, densely puberulous within; petaloid appendages 10, inserted at the throat of the tube, oblong or slightly ovate-oblong, about 1 mm long, slightly incurved, densely pilose; stamens 10, free, emerging from the throat of the tube, filamentous, 1.2-2 mm long, episepalous ones longer than the others; anthers linear, obtuse; pistil included; ovary ovoid, 1-1.5 mm long, 2-celled, densely pubescent; style obscure, stigma capitate. Fruit a loculicidal capsule, obovoid or obovoid-cylindrical, 3-4 × 2.5 cm, usually compressed, pubescent, glabrescent, base cuneate, apex rounded; pericarp woody. Seed ovoid, 10 × 6 mm including a beak 4 mm long, densely red-haired, bearing from the base a twisted, tail-like, pubescent appendage as long as the seed (Hooker, 1886; Beniwal, 1989).

2.6. Phenology and Reproductive Biology

From the vegetative phenology the plant has been described as semi-evergreen, exhibiting leaf fall and new flush overlapping with each other. Leaf fall starts in January and continues up to April. New flush starts in February and continues till May. Flowering occurs from April to June, and flowering phenophase lasts for about 2 months. The time required for fruit setting is about one month and seed maturation is about two months from flowering. In upper Assam, flowering starts in the later parts of March if there is early monsoon. Otherwise, flowering occurs from April onwards. In Tripura flowering takes place in April-May and fruiting takes place in June-July. Flowering is influenced by temperature and rainfall. *A. malaccensis* is a highly cross-pollinated species and mode of pollination is entomophilous. Generally flowering is pre-monsoon and fruiting is during monsoon, as an adaptation for survival. About 10- 15% of capsule split open naturally and seeds remain attached to the plant hanging by the funicle cord (thread) for 2-4 days till they drop down or are blown away by winds. Seed dispersal is also carried out by wasps, called as vespicochory (Manohara, 2013; Saha and Datta, 2018; Borogayary *et al.*, 2018).

2.7. Silviculture of the species:

2.7.1. Silvicultural characteristics:

The plant grows between altitudes of 0-850 m and up to 1000 m in locations with average daily temperatures of 20-22 ^{o}C; it grows well in mean annual maximum temperature of 22-28 ^{o}C and a mean annual minimum temperature of 14-21 ^{o}C. It cannot grow in places where the temperature goes below 5 ^{o}C. It prefers a mean annual rainfall of 1500 to 6500 mm. It is adapted to various types of soil including those that are rocky, sandy or calcareous, but prefers light to medium textured, well-drained and acidic to neutral soil.

The species is a shade tolerant species, regenerating in patches under the mother tree. Flowering and fruiting starts at 5-6 years and each tree produces about 1.5 kg of seeds. It is an obligate outcrossing species pollinated by insects. Fruit is a capsule with two locules, each having one seed. Seed dispersal is not far from the mother trees. Natural regeneration is usually poor. The tree is generally slow growing.

2.7.2. Artificial regeneration:

Seeds are collected from mature fruits. Fruits have normally two seeds. Seed collection can be started from mid-June and continued till mid-August. Peak time of collection is July-August. Maturity of capsule can be judged by observing the easy splitting of capsule on pressure between two fingers. Fruits should be dried under shade for two days before extraction of seeds. For transportation of seed to long distances well ventilated cotton cloth bag should be used. One kg of fruit will give about 1300 seeds. Individual seed weight ranges from 29 to 135 mg and seed weight has strong effect on germination. Germination percentage increases with increase in seed weight; heavier seeds also need less time for germination. The seedling growth parameters are also better with heavy seeds. Therefore, sowing of heavy seeds of over 80 mg fresh weight is recommended (Uma Shankar, 2012).

Aquilaria seeds are recalcitrant, and rapidly lose viability at moisture content below 20%. The seed cannot be stored for long and should be sown within 2-5 days after collection. Storing in refrigerator may prolong the viability up to 30 days. The seeds do not require any pre-treatment. Raised seed beds are required as seeds are sensitive to high moisture and water logging. For approximately 1000 seedlings, two beds of 2.5 x 1.2 m are sufficient. Initial shading is required. Sand medium is best for raising the seedlings, and it can be mixed with farmyard manure or cow dung. Appropriate mycorrhiza can be inoculated. The seeds can be sown at 5 x 5 cm spacing on top of the bed and slightly pressed into the medium. One kg of seeds will give about 1000 seedlings. Germination of seed is epigeal and cotyledons are raised above the ground where they continue to provide nutritive support to the growing plants. Germination starts in 10-12 days of

sowing and completes within one month. After germination, seedlings attaining 4-5 cm height with 2-3 leaves should be transferred to the poly bags (20 x 25 cm) containing sand, soil and FYM in the ratio of 1:2:1. The seeds can also be directly germinated in root trainers (Saikia and Shrivastava, 2013).

Seedlings of 30-60 cm height, generally achieved in 1-1.5 years, are ready for planting. Plantation in the month of May to September during monsoon, gives better survival of the seedlings in the field. The spacing of 2.5 to 3.5 m is generally adopted for block plantations, and it may be wider in agroforestry or in tea estates. The growth is good in sandy to sandy-clay soils. After transplanting to the field, the site should be kept free from weeds for better and faster growth. To provide proper aeration hoeing should be done at 50 cm radius around the seedlings at 3-4 months interval. Plantation should be protected from grazing.

In plantations that are intensively managed, inorganic fertilizers are applied. *Aquilaria* are susceptible to various pests and diseases. Care should be taken to ensure good hygiene during nursery, early growth and at the planting site. Germinating seeds and young seedlings are prone to damping off caused by fungi. Careful preparation of seedbed avoiding too much moisture is the best precaution. The initial establishment of seedlings is a problem and most of the seedlings die due to root infestation by soil borne pathogens. Treatment with fungicide may be necessary. Leaf tip flea is a sap-sucking pest that causes curling of leaves in young seedlings that get stunted. *Heortia vitessoides*, a defoliating caterpillar is the main pest of this plant. The intensity of attack during the months of March-April (drier season) is more as compared to the months of July-August (rainy season). Agar trees in open condition are more susceptible to this pest as compared to the trees under shade. Hand picking of the caterpillar and destruction of clusters of caterpillars is recommended in nurseries and small plantations. Application of neem seed kernel extract or green chilly extract at 7-14 days interval is also effective. In case of severe infestation chemical insecticides can be applied at 10-15 days interval. Generally chemical control is not advisable as it kills the beneficial insect borer associated with agarwood formation.

2.8. Formation and Development of Agarwood:

Natural infection: The diseased wood of the Agar tree which is formed as a result of fungus-host interaction is commercially termed as Agarwood. Plants above the age of seven years are vulnerable for infection by the fungus. Natural infection by the fungi occur in the wood when trunks of standing trees are bored by the larvae of *Neurozera conferta* (syn: *Zeuzera conferta*), a stem borer (Gogoi and Mitra, 1994). The stem borer larvae make vertical tunnels which are the initial sites of infection and from there, infection gradually spreads up and oleoresins are accumulated in the infected areas. The invasion by fungi through these tunnels has led to the hypothesis that the oleoresinous deposits in agar trees are the results of defence mechanism inherent to the tree itself (Gibson, 1977). However, there are reports that the oleoresin is produced

by the fungus and not the plant, which only provides the substrate (Adams et al., 2016). Although, various workers have been investigating the different aspects regarding agar wood formation, what triggers agar wood to form is still an unsolved mystery. Naturally the fungal infection takes long time to establish and trees of about 50 years old may produce highest concentration of agarwood. Only 7-10% of the trees are reported to get infected (Ng et al., 1997) though the rate of infection is much higher in Upper Assam due to presence of *Neurozera conferta* in large numbers. If the infection starts at a young age (5-6 years), then the tree may yield agarwood at 10 years. In India, Rain Forest Research Institute, Jorhat has identified three fungi responsible for agarwood formation and is maintaining the pure cultures of the same in the laboratory for future studies as well as artificial inoculation (Borah, 2015). The Energy Research Institute (TERI) has also identified specific microbes (Vide patent No: 664/DEL/2015) that have capacity to induce production of agarwood through artificial infection methods.

Artificial induction: Several techniques are practiced for artificial induction of agarwood in *Aquilaria*. Broadly they can be classified as physical, chemical and biological methods. In physical method, mechanical injury is caused to the plant to allow infection to take place, by deep cuts or driving of nails, partial trunk pruning, burning-chisel drilling, etc., but this can be successful only if sufficient pathogen load is available in the locality. In chemical method, certain hormones and chemicals are injected into the tree, which causes formation of agarwood. There is a kit called the CA Kit (CA- Cultivated Agarwood) developed in the University of Minnesota and patented in USA (Patent No. US 7,638,145 B2 dated 29.12.2009) which is in use. There are reports of failure as well as death of the tree, when chemical methods are employed. In biological method, the disease-causing organism is cultured and injected into the plant, allowing its natural growth and spread within the plant. This method has been reported to be reliable and effective. Since the recent studies indicate that the production of oleoresins may be by the pathogen as well as the host, besides their interaction, the comparatively higher success rate of biological methods is justified.

The external symptoms for identifications of initiation or formation of agarwood in agar tree are i) appearance of borer hole, ii) oozing out of watery substances from fresh borer hole, iii) accumulation of frass at the base of the tree, iv) closing of borer hole by the growth of host tissue leaving a small spindle shaped mark, v) longitudinal cracks on the trunk/bole, vi) a poor unhealthy crown with small and yellow leaves, vii) swelling or depression and sometime canker formation on the bole/tree, and viii) appearance of hordes of ants in the tissue and formation of ant's nests. Using these symptoms, the trees with agarwood are identified and extracted.

2.9. Regeneration of the species:

In natural stands, the regeneration is reported to be poor. The species produces seeds after 7-9 years and seed production peaks when the dbh is approximately 40-50 cm, and individual trees can produce up to 19000 seeds per season. The seedling dispersal is limited, with more than 65% of seedlings occurring within 5 m of the mother tree. The seedling mortality is high and seedling

population is reduced to 20% of the regeneration in just one year (Chua, 2008; Soehartono and Newton, 2001; Soehartono et al., 2002).

However, *Aquilaria malaccensis* has been found to regenerate naturally in the homestead gardens of Upper Assam, where the species is maintained in a semi-natural state, at a very high density of plants ranging from 429 to 6236 plants per hectare, with a mean of 1609 $\pm$ 217 individuals per hectare in the homesteads. *Aquilaria malaccensis* is one of the dominant species in the homesteads of Upper Assam, representing 10- 54% of tree density with a mean of 34 $\pm$ 2%, showing a trend towards monoculture (Saikia and Khan, 2014). A study in Golaghat district of Upper Assam has shown distribution of plants of *Aquilaria malaccensis* as 56.06% seedlings, 29.38% saplings and 14.56% trees. Regeneration through coppice with an average number of 2.83 + 0.24 coppices per stump has also been noticed (Choudhury and Khan, 2010). The homestead owners harvest the trees, as and when they mature and get infected, and depending on the need. No planting is done in those homestead gardens.

In monoculture plantations of agarwood natural regeneration is not noticed, probably due to the weeding operations and agricultural activities that are undertaken in them. Further, in many of the plantations the trees are harvested before they commence profuse seeding. This indicates that if left undisturbed, natural regeneration is not a constraint in the reproduction of the species. Those who are undertaking commercial plantations generally go for artificial regeneration using seedlings raised in nurseries that exist with many private agencies and forest department.

2.10. Population and trends:

The natural population has been drastically reduced over the years due to over-exploitation and illicit felling. The depletion of agarwood in India was reported as early as 1907 and as a response the plantation activities started in the 1930s and 1940s in Assam and East Bengal. Even in 1994, the World Conservation Monitoring Centre of UNEP recorded the status of *Aquilaria malaccensis* in Assam, Manipur, Meghalaya and Tripura as Rare, while Arunachal Pradesh and Nagaland were not recorded in the report. Now the remnant natural stands are found only in remote forest areas, protected areas (National Parks and Wildlife Sanctuaries) and some community forests in the hilly areas of Northeast India. These are also under threat due to land use changes, shifting cultivation and the associated forest fires, mining and other developmental activities that are reducing the area under natural forest cover in the Northeast region. In Assam it is already reported to be extinct from wild.

The present population of the species is largely found in cultivation in the native range as well as outside the native range. While the natural population is on the decline, the cultivated population is on the rise. The population estimates of *Aquilaria malaccensis* (> 10 cm dbh) statewise as recorded by Forest Survey of India (FSI), is given below in Table 1. This is grossly underestimated, may be due to methodological issues. The reported distribution in forests and as Trees outside forests (TOF) by FSI is with reference to green cover and not legal status, as could

be understood by the reporting of the species in forests, where it is not naturally distributed, viz., Kerala and Odisha. Major populations are located in the States of Assam, Tripura, Kerala and Karnataka.

Table 1: Population estimates of agarwood in States of India (Source: FSI)

State	Population in forest	Population in Trees Outside Forests (TOF)	Total population reported by FSI	Remarks on differing estimates/ current survey
Assam	3,42,605	1,98,164	5,40,769	Forest department has reported a population of 14.33 lakhs in non-forest areas (Anon., 2018)
Kerala	72,480	-	72,480	21.50 lakhs of plants are reported by the planters, in non-forest areas.
Manipur	29,47,669	-	29,47,669	Information could not be collected due to travel restrictions
Odisha	2,64,822	-	2,64,822	Information could not be collected due to travel restrictions
Nagaland	-	4,000	4,000	Information from Forest department was restricted to two districts. From other districts information could not be collected due to travel restrictions
Rajasthan	-	3,282	3,282	Information could not be collected due to travel restrictions
Telengana	-	12,950	12,950	Information could not be collected due to travel restrictions
Tripura	-	59,243	59,243	Forest department has reported a population of 54.54 lakhs in forest and non-forest areas.
Karnataka	-	-	Nil	Population of 24.88 lakhs is reported from private planters.

2.11. Conservation status:

2.11.1. Global conservation status: Globally the species *Aquilaria malaccensis* is considered Critically Endangered. Earlier it was considered 'Vulnerable' as per the IUCN assessment in 1998, but the status has downgraded to 'Critically Endangered' in 2018 assessment due to the continued unsustainable exploitation of the species, leading to decline of the population by over 80% over the last three generations (Harvey-Brown, 2018).

2.11.2. National conservation status: The Botanical Survey of India lists *Aquilaria malaccensis* under the Rare, Endangered and Threatened (RET) taxa in India. It is listed in the Red Data Book of Indian plants (Nayar and Sastry, 1990) and as a species facing genetic erosion (Kumar, 1997). It is one among the 197 red-listed medicinal plants recorded by the Foundation for Revitalization of Health Traditions (FRLHT). National Biodiversity Authority has notified *Aquilaria khasiana* as a species on the verge of extinction in Meghalaya and *A. malaccensis* as a species on the verge of extinction in Mizoram under the provisions of Biological Diversity Act, 2002.

2.11.3. Main threats within India: In its native range, the remnant populations harbour the genetic diversity within the species. Because of the diversity of the terrain in the native distribution range, and the barriers to gene flow, intraspecific diversity is high within *Aquilaria malaccensis*. Studies have shown that there are large differences in the vegetative and reproductive morphology and phenology across the northeast region. As on date, fourteen provenances have been delimited in the distribution range of the species, by RFRI. These natural populations are suffering mainly from fragmentation, land use changes, shifting cultivation, mining and other developmental projects, leading to genetic erosion. The plantations also suffer from unsustainable harvest, as the harvestable size is steadily going down.

3. SPECIES MANAGEMENT IN INDIA

3.1. Management Measures

3.1.1. Management history: Agarwood was regularly exploited from the foothills of the present-day Arunachal Pradesh since 1957-58 leading to complete depletion, because of which the forest department had to ban the commercial exploitation in 1982-83. Forest department attempted artificial regeneration of the species, but results are not known. Assam forest department had been leasing out forest areas on a three-year term for extraction of agarwood, called as Agar Mahals. In Assam illicit felling was rampant as early as 1905-06 which led to depletion of population and consequent raising of plantations in the then Assam and East Bengal province. Plantations started in 1921 in and around Garampani in Assam and in 1925 in the present day Bangladesh. However, the plantations in Assam have been decimated by illicit operations by 1960s, and now the species is found scattered in the forests, in limited numbers. In Mizoram, agarwood used to be found in abundance, especially in the catchment of river Tuivawl, but now it is found only sporadically, and the species is already declared as on the verge of extinction in the State. In Meghalaya, long

history of illicit felling and over-exploitation has eliminated the species, and is now found only in pockets in the community forests of Khasi and Garo hills, and these are the remnant populations which need preservation for conserving the genetic diversity. The dense agarwood forests of Nagaland have been reduced to sporadic trees, but cultivation has started in Dimapur and Mokokchung districts. In Tripura and Manipur the once rich forests of agarwood have greatly reduced in area. Thus the management of the species in its native range, has been one of gross mismanagement catering to the greed of the industry. Unscientific extraction and extensive exploitation by unskilled workers who cannot differentiate between the tree that has formed agarwood and the one that has not, has led to the decimation of the species. In nature, only about 10% of the trees develop agarwood, and if these are not identifiable, the rest of the population also gets felled.

3.1.2. Purpose of the management plan in place: Currently there are no management plans for agarwood in any of the Working plans of the states falling in the native range. The forest departments have been making sporadic attempts to raise plantations within the forest areas, but this is not with much enthusiasm, due to the fear of illicit felling. The population is now largely in the private plantations and homestead gardens in Assam and Tripura and the community forests of Nagaland, Meghalaya, Manipur and Mizoram. In Arunachal Pradesh and northern part of West Bengal, plantations have been raised by farmers. A systematic plan to raise plantations on a 10-15 year rotation, providing for regular clear felling and replanting in annual coupes, will help in conservation of the species *ex-situ/ circa situ*. In the States outside the native range, such as, Kerala and Karnataka where substantial population is found, it is all on private land outside forests, and are therefore not covered by any management plan. In those areas where the plantations are managed under semi-natural conditions, with natural regeneration and selective harvesting, minimum diameter limit can be fixed for harvest, so that the young trees are not harvested.

3.1.3. General elements of the management plan: As on date, there are no management plans for the species in place. However, if a management plan is prepared, it should provide for (a) establishment of nurseries of *Aquilaria malaccensis*, both with the government and the private sector, for production of quality planting stock, (b) establishment of seed production areas in plantations and seed orchards (both Seedling seed orchards and clonal seed orchards) using the superior germplasm, identified within the provenances, (c) establishment of Provenance Resource Stands, in order to conserve the intraspecific genetic diversity, (d) establishment of monospecific plantations, in a systematic manner, to allow for sustainable harvest every year on a perpetual basis, (e) provision for artificial induction of agarwood in those areas where natural infection does not occur, (f) improved methods of harvest, processing, value addition, distillation of oil, quality control, scientific grading of chips as well as oil, and (g) traceability of the material from the wild and cultivated sources, by proper documentation and registration of cultivated sources, which will facilitate obtaining of export permit and also future NDF studies for revision of export quota, if necessary, (h) development of protocols for product identification, and (i) awareness creation

among the tree farmers and agarwood processing units, about improved methods of cultivation and harvest, processing, marketing and legal requirements. There is a need for the Management authority to get a Conservation and Utilization Plan prepared to be implemented by the States having natural distribution of the species. In the areas outside the natural range, the farmers are planting themselves, and they need to be provided the appropriate guidance on plantation management, pest and diseases, artificial induction of agarwood, extraction procedures, distillation methods, grading and quality control and export procedures.

3.1.4. Restoration or alleviation measures: In order to restore the species in its native habitat, enrichment planting of the species in the forest areas that were the original areas of distribution, using seeds from the remnant populations, if any, of the same provenance (to avoid genetic pollution and loss of intraspecific genetic diversity) needs to be undertaken by the forest departments, with the assistance of the research organizations. In the community forests, as in the Northeast India, the communities can be involved in restoration of the populations.

3.2. Monitoring System

3.2.1. Methods used to monitor harvest: Harvest of the species is happening in the States falling in the native range of the species, as natural infection occurs in these areas. Harvest is very much limited outside the native range (in States of Southern and Western India) due to the young age of the plantations, and lack of natural infection in those areas. Though the species is included in the Appendix II of CITES, and export of any material would require Certificate of Cultivation and Certificate of Legal Procurement from the Divisional Forest Officer, there is no system in place to register the plantations with the forest departments of any of the States that have these trees, except Tripura. Assam, which had the system in place vide Assam (Control of felling and removal of trees from Non-forest lands) Rules, 2002 has done away with the requirement for areas lesser than 5 ha in 2019 through an amendment, equating agar with Eucalyptus and Poplar, under the guise of promoting agarwood cultivation. The rules which were drafted for regulation of harvest and processing in 2017, are yet to be finalized and notified. This has led to a situation where the forest department does not know how much agarwood is under cultivation, and where, and is not in a position to provide the Certificates required under CITES. Though this step taken by the Government of Assam, might have helped in promoting cultivation and harvest, it has not helped in export of the material through legal means, conforming to the CITES regulations.

3.2.2. Confidence in the use of monitoring: There is no monitoring at all by the forest departments regarding the cultivation or harvest of agarwood, except Tripura which has issued guidelines for this purpose in 2019. Though the CITES regulations require issue of Certificate of cultivation and Certificate of Legal Procurement from the Divisional Forest Officer, there is no system in place for registration of the plantations of the CITES-listed species, in the other States. Assam is in the process of formulating a policy for the purpose.

3.3. Legal Framework and Law Enforcement

The legal framework presently governing the extraction and utilization of *Aquilaria malaccensis* is the Indian Forest Act, 1927 and the various State Forest Acts, and the rules framed thereunder, which regulate the harvest, transit, storage and trade of forest produce. There is no legal framework specific to Agarwood or even the other CITES listed species. However, there are certain policies framed with reference to agarwood. The Draft Policy for Sustainable Utilization of Agarwood, 2014 formulated by the Ministry of Environment, Forest and Climate Change, Government of India, is still in the draft stage. The Government of Assam has formulated a policy on agarwood, and is yet to be notified (as on the date of preparation of this report). Government of Tripura has notified certain guidelines for "Sustainable extraction/ utilization of Agar trees available in private lands in Tripura". No other State has any policy or guidelines on this issue of agarwood cultivation or utilization.

The other legal provisions related to the management of *Aquilaria malaccensis* are the Wildlife (Protection) Act, 1972 in respect of those remnants of wild populations located within the Wildlife Sanctuaries and National Parks, and the Biological Diversity Act, 2002 which will apply in case any novel product or medicine is developed from any material sourced from the wild or the community forests.

The international trade is regulated by the EXIM Policy. Under the existing policy, the export of 29 plants, portions and their derivatives and extracts obtained from the wild, except formulations (products which may contain portions/ extracts of plants on the prohibited list but only in unrecognizable and physically inseparable form) is prohibited. For an Appendix II species such as *Aquilaria malaccensis*, foreign trade is regulated only to the extent that the exporter needs a Certificate of Legal Possession (CLP) issued by the jurisdictional Divisional Forest Officer. Currently export is allowed only through Mumbai, Kolkata, Kochi, Delhi, Chennai, Tuticorin and Amritsar (Yadav and Badola, 2019).

For obtaining the Certificate of Cultivation and also for annual revision of export quota through NDF, registration of plantations will be beneficial, and is also one of conditions imposed by the CoP decisions of CITES. The Guidelines for Felling and Transit Regulations for Tree Species Grown on Non-forest/ Private Lands, issued by the Ministry of Environment, Forest and Climate Change to all the States, (F.No. 8-14/2004-FP [Vol.2] dated 18.11.2014) recommends a transparent and simple methodology for maintenance of records of tree plantation on private lands, as it is important for creating and maintaining a dynamic resource inventory. Such records will help in decentralizing issuing of transit permits and facilitate harvesting of trees subsequently at village level. In case of agarwood, this exercise will facilitate estimation of growing stock by sampling and fixation of quota for exports, annually. Any revision of quota can be supported by these statistics of plantations, maintained by the State government. The State Forest Departments should bring out a list of all trees exempted from the requirements of felling and transit permission

in the concerned State, with the concurrence of the Ministry of Environment, Forest and Climate Change specially to confirm that such species are not threatened or come under threatened list of any national statute or international conventions, such as, CITES. However, no such record of plantations in respect of agarwood was found to be maintained by any of the State governments.

4. UTILIZATION AND TRADE FOR INDIA

4.1 Type of Use (Origin) and Destinations (Purposes)

The first comprehensive study on the trade of agarwood in India was done by TRAFFIC-India (Chakrabarty et al., 1994). The main and traditional use of agarwood has been as incense, especially in the countries of the Middle East. When the resinous wood is burnt it produces a pleasant smell and is used in baths, prayer halls and social gatherings. The other major use is as a perfume or as a fixative for high quality perfumes, and is largely exported to the European countries for this purpose. The emerging use of agarwood is for medicinal purposes, especially in Chinese medicine. The market for agarwood and its products is mainly export oriented, and there is no significant local consumption. The major importers are the UAE, Saudi Arabia, UK and Bahrain.

Since the locally harvested agarwood, even from cultivation in non-forest lands cannot be exported in the absence of export quota, which needs to be fixed after an NDF study, there is no legal export of any of the cultivated agarwood from India at present. Since no NDF study was ever done, no quota for export exists. The traders import agarwood from Southeast Asian countries, process and re-export, which conforms to the requirements of CITES, and this serves as a mechanism to cover up the illegal exports of domestic agarwood.

As observed by UNODC, (UNODC, 2016) India may also be serving as conduit for illegal wood harvested in the neighbouring countries. Smuggling of agarwood from Myanmar through Manipur has been cited in the study by TRAFFIC- India. There is great amount of secrecy maintained by most of the agarwood traders, as cited by a recent survey conducted (Anon., 2018) indicating lack of transparency in the agarwood business.

4.2. Harvest management control (quotas, seasons, permits, etc)

Since most of the agarwood now coming into the market is from private lands or community forests, no management control of any kind exists. There are no quotas fixed for extraction, no season prescribed or permits issued. In the area of natural distribution, in the Northeast India, except for areas in the Brahmaputra valley, Imphal valley and parts of Tripura, no land tenure exists in favour of individuals. The land and the forests are community owned, and large areas of land are under the category of Unclassed Forests, and agarwood is found in such forests. Therefore, the Government is not in a position to impose any control over the harvest.

There is a need for fixing a quota on harvest from each State, besides a quota on export of products required under the CITES. If all the plantations are registered, it would be possible by sampling to determine the growing stock and annual yield, and fix harvest quota on 10-year basis. This can be regulated by the forest departments of the States concerned or the Autonomous District Councils or the community organizations, wherever the land tenure is controlled by these organizations. Through such a quota, it can be ensured that the population does not go below certain level, and further the population trend can also be monitored.

4.3. Legal and Illegal Trade Levels

As already stated, there can be no legal international trade with locally cultivated material in the absence of any quota fixed so far by the Management authority. The only legal trade permitted is of the imported material that is processed in the country and re-exported, with which the local material gets mixed up. The details of the legal trade as available from the Export Import Databank of the Department of Commerce, Ministry of Commerce and Industry, Government of India (tradestat.commerce.gov.in) are as given below. Only two commodities namely agarwood chips including dust and agar oil are clearly discernible in the said statistics through ITC-HS codes. Other products of agarwood are mixed up with similar products from other plants under Chapter 06 (as plants, plant portions of wild or cultivated origin, of species specified in Appendix II or III of CITES) or chapter 30 (as derivatives, extracts and formulations). The legal trade levels of agarwood chips/dust and agar oil are as follows:

Year	Agarwood chips/ dust (ITC-HS Code 12119080)				Agar oil (ITC-HS Code 33013010)			
	Imports		Exports		Imports		Exports	
	Qty (MT)	Value (Rs. In lakhs)	Qty (MT)	Value (Rs. In lakhs)	Qty (MT)	Value (Rs. In lakhs)	Qty (MT)	Value (Rs. In lakhs)
2003-04	43.09	38.57	141.09	142.58	12.95	106.3	5.02	54.57
2004-05	66.07	94.73	6.93	54.14	9.96	172.52	14.44	78.35
2005-06	34.59	55.78	8.65	71.6	9.13	145.58	93.69	744.76
2006-07	64.51	320.82	0.22	0.23	4.35	62.23	9.67	66.94

2007-08	33.56	49.36	1.49	1.67	0.64	11.78	3.63	6.5
2008-09	6.54	11.94	2.7	4.18	8.67	43.22	1.57	1.11
2009-10	34.01	60.38	53.77	122.56	0.05	1.52	4.3	5.1
2010-11	21.55	35.99	7.59	93.71	0.03	6.03	1.72	3.49
2011-12	81.48	62.89	12.9	144.71	3.01	21.98	4.4	85.35
2012-13	26	73.82	18.42	271.62	0.06	5.35	1.17	21.41
2013-14	62.56	139.12	16.1	274.51	0.18	15.27	4.69	78.49
2014-15	50.67	155.89	18.89	332.38	0.69	246.33	0.11	21.42
2015-16	31.71	114.24	17.01	159.96	0.03	1.26	0.04	0.04
2016-17	45.96	114.14	29.12	386.67	0.07	164.16	1.19	0.77
2017-18	28.93	116.72	35.71	424.48	0.14	73.79	0.03	0.22
2018-19	45.1	237.68	23.53	603.36	0.04	159.23	0.03	10.09
2019-20	63.07	294.44	46.66	1001.70	0.41	231.7	0.04	2.01
2020-21 (up to 9/2020)	27.77	160.79	12.61	374.44	0.05	87.24	0.71	102.85

On the levels of illegal trade, official statistics available are only from the CITES Annual Reports published by the Ministry of Environment, Forest and Climate Change, Government of India and the Annual Illegal Trade Reports being submitted to CITES from 2016 onwards. These reports are related only to CITES and Foreign Trade Policy violations. Offences related to illegal felling, transport, processing or trade within the country need to be collected from the forest departments, but most of them could not share any information, till finalization of the report, and hence the same is proposed for inclusion in the next NDF.

The details of illegalities reported in the CITES Annual Reports of India for the years 2007 to 2015 and the Annual Illegal Trade Reports submitted to CITES from 2016 to 2019 are tabulated below:

	S. No.	Place of detection	Date	Origin/ consignor	Destination	Description of item detained	Qty	Nature of offence
2007								
	1	RDD (NR), Office	09.03.07	Saleem Ahmed, Okhla, New Delhi	Mohd. Helaluddin, Alahli, Ajman UAE	Agarwood chips	2.5 kg	Violation of EXIM Policy & CITES
	2	IGI Air Cargo, New Delhi	07.07.07	M/s Najrul Islam, Hayai Nagar, Assam	M/s Sakirul Haque, Bangkok, Thailand	Agarwood chips	8 kg	Violation of EXIM Policy & CITES
	3	DHL, IGI, Air Cargo, New Delhi	25.09.07	M/s Abdul Matin, Hojai, Assam	M/s Perfume Ajni, Kuwait	Agarwood chips	7 kg	Violation of EXIM Policy & CITES
	4	Chhatrapati Shivaji, International airport, Mumbai	04.04.07	Mohammed Abdul, Jalil, PP No.-1302373	Bangkok, Thailand	Agarwood chips	18 kg	Violation of import Policy & CITES
	5	NSCBI Airport, Kolkata	16.05.07	Mr. Muhibar Rehman, Hojai, Assam	not known, imported from UAE	Agarwood chips	32 kg	Violation of EXIM Policy & CITES
2008								
	6	FPO,	24.06.0	C.Z. Gai, 18, Teretti Bazar,	Mr. Dai Dong Fang, Hong	Agarwood	3.6	Violation of

		Kolkata	8	Kolkata-16	Mei shop, Laiyang City, China	chips	kg	EXIM Policy
	7	IGI Air Cargo, Delhi	12.11.08	M/S Neha, International 535, Mehta Chamber 5th, Floor Kalyan Street, Dana Bunder, Masjid(E) Mumbai	Red Diamond Readymade Garments, Sikkat Al. Khail Road, Dubai	Agarwood chips	3.4 kg	Violation of EXIM Policy & CITES
	8	IGI Air Cargo, Delhi	15.12.08	M/S Mountain Valley, Spring India Pvt Ltd, Noida U.P.	Omar Gulsaran, babaros Bulvari, Turkey	Derivatives containing agarwood	1 bottle	Violation of EXIM Policy & CITES
2009								
	9	CWC CFS, JNPT, Mumbai	01.g06.09	Rubina International, Trading Org, Hira, Mahal, 2nd Floor,Room 6A, Near KaziSayyed Street, Mumbai.	Royal Palace, Perfume Ind. Sharjah, UAE.		470 kg	Violation of trade Policy & CITES
	10	IGI AIR CARGO, New Delhi	02.02.09	D.S. Exports, D-16/19 Man, Mandir, Dasaswamedh, Varanasi	Mr Fabio Parcale, Vieson Martino, 7706060 Lisccano, Nrceone,	Agar (Aquilaria)	70 bottles	Violation of Foreign Trade Policy & Wildlife (P) Act

					Perngia, Italy			1972 &CITES
	11	IGI AIR CARGO, New Delhi	23.11.09	M/s Prayer incense, World Wide, 4773, main Bazar Paharganj, New Delhi	Lilah Distribution maison orkodi,RTE DPT 312,Quartier DES,Barthes Neuves 64990 Mouguerre,France	Agar-sogchig, insence sticks	35 x 5 packets	Violation of FTP & CITES
2010								
	12	Air Cargo Complex Kochi	25.02.10	Mr. Arafat M.K. Calicut	M. Razak N.K Indonesia	Agar wood Pcs	15 kg	Violation of Export Policy& CITES
	13	FPO, Kolkata	23.03.10	Allayurveda. com Pvt. L. 1, Gupta Lane, Kolkata-6	Raisa Hadas 18, Ofaquim, 80300 Israel	Herbal food supplement with agar wood (Aquilaria agallocha)	2 kg	Violation of CITES and foreign trade policy
	14	IGI Air Cargo, Delhi	03.08.10	Md. Jajnal uddin, Nagaon, Guwahati, Assam	Md. Nazim Uddin Ras Ali khaimah Dubai	Agarwood chips	4 kg	Violation of CITES and foreign trade policy
	15	IGI Air Cargo, Delhi	06.09.10	R. K. Sons & Company 28, Farsh Road,	Mr. Paul Kan Chaiwan, HKSAR	Agarwood chips	0.5 kg	Violation of CITES and

				kannauj UP	Hongkong			foreign trade policy
2011								
	16	IGI Air Cargo, Delhi	10.01.11	LA- Medica (india) Pvt. Ltd Plot No. 168 Sec. 7, 11 MTv Manesar Gurgaon, Haryana	Indian Herbal SRL Mitrea Angelica Str. Gura Ialomitei, Nr. 6, BI H30, Sc 2 Ap 18, Bucuresti Romania	Agarwood Powder Aquilaria Sps.	5 kg	Violation of CITES and foreign trade policy
	17	Air Cargo Complex Kochi	09.03.11	Veda Herbal and Heritage, Calicut	Singapore	Red sander wood powder ayurvedic products- 6 items containing Saussurea lappa and Agarwood	5 Kg 1300 bottles of 200ml each	Violation of CITES WLPA & FTP
	18	IGI Air Cargo, Delhi	13.06.11	LDG International Plot No. A/42 Badli Extn, Badli Village New Delhi	Md. Hilal Perfumes Factory Buchcira, Corniche, Sharjah	Agarwood oil	20 gm	Violation of CITES and foreign trade policy
	19	CFS Patparganj Delhi	14.07.11	N D Export M-13, New Multan Nagar, New Delhi-56	S. Rambali Jodenbrestaat - 13, Paramavibo Republic of Surinam	Agarwood (Dabur Chyawanprash)	180 Pcs	Violation of CITES and foreign trade

								policy
	20	IGI Air Cargo, Courier Terminal	03.10.11	Trung Phat Co Ltd 22 Nguyen Ba Tong st. Ta Binh, Ho Chiminh City, Vietnam	Mr. S. Chuba Aier, 101 Fellowship Colony Dimapur -12 Nagaland	Agarwood chips	10 kg	Violation of CITES and foreign trade policy
	21	Foreign Post Office (Import)	12.10.11	Indonesia	Mr. Ali KV Malabar Power Tools, Calicut	Agarwood	15 kg	Violation of CITES and foreign trade policy
2012								
	22	Kolkata Airport	20.01.12	Sasha Exports, 1/C, Chatu Babu Lane, Kolkata-14	Trade Air Importers Ltd., 174, Grey hurst Road, Christchurch, New Zealand	Herbal products m/o Agarwood (Aquilaria agallocha)	3.540 kg	Violation of FTP & CITES
	24	IGI Air Cargo (Courier Terminal)	30.07.12	Imran Hussain Nagaon Guwahati Assam	Khairul Islam Golden Market Perfumes LLC Mur shid bazar Gold Song. P.O. Box No.26127 Neira Dubai	Agarwood chips	20 kgs	Violation of FTP .

					UAE			
	25	Air cargo complex, kochi	21.11.12	Kochi	Seychelles	Herbal product containing Agarwood	2 Pkt	Violation of FTP & CITES
	26	Q10- CFS	17.12.12	Kochi	Queensland	Herbal product containing Agarwood (Aquilaria agallocha)	11 Bottles	Violation of FTP & CITES
	27	CSI Airport	19.12.12	Passenger: Aftab Hussain Khan. Passport No. F 4912020. Mumbai.	Dubai, UAE.	Agarwood Pieces Small Essential Agarwood Oil	28.5 kg 764 gm	Violation of FTP & CITES
	28	Q10- CFS	21.12.12	Kochi	Maldives	Herbal product containing Agarwood (Aquilaria agallocha)	20 Bottles	Violation of FTP & CITES
	29	ACC	26.12.12	26.12.12 Maharaja Exports, F-74, Oberoi Towers, 2nd Floor, Nariman Point, Mumbai. IE	Ahmed Al Obaidaly, P. O. Box. No. 6077, Doha, Qatar.	Agarwood (Aquilaria malaccensis) Chips	10 kg	Violation of FTP & CITES

				Code – 0395069211.				
2013								
	30	Q10 CFS	15.01.13	Esteem services, Trichur	Koper	Ayurvedic product containing Agarwood	25pcs	Violation of FTP & CITES
	31	Q10 CFS	04.03.13	Bhuvaneswari Ayurvedics, Thrissur	Hamburg	Ayurvedic product containing Agarwood.		Violation of CITES
	32	IGI air cargo	12.07.13	Shiva Exports 35-Farsh road, Kannauj-209725, UP	Kayangam Spa Pantal Cenanag P.O.Box No. 242, Mukim Kedawang, Langkawi, Kedah Darul Aman, Malaysia	Sandalwood oil-5 gms Agarwood oil-10 gms	5 gm 10 gm	Violation of FTP & CITES.
	33	Air Cargo Complex Kochi	08.11.13	Shree Dhariyam Ayurvedic medicine Pvt Ltd, Ernakulam	UTI, Netherlands	Anu tailam containing Agarwood as an ingredient	16 bottles	Violation of CITES
	34	Courier Cell, Thoka No.	02.12.13	Exporter: Pankaj Exports, Unit No. 9,	Importer: Al Tum Tam Trading, P O	Agarwood Chips (Aquilaria	45 kgs.	Violation of FTP

		42316 dated 13-11-2013. 02-12-2013 Exporter		Udyog Madir Industrial Estate, V S Marg, Mahim, Mumbai -16. Exporter: Fantastic Enterprises, 121, Samarth Industrial Estate, Mahim, Mumbai –16. Exporter: Roopali International, 101, Shitla Industrial Estate, Shitladevi Marg, Mahim, Mumbai –16. Exporter: Roopali International, 101, Shitla Industrial Estate, Shitladevi Marg, Mahim, Mumbai – 16. Exporter: Green	Box No. 40604, Doha, Qatar. Importer: Ali Essa Mollemi Trading LLC. P O Box No. 28167. Flat No. 107, Din Thani Building No. 2, Murshid Bazar, Deira, Dubai, UAE. Importer: Moin International LLC. P O Box. No. 5149, Ajman, UAE. Importer: Bait Al Arab Trading LLC, Naif Road, Zerwani Building, Flat No. 110, P O Box. 4271. Deira, UAE. Importer: Sultan Trading LLC.	agallocha)		2009-14& CITES

				Exports, Room No. 285, Lane No. 21, Park Side, Vikhroli (West), Mumbai –79. Exporter: Green Exports, Room No. 285, Lane No. 21, Park Side, Vikhroli (West), Mumbai –79. Exporter: Green Exports, Room No. 285, Lane No. 21, Park Side, Vikhroli (West), Mumbai –79.	Old Market, P O Box. 19619. Doha, Qatar. Importer: Itter Aloud Trading LLC. Mohd. Zahoor, Near Gold Souq. Behind Kuwaity Mosjid, Deira, Dubai. P O Box. 1783. UAE. Importer: Bu-Rashid-Trading LLC (Nurul), Behind Al-Eklas Hotel, Gold Market, Deira, Dubai. P. O. Box. No. 15861. UAE. Importer: Akhtaruzzaman Choudhary, Al-Rigga Plaza Apt. Block – 9, Apt#424. Al-Rigga,			

					Deira, Dubai, UAE.			
	35	IGI air courier terminal	13.12.13	Amarnath Exports 33, Farsh road Kannauj, Uttar Pradesh-209725	Hassan A.A.Ahmad House 3, St-61 Block-6, Alfaina Kuwait	Agarwood chips & Agarwood oil	225 gm; 10 gm	Violation of FTP 2009-14 & CITES
2014								
	36	IGI air courier terminal	13.12.14	Amarnath Exports 33, Farsh road Kannauj, Uttar Pradesh-209725	Hassan A.A.Ahmad House 3, St-61 Block-6, Alfaina Kuwait	Agarwood chips	225 gm	Violation of FTP 2009-14 & CITES
	37	NIPT Courier Cell, CSI Airport, Sahar, Mumbai. AWB No. 579275570 550.	12.02.14	Mohammad Rahim Uddin, Villa Islam Nagar, Nilbagan, Hojai, Nagaon – 782445, Assam, India.	Hussain Anfar Perfumes LLC, P. O. Box. 1006, Murshid Bazaar, Near Gold Souq, Dubai, UAE.	Agarwood chips	7.6 kg	Violation of CITES and Export Policy.
	38	Cell, CSI Airport, Mumbai.	24.10.14	Moinul Haquek, Shree Ganesh Enterprises, 116-Keshav Naik Road,	Mr. Kamal Uddin, Jabal Ali Perfumes LLC, P.O. Box. 65018. Deira,	Agarwood chips	6.86 kg	Violation of CITES and Export Policy.

				Mumbai.	Dubai, UAE.			
	39	Cell, CSI Airport, Mumbai.	24.10.14	Moinul Haquek, Shree Ganesh Enterprises, 116-Keshav Naik Road, Mumbai.	Perfumes LLC, C/o Husain Ahmed. P.O.Box. 26127, Deira, Dubai, UAE	Agarwood chips	6.84 kg	Violation of CITES and Export Policy.
	40	Cell, CSI Airport, Mumbai.	24.10.14	Moinul Haquek, Shree Ganesh Enterprises, 116-Keshav Naik Road, Mumbai.	Mr. Mojibur rahaman, Golden Market Perfumes LLC, P.O. Box. 26127, Deira, Dubai, UAE	Agarwood chips	4.02 kg	Violation of CITES and Export Policy.
	41	IGI air cargo	17.11.14	Oriental Perfumes & Export Tandon Niwas M.G.Road, Kannauj-209725 Uttar Pradesh	West Union Logistics (China) Co. Ltd.DD.119, Lot.1163, Pak Sha TsenKung Um Road, Yeun Long,New Territories, Hongkong	Agarwood oil	2 kg	Violation of CITES and Export Policy.
	42	NS Dock	15.07.14	AIK Hong Agarwood PTE LTD., 5 Kaki Bukit Road-2, City	Evergreen Aroma Industries, Rafi Ahmed Kidwai,	Chips and logs	24 bags. 2994.2 kg of logs	Violation of CITES and Export

				Warehouse, Singapore	Assam		3000 Kg of chips	Policy.
	43	Air Courier Terminal, Chennai	17.10.14	Best Exports Pvt, Ltd Srilanka	Agarwood Kerala, Amara builders, Kottanad, Palakkad	Agarwood Chips	3 kg	Imported without CITES Permit
	45	NS Dock	15.07.14	AIK Hong Agarwood PTE LTD., 5 Kaki Bukit Road-2, City Warehouse, Singapore	Evergreen Aroma Industries, Rafi Ahmed Kidwai, Assam	Agarwood Chips and logs	24 bags. 2994 .2 kg of logs 3000 Kg of chip	Violation of CITES & Exim Policy
	46	Air Courier Terminal, Chennai	17.10.14	Best Exports Pvt, Ltd Sri Lanka	Agarwood Kerala, Amara builders, Kottanad, Palakkad.	Agarwood Chips	3 kg	Imported without CITES Permit
2015								
	47	Courier Cell, Thoka No. 056980 dt 18-02-2015.	04.03.15	Mr. Ashok Arora, Plot. No. 109/A, Room No. 201, Collector Colony, Chembur,	Mr. Khilid Mohammed, P.O. Box. No. 8321, Dubai, UAE	Agarwood (Aquilaria sp.) Chips	3 kg	Violation of CITES AND EXIM Policy.

				Mumbai – 400074.				
2016								
	48	IGI Airport, Delhi	21.10.16			LOG	2.7 kg	WCCB
	49	Kochi, Kerala	14.12.16			chip	30 kg	WCCB
2017								
	50	IGI Airport New Delhi	04.08.17			OIL	1 ltr	Customs & WCCB, NR
	51	Mumbai Internatio nal Airport	29.09.17			CHP	33 kg	Customs & WCCB, WR
	52	NSCBI Air Cargo	18.08.17			CHP	185 kg	WCCB/ ER
	53	lGl Airport, Delhi	20.10.17			CHIP	0.5 KIL	Customs & WCCB, NR
2018								
	54	Air Cargo, Mumbai	15.01.18			OIL	5 ltr	Customs & WCCB
	55	lGl Airport, Delhi	27.04.18			OIL	0.01 ltr	Customs & WCCB

	56	lGl Airport, Delhi	23.05.18			WPR	0.05 ltr	Customs & WCC8
	57	Courier terminal ,IGI Airport	17.10.18			CHP	16 kg	Customs & WCCB
	58	Air Cargo , Mumbai	17.10.18			CHP	2 kg	Customs & WCCB
	59	ACC, New Delhi	30.11.18			OIL	41 no.	Customs & WCCB
	60	IGI Airport Courier complex	10.04.18			chip	0.5 kg	Customs & WCCB
	61	lGl Airport, New Delhi	27.06.18			chip	3.8 kg	Customs & WCCB
2019								
	62	lGl Airport, New Delhi	14.03.19			chip and oil	34.35 kg; 0.5 kg	Indian Customs , CISF and
	63	IGI Airport, New Delhi	20.09.19			chip and oil	120 kg; 45 kg	WCCB/ NR
	64	IGI Airport, New	26.10.19			chip	30 kg	Indian Customs and

		Delhi						WCCB/ NR
	65	Foreign Post Office, New Delhi	08.03.19			WPR (wood product)	300 gm	Indian Customs and WCCB/ NR

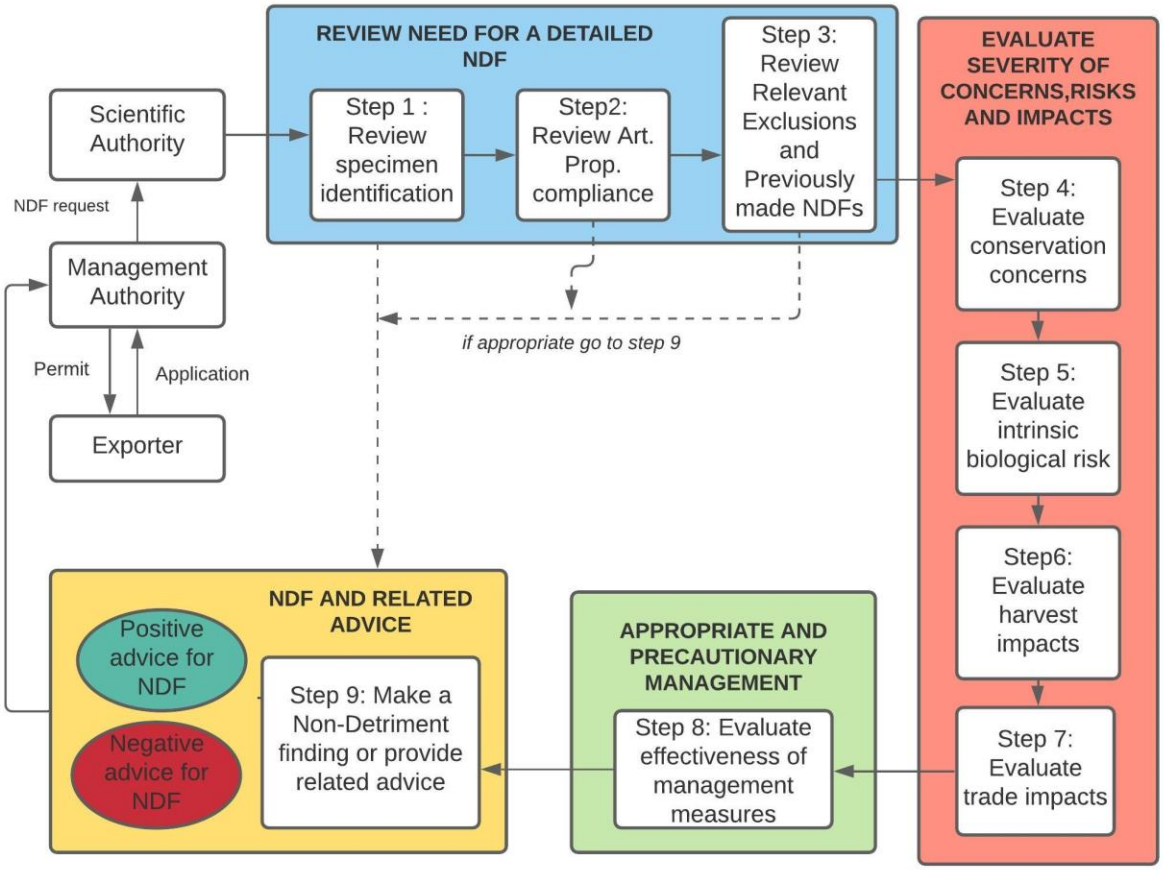
The United Nations Office on Drugs and Crime (UNODC) had commissioned a study on illegalities related to agarwood in March 2019, but the report is not yet published. However, the World Wildlife Crime Reports of 2016 and 2020 mention that between 2005 and 2014 the agarwood seizures stood at 6% of the aggregated standard value based on all the seizure incidents during the period, and this reduced to 4% between 2009 and 2013, and further reduced to 0.6% between 2014 and 2018 (UNODC, 2016, 2020). It has been estimated that the volume of illegal wood seized globally amounts to approximately 0.5% of the volume in legal trade, and this is not substantial. However, it is likely that very small share of illegal trade is detected, since the product can assume many forms, and the enforcement agencies are not aware of these. It has been suggested by UNODC that India may be serving as a conduit for illegal wood (UNODC, 2016).

The illegality concerning agarwood is termed "farm laundering" where farming operations are used to launder illegally wild-sourced products. These commodities have access to legal demand, because the buyers may be unaware of the illegal origin of the product. These risks are particularly high in rapidly growing markets, where demand outstrips the licit supply capacity, such as agarwood (UNODC, 2016).

To quote the UNODC report of 2020, "Wildlife crime, like other organized crimes, must be addressed through a balanced approach that targets the complementary pillars of supply, demand and livelihoods." UNODC had suggested undertaking an in-depth assessment of crime through the ICCWC Wildlife and Forest Crime Analytic Toolkit process to better understand the criminal justice and preventive responses to wildlife and forest crime. However, a combination of lack of understanding of the nature of crimes and their broader impact, insufficient prioritization and/or lack of capacity or resources is hindering the process. The report suggests various policy implications, which need to be addressed by the Management authority (UNODC, 2020).

II. Non-Detriment Finding Procedures (NDFs)

The NDF methodology was prescribed first by IUCN (Rosier and Haywood, 2002) which was deliberated at Cancun NDF workshop in 2008 leading to the formulation of NDF guidance (Rose, 2014). Leaman and Oldfield (2014) proposed the nine-step methodology for NDF studies and this was improved specifically for perennial plants (Wolf et al., 2016) and timber species (Wolf et al., 2018). The nine-step pathway that was followed in this study is illustrated below (after Leaman and Oldfield, 2014):



Following Wolf et al (2016) and the various decisions of Conference of Parties of CITES, related to agarwood, the present report has been prepared and is presented hereunder.

Step 1: Review specimen identification

1.1. Has the plant/ specimen been correctly identified, and, is the scientific name used compliant with the appropriate CITES standard?

There are two species of *Aquilaria* in India, namely, *Aquilaria malaccensis* and *A. khasiana*, and the latter has a limited distribution in the Khasi hills of Meghalaya. What is used in trade is *Aquilaria malaccensis* (syn: *Aquilaria agallocha*). The trade name of the species is Agaru or Oud. The taxonomic status of the species is available for reference in The Plant List (http//:theplantlist.org), IPNI (http//:www.ipni.org). The specimens examined during this study are of *Aquilaria malaccensis*. It is confirmed that the scientific name used (*Aquilaria malaccensis* Lamk.) is compliant with the appropriate CITES standard.

Step 2: Review compliance with artificially propagated requirements

2.1. Is the permit application for artificially propagated specimens?

The management authority has not specifically requested advice on wild or cultivated specimens. The wild population is already on the decline and is Critically Endangered or on the verge of extinction in certain locations, and therefore export of specimens sourced from wild is not recommended. However, the export of cultivated/ artificially propagated specimens, may be considered subject to strict control and following the CITES guidelines.

2.2. Is export of artificially propagated specimens of this species permitted?

Though legally the export of artificially propagated specimens of this species is permitted, it is subject to following the CITES guidelines. Since, the NDF studies of this species had not been done till date in India, and export quota also not fixed subject to positive finding in the NDF study, no export of artificially propagated specimens is permissible as on date. Export will become permissible once the NDF study is completed and export quota is fixed.

2.3. Do specimens clearly meet all the requirements for artificial propagation?

According to CITES the definition of the term "artificially propagated" with reference to agarwood is elaborated in Resolution Conf.11.11 (Rev. CoP15), Resolution Conf. 10.13 (Rev. CoP15) and Resolution Conf. 16.10. The term artificially propagated shall be interpreted to refer to plant specimens of agarwood as follows:(a) grown under controlled conditions; and (b) grown from seeds, seedlings, saplings, cuttings, grafting, marcotting/ air-layering, divisions, plant tissues or

other propagules that have been derived from wild or cultivated parent stocks, according to the definition of 'cultivated parental stock' in Resolution Conf. 11.11 (Rev. CoP15). Further, the trees of agarwood producing taxa grown in cultivation such as, (a) gardens, (b) state, private or community production plantation, either monospecific or mixed species, shall be considered as artificially propagated in accordance with the definition above.

It further determines that plants grown from cuttings or divisions are considered to be artificially propagated only if the traded specimens do not contain any material from the wild." [Resolution Conf. 11.11. Rev. COP17]. "However, it recommends that an exception may be granted and specimens deemed to be 'artificially propagated' if grown from wild-collected seeds" subject to the condition, among others that "the relevant Management authority of the range State has determined that the collection of seeds or spores was legal and consistent with relevant national laws for the protection and conservation of the species; … and the relevant Scientific authority of that range State has determined that a) collection of the seeds or spores was not detrimental to the survival of the species in the wild; and b) allowing trade in such specimens has a positive effect on the conservation of wild populations".

In the range State of India, the natural distribution of *Aquilaria malaccensis* is confined to the northeast region, and is found only in remote forest areas, protected areas and community forests as remnant stands. Wherever, the species has become scarce, cultivation is practiced broadly by three different methods: 1) in semi-natural conditions allowing natural regeneration, mainly in homesteads of Upper Assam or 2) in monospecific tree plantations in Assam, Tripura, Nagaland, Manipur within the natural range and in Tamil Nadu, Kerala, Karnataka, Goa, Telengana, Andhra Pradesh, Maharashtra and Gujarat in the areas adjoining the Western ghats and Eastern ghats, and 3) as shade crop for tea plantations, mainly in Assam.

The planting stock for these plantations are sourced from the nurseries of private agencies or the forest department. The seeds for raising the planting stock are collected from the existing plantations and the collection of such seeds is not detrimental to the survival of the species in the wild. The plantations of the species outside the natural distribution range clearly meet the requirements of artificial propagation, without any doubt. The homestead plantations, though not artificially propagated, are located in the private property of individuals located in non-forest areas and are equivalent to the artificially propagated populations, as the original mother plants shedding seeds for regeneration are artificially propagated. Thus, the specimens in India clearly meet the requirements of artificial propagation.

2.4. Are there concerns about compliance with CITES requirements for artificial propagation that cannot be resolved?

There are no concerns about compliance with CITES requirements for artificial propagation. Outside the natural range of the species, almost one-third of the population exists, which is clearly artificially propagated. Within the natural range also the population includes the remnant of the

original wild population, which is limited and the semi-natural populations maintained in the home gardens of Upper Assam and the even-aged plantations across the region.

Step 3: Review of relevant exclusions and previously made NDFs.

3.1. Is the export of wild-harvested specimens of this species permitted?

No export of wild-harvested specimens is permitted. However, the areas of wild distribution and artificial cultivation are closely situated and there is chance of mix-up.

3.2. Is the specimen covered by CITES Appendix II?

Yes. The species *Aquilaria malaccensis* is listed in Appendix II. It is the first of the agarwood producing species listed in CITES in 1995, in CoP9, from 16.2.1995. Now the whole genus *Aquilaria* is listed in Appendix II, as decided in CoP13 since 12.1.2005. Current listing is that the genus *Aquilaria* spp. is in CITES Appendix II, with annotation #14 of 2.1.2017 that regulates international trade of all parts and derivatives, except: a) seeds and pollen; b) seedling or tissue cultures obtained in vitro, in solid or liquid media, transported in sterile containers; c) fruits; d) leaves; e) exhausted agarwood powder, including compressed powder in all shapes; and f) finished products packaged and ready for retail trade; this exemption does not apply to wood chips, beads, prayer beads and carvings.

There is also an exemption under CITES personal and household effects derogation [Resolution Conf. 13.7 (Rev. CoP16)] for specimens of agarwood. Up to 1 kg woodchips, 24 ml oil and two sets of beads or prayer beads (or two necklaces or bracelet) per person is permitted with permits, provided both the countries of import and export implement the personal and household exemptions for the species.

3.3. Has a science based NDF been made for this species that is still valid and sufficient to evaluate the current application?

No NDF study has been made for this species yet, and the present one is the first such study. However, due to the limited time granted for the study and the travel restrictions imposed by various States that have populations of *Aquilaria malaccensis*, owing to the COVID-19 pandemic only secondary information from the Associations of planters, forest departments and other farmers was collected. First hand collection of data was done only in Upper Assam and in Tripura. The next NDF has to be based on survey by the Scientific authority itself.

Step 4: Review of conservation concerns

4.1. Has the conservation status of the species been assessed?

Yes. Aquilaria malaccensis is considered Critically Endangered by IUCN. The Botanical Survey of India lists *Aquilaria malaccensis* under the Rare, Endangered and Threatened (RET) taxa in India, and is also listed in the Red Data Book of Indian plants (Nayar and Sastry, 1990) and red-

listed medicinal plants recorded by the Foundation for Revitalization of Health Traditions (FRLHT). It is one of the species facing genetic erosion (Kumar, 1997). National Biodiversity Authority has notified *Aquilaria khasiana* as a species on the verge of extinction in Meghalaya and *Aquilaria malaccensis* as a species on the verge of extinction in Mizoram under the provisions of Biological Diversity Act, 2002.

4.2. Considering the existing conservation status assessments, what is the indicated severity of conservation concern?

The major conservation concern is the loss of genetic variability leading to genetic erosion in the area of natural distribution in the Northeast India, due to land use changes, shifting cultivation and unregulated extraction from the unclassed forests and community forests. Large scale cultivation that has begun, will not be able to restore the genetic diversity, as the source of planting material can be from limited sources, such as, plantations or forest areas that are easily accessible.

The species itself is not under severe threat, as it is getting conserved on-farm, as plantations. However, caution needs to be exercised not to harvest all the plantations in one go, but to do it in a phased manner, for which a detailed Conservation and Utilization Plan need to be prepared by each State. In the States falling in the natural distribution range, enrichment planting has to be undertaken in the forests, using the remnant populations of the fourteen provenances identified, without moving the seeds across the provenances, which may lead to 'genetic pollution'. These populations in the forest areas need to be conserved as a genetic resource. This will be in conformity with the decisions of CoP17 (Decisions 17.195 and 17.200).

The populations outside the distribution range can be managed intensively as plantations, and also the plantations in non-forest areas within the natural range, where domestication and breeding for improvement in desired traits can be undertaken, viz., susceptibility to infection and formation of agarwood, composition of the agar oil, quality of the chips and oil produced, yield of chips and oil, etc. Systematic Tree Improvement programme is required to be formulated for improvement in yield and quality of products, in conformity with the decision 17.196 of CoP17.

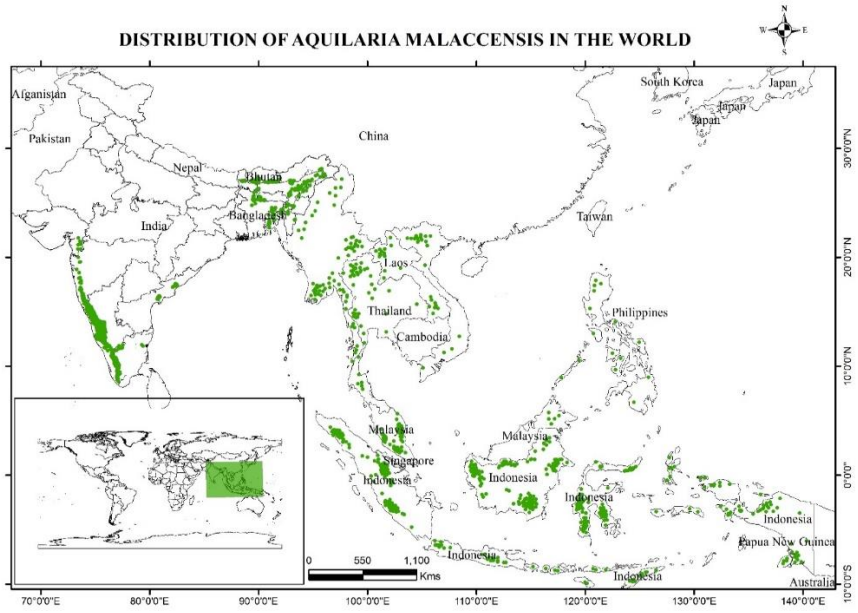
Step 5: Evaluation of the potential intrinsic biological risk of wild harvest

Consider the intrinsic biological characteristics that affect the potential risk of wild harvest to species survival. Is the severity of intrinsic biological risk indicated for each of these factors "Low", "Medium", "High" or "Unknown"?

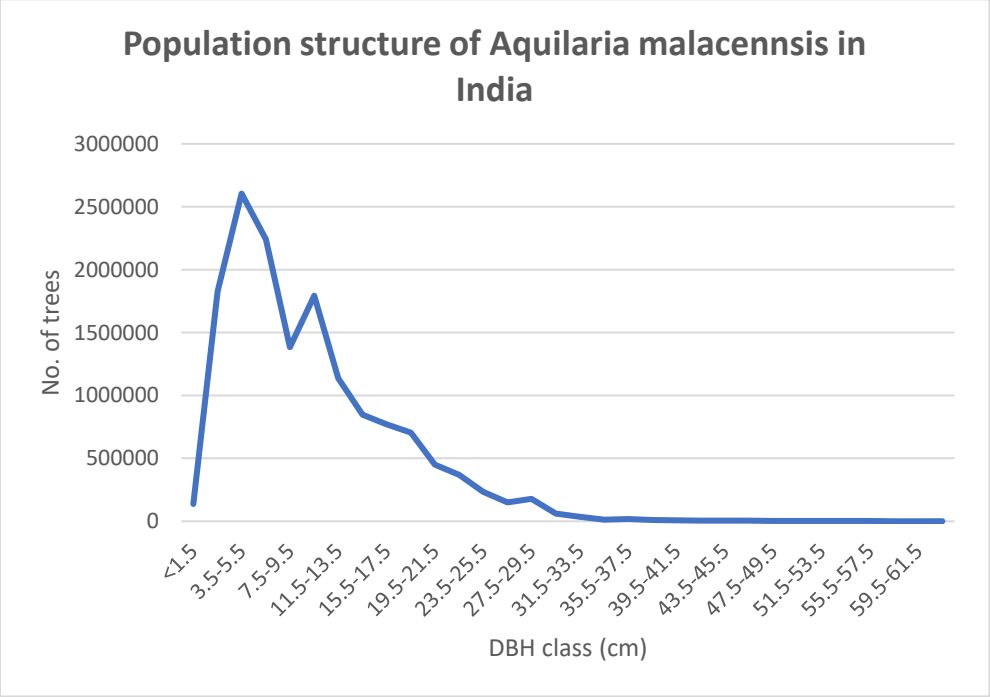
5.1. Plant part harvested and plant life form: The most important intrinsic biological factor related to risk is the plant part harvested, and as the whole tree is harvested for agarwood extraction, the risk severity is high. Currently, the extraction of trees is limited, as the rate of infection and the consequent agarwood formation is low. It takes place naturally only in limited areas of Assam. In all the other areas of distribution, the plant requires artificial induction of agarwood. In case there is no restriction imposed in terms of harvest quota or exploitable diameter at breast height (dbh) limit, there is chance of losing large populations simultaneously by harvest.

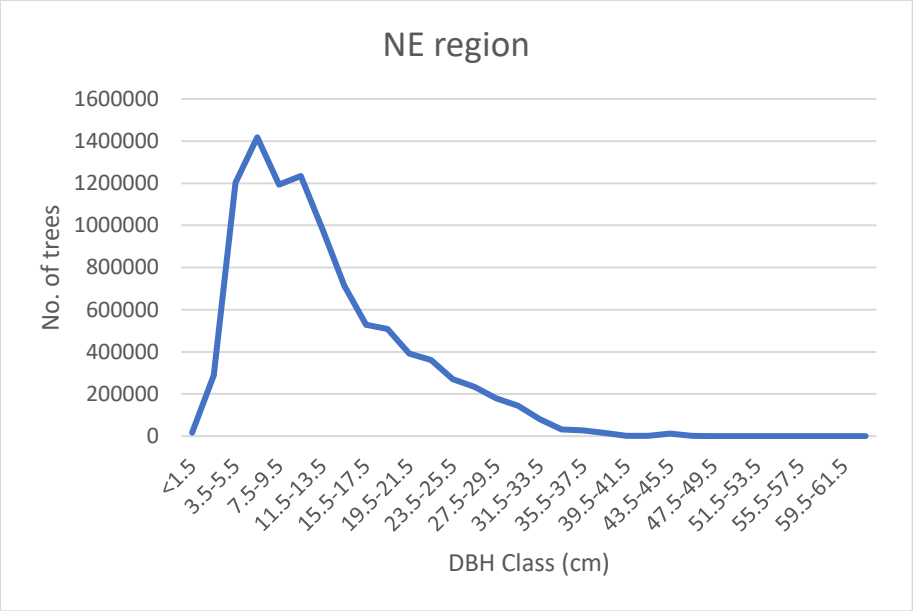
5.2. Geographic distribution: The species has a wide distribution extending from Bhutan in the west to Indonesia in the east, but throughout the range it is threatened by excessive exploitation, illegal removal from the wild and genetic erosion. Cultivation is also taken up on a large scale in various countries where the species is naturally distributed. Within India, it is planted extensively all along the Western ghats, outside the natural distribution range of the species. The global distribution of the species is shown in the map below. The risk based on geographic distribution is medium, for the reason that though naturally restricted to the northeastern region of India it is fairly widespread outside the natural range, along the Western ghats.

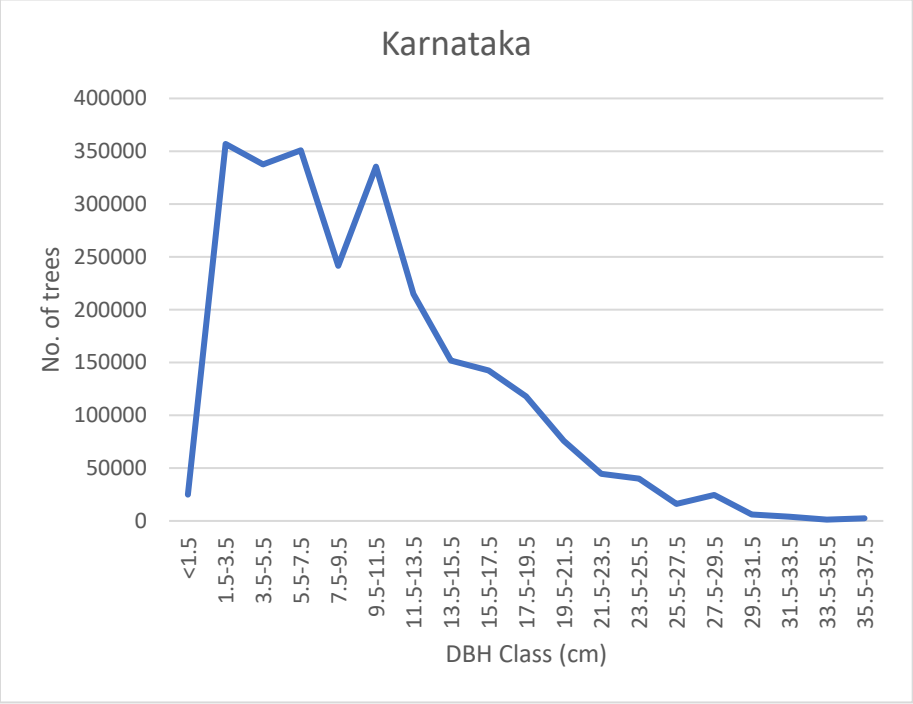
5.3. National/ sub-national population size and abundance It was estimated in 2016 that there may be a population of about 10 million trees in plantation in India (UNODC, 2016). Now the remnant populations of the original distribution are located only in remote hilly areas, Wildlife sanctuaries, National Parks and community forests in the hills of northeast India. Plantations have been taken up in a large scale in four States, namely, Assam, Tripura, Karnataka and Kerala. The present estimate based on details collected in this study is that the population may be about 15 million trees in the country, most of them in the younger age group, in view of the recent spurt in planting activities, and conversion of area under rubber and tea into agarwood on a small scale, and this is likely to increase in future. Out of this population, nearly 10 million is estimated to be located in the northeastern part of the country in the Eastern Himalayan region and Brahmaputra plains and about 5 million in the south eastern part of the country along the Western ghats. The exact figures would be known only if the system of registration of plantations, as suggested by CITES, is strictly enforced. The distribution map of the species in India is included in Sec 2.4. of the report



The structure of the populations differs at sub-national level, though all of them show unimodal distribution. In Assam and Tripura where the population has become scarce in the forest area, and now farmers have started cultivating the species, and in Karnataka where the species has been introduced outside the natural range, the sampling of populations revealed the structure where the lower diameter class ranges were predominant. In those States where the natural populations exist in the unclassed forests and community forests, along with new plantations, the higher diameter classes were dominant. The diameter class-wise distribution of the sampled population in the Northeastern region which has remnant populations of higher diameter classes as well as the plantations maintained in semi-natural state with uneven age classes and also the even-aged monospecific plantations, is distinctly different from the populations in the introduced areas, such as Karnataka. Statewise, the populations show unimodal distribution with skewed distribution towards the lower diameter classes, which are of the younger age classes. At national level, the population shows a bimodal distribution, due to the differences in the origin of plantations in the area of natural distribution in the northeast India and the areas of introduction, mainly in South India. These figures need to be revised in the next NDF after collection of statistics from Kerala which has a substantial population and the other States, such as, Odisha, Telengana, Andhra Pradesh, Rajasthan, Gujarat and Goa which have begun planting agarwood recently.







5.4. Habitat specificity and vulnerability

The plant grows between altitudes of 0-850 m and up to 1000 m in locations with average daily temperatures of 20-22 ºC; it grows well in mean annual maximum temperature of 22-28 ºC and a mean annual minimum temperature of 14-21 ºC. It cannot grow in places where the temperature goes below 5 ºC. It prefers a mean annual rainfall of 1500 to 6500 mm. It is adapted to various types of soil including those that are rocky, sandy or calcareous, but prefers light to medium

textured, well-drained and acidic to neutral soil. Therefore, the habitat preference is not too narrow, and that is evident from the successful introductions in the high rainfall zones outside the natural range.

5.5. Regeneration

The species is resilient and can easily be restored in the areas of original distribution. The success of the plantations in semi-natural state maintained in Upper Assam, with profuse natural regeneration indicates the regeneration potential of the species, if the area is not disturbed anthropogenically. The successful artificial regeneration outside the natural range of the species, is indicative of the adaptive potential of the species.

5.6. Reproduction

The species reproduces sexually and has common pollinators. Seed dispersal is not widespread and the young plants regenerate close to the mother plant, and thus tends to form groups. Specialized dispersal mechanism through wasps is reported. The potential biological risk is the short viability of the seeds, poor natural regeneration and susceptibility to defoliator and diseases. However, these are overcome to a large extent in the plantations, through artificial regeneration and pest and disease management. Since most of the commercial nurseries depend on a limited number of sources for seeds, there is risk of reduction in genetic diversity of the future population. This can be overcome by establishment of seed orchards using diverse germplasm, close to the nurseries that are engaged in seedling production. The composition of the orchards, their design, seed collection and processing procedures, nursery management and plantation raising should form a part of the Domestication and Breeding plan for the species.

5.7. Role of the species in its ecosystem

It is not a keystone species and there are no dependent species or key functions related to the species. There is no known specific ecosystem function for the species.

Step 6: What is the severity of harvest impact on individual plants, target populations, the national population and other species?

6.1. Impact of harvest on individual plants for the exports requested

Currently there is no wild harvest. The harvest from the wild in the form of ‘agar mahals’ earlier has decimated the species, and is making a gradual comeback. The remnant populations need to be conserved and used as base material for propagation and planting within the provenance. The current harvest in mostly from plantations. The harvest impact is severe, as the harvest is lethal and the whole plant is extracted.

6.2. Impact of harvest on target populations for the exports requested

The harvest of the plantations is currently being done when the plants attain the DBH of about 20-25 cm. With increasing demand the diameter class of the trees extracted may go down. It is necessary to fix the minimum diameter limit for extraction, preferably at 25 cm dbh, if the species is to be maintained at sustainable levels. In the uneven aged plantations maintained at homesteads of Upper Assam, the extraction is done selectively, and the regeneration is natural. This can sustain as long the exploitable dbh of the trees is not brought down. In the even aged plantations, there is need for a plantation and harvest plan, in the form of annual coupes which can be clear-felled and replanted. If natural agarwood formation is not happening, these plantations can be artificially induced to form agarwood, in batches, so that the entire plantation is not harvested in one go.

6.3. Impact of harvest on national population for the exports requested

At present proportion of population affected by harvest is limited, as the formation of agarwood is not found uniformly across the distribution range. With popularization of the artificial induction methods, and increasing demand for agarwood, the proportion of population harvested may increase. Presently, the national population is on the increase due to increased planting activities, and harvest may not have any adverse impact on the population at national level. However, at local level, in those States falling in the natural distribution range, planting needs to be promoted on a large scale, so that the wild populations are safe.

6.4. Impact of harvest on other similar species

There is only one species of agarwood in trade in India, and therefore, there will be no impact on other species.

Step 7: What is the impact of legal and illegal trade on the national populations of the species concerned?

The legal trade permitted as on date is only import, processing and re-export. No international trade is permissible with the local material, in the absence of any export quota fixed so far, as NDF has not been done till date. This is the first NDF study done, and based on this the export quota can be fixed and legal trade with locally harvested materials can be permitted.

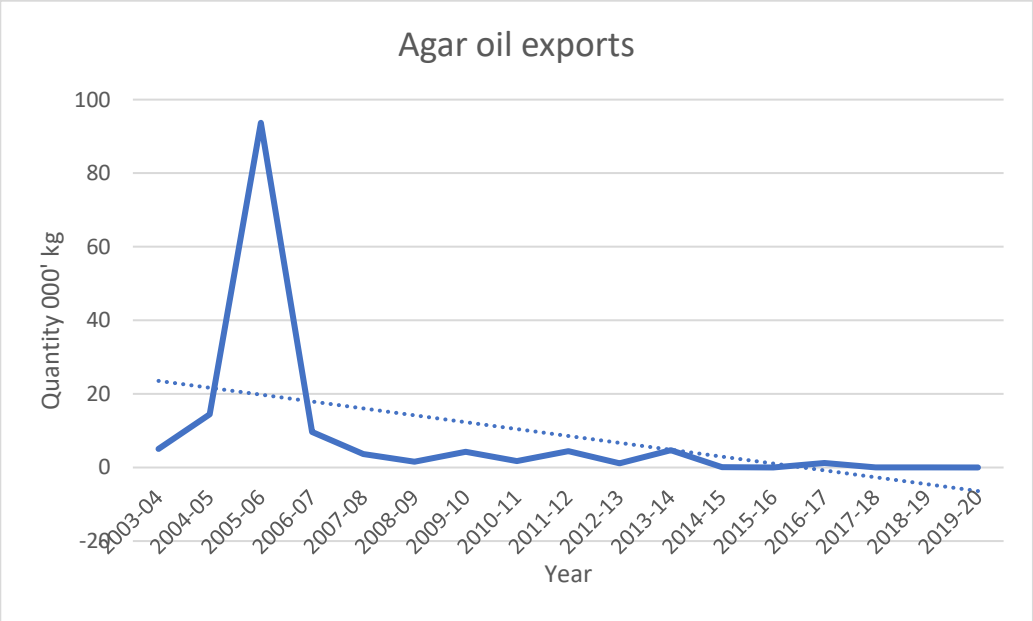
The imports made appear to be a cover up for the mix up with locally extracted materials, and also to cover up the smuggled materials. It has been reported that agarwood gets smuggled from Myanmar through Manipur into the areas where processing is done. The UNODC has also cited India as a conduit for illegal trade. This is one of the reasons for the great amount of secrecy maintained by the traders, who do not disclose any information on the quantity of material processed or products produced. The system of registration of the industries is not in place in most

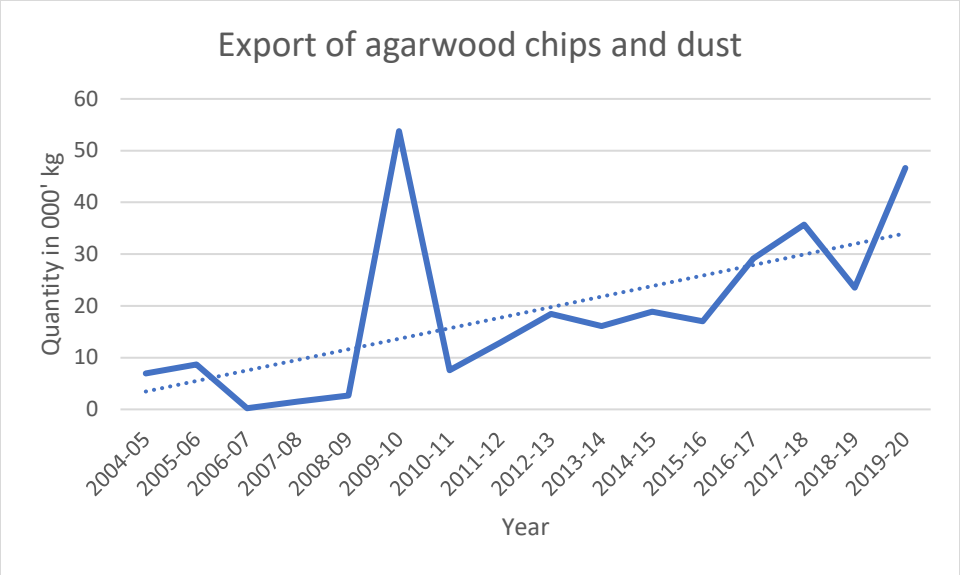
of the States, and even if present is not strictly enforced.

Trade impact is severe as the documentation is poor, and there is mismatch in the quantity reported by India, and its importers as well as exporters in the CITES Trade database. The trade chain is difficult to follow, as there is no registration of industries or documentation of the production. The trade volume is increasing especially for the agarwood chips (including dust) and if not properly regulated, can pose a threat to the species.

7.1. Magnitude and trend of legal trade

The magnitude of trade as revealed by the official statistics of the Department of Commerce and Industry, Government of India is provided in section 4.3. However, this pertains to two products, namely agarwood chips including dust and agar oil. Other products, such as, perfumery, formulations, agar leaf tea, cosmetics, etc., are not discernible from these statistics, as they are mixed up with similar products. The export of agarwood chips (including dust) is showing an upward trend, while that of the agar oil is showing a downward trend. These statistics of Government of India, does not tally with the CITES Trade Database, and even within that the quantity reported by the other countries exporting or importing to and from India, does not tally with what is reported by India. This calls for a robust data collection mechanism at the level of the Management authority. The trends of exports are illustrated below.





7.3. Magnitude of illegal trade

UAE is reported as the major exporter of illegal agarwood into the European countries, mainly UK, based on the number of seizure records, though this has shown decline after the relaxations granted in CoP16 for certain commodities of agarwood (Mundy-Taylor, 2013). Major exporter to UAE is India, and already it has been cited as a conduit for illegal trade in agarwood (UNODC, 2016). It is difficult to quantify the magnitude of illegal trade, as the official statistics published pertains only to the violations of the Foreign Trade Policy and the CITES guidelines. The illegalities related to the felling of trees from the wild, harvesting and processing violations, illicit transport, etc., which happen within the States are not reflected in the statistics. The States also did not respond to questions on this issue.

Step 8: Evaluate effectiveness of management measures

8.1. What management measures are in place for the target species?

Review of legislations

At National level, the Management authority controls the issue of export permits, through its offices located at various regions. It also collects the statistics on CITES violations and reports to the CITES headquarters. The ownership of the land where the species grows is either with the State governments or the communities (especially in the northeastern region) or individuals, and management/ protection measures need to be exercised at sub-national level. The Management authority, however, can issue guidelines on the management/ protection of the CITES listed species, but no such guidelines specific to the CITES species could be seen. It is for this reason that many of the States do not exercise any control over the cultivation, harvest, processing or trade of agarwood, except Tripura, which has issued the guideline in 2019. Assam which had controls over the matter, wished to streamline the same, and formulated necessary rules in 2017, but this is yet to reach finality. On the contrary, it loosened the controls in 2019, placing agarwood at par with exotic species like Eucalyptus and Poplars, which defies logic.

At State level, the relevant forest statutes afford protection to the species located in forest areas. In the Protected Areas, the species is afforded protection through the Wildlife (Protection) Act, 1972. There is need for registration of plantations and industries processing agarwood, as stipulated in the CoP decisions of CITES, but this is not being done, except in Tripura, which has formulated the guidelines in 2019.

Review of protection measures

The protection afforded through the forest laws and wildlife legislation are adequate for the species found in the forest areas and Protected areas. However, there is no control over the CITES listed species found in the community forests or the private lands. The need for registration of plantations and industries, which can help in monitoring and promoting legal trade needs to be emphasized by the Management authority, through appropriate guidelines to the States. There is a need to develop Traceability mechanism so the products can be traced to the source. There is also a need for product labelling and development of catalogues for identification of the products of agarwood, to help the enforcement authorities. There is also a need for a scientific grading, quality control and valuation, so that the right price is paid to the farmers, industries and exporters. The Government would also benefit by getting the appropriate levels of taxes and duties, as under the present system of grading and valuation based on the subjective assessment of traders and users, there is possibility of undervaluation, under-invoicing and the consequent evasion of duties due to the Government. This is evident from the abnormally low prices of agarwood materials imported into India as well as the products exported outside India, and these bear no relation to the high values quoted in the international markets.

8.2. Do existing management measures adequately mitigate harvest and trade impacts?

The existing measures do not adequately address the issues related to harvest and trade. Since there is large scale plantation going on in various parts of the country, the population is not apparently threatened at present. If the plantations activities are not sustained at this level, and if the present plantations get harvested to meet the increasing demand for agarwood products in the international market, there will be threat to the species. This calls for promotion of cultivation in suitable areas, proper registration of plantations, fixing of harvest quota, registration of industries, registration of traders/ exporters, development of traceability mechanisms, correct product identification and appropriate valuation. All these are lacking and need the attention of the Management authority.

8.3. The way forward for enforcement

As elaborated in the Asian Regional Workshop on the Management of Wild and Planted Agarwood Taxa, held at Guwahati in 2015, there are three expectations on the agarwood trade (Anon., 2015), and for India they are as listed below:

1) Sustainability,—continuity of supply; and the use of NDFs and the precautionary principle in conformity with Articles II and IV of CITES. This requires promotion of plantations of agarwood

wherever suitable, periodic assessment of the growing stock and fixing of quota for harvest from different States.

2) Traceability and legality—practices should conform with national laws, and the CITES permitting system should be in place. Harvesters, collectors and traders should be registered or certified. Parties should develop registration systems for plantations, as mandated in Res. Conf. 16.10. This is not enforced at the sub-national level (States), and this requires intervention of the Management authority.

3) Quality and type of products—agarwood is traded in several raw (wood chips and dust, oil) and finished forms (incense, perfumes, etc.). CITES Management Authority should register traders/exporters and also develop a product label and agarwood glossary for easy identification of the various products by the enforcement agencies. Products identification, their grading and correct valuation are necessary for regulation of the trade and also realization of revenue from export/import duties and GST. This also requires intervention of the Management authority, which can engage the Scientific authority to develop these systems.

Step 9: Make NDF and provide related advice

I. Non-Detriment Finding of *Aquilaria malaccensis*

From step 1

9.1. Specimen identification is not clear and/or scientific name is not compliant

The specimen identification is clear in this case, as only one agarwood producing species is in cultivation, and the products are also clearly identifiable. There is no record of it being traded in any other name. There are reports of fake agarwood chips being traded in the name of Black Magic Wood (BMW), which are made darker using mineral oils. The different grades of the product are identified only using the aroma and colour which are subjective, and still no objective system of grading, based on chemistry of the compounds is in place in India, though studies in this direction are going on.

From step 2

9.2. Export of artificially propagated specimens of this species is not permitted by national law or relevant subnational legislation.

As on date, the export of artificially propagated specimens of this species is not permitted, except those exempted under Annotation #14 (as adopted in CoP16), in the absence of NDF studies and fixation of quota. This may be permitted once the study is completed and quota is fixed.

9.3. Specimens covered by export permit application clearly meet all the requirements for artificially propagated according to Res. Conf. 11.11 (Rev. COP 15).

The present growing stock is largely from cultivation on non-forest lands, and the seeds for artificial propagation are also sourced from existing plantations. As the cultivated specimens are permitted under the national legislation/ rules subject to certain conditions, a **POSITIVE ADVICE** is rendered for export of specimens from cultivated sources, in this NDF report.

From step 3

9.4. The specimen is not covered by CITES Appendix II

The specimen is covered by CITES Appendix II.

9.5. Export of wild harvested specimens of this species is not permitted by national or relevant sub-national legislation or regulation.

The wild populations are protected and no export of wild specimens is permitted. In fact, no export of any specimen from the range State is permitted at present in the absence of NDF report and fixation of quota. In view of the limited remnant population of the species in wild, the present NDF renders a **NEGATIVE ADVICE** for harvest of wild populations.

9.6. Evidences used for a previous NDF is still valid and sufficient to evaluate the current permit application.

No NDF was conducted previously, and this is the first such study.

From steps 4-8

9.7. Do existing management measures adequately mitigate harvest and trade impacts?

The existing management measures do not adequately mitigate harvest and trade impacts. Documentation of the cultivated sources is inadequate, and on the pretext of deregulating the restrictions and promoting cultivation, the need for registration is being dispensed with. Registration of plantations with any government agency, viz., forest department, horticulture department, agriculture department or industries department, will help in easy assessment of growing stock and estimation of quota of products to be allowed for export, in the future revisions of quota. If details of age-wise growing stock are not maintained, it would be difficult to fix quota for export.

Resolution Conf. 16.10 encourages range states to establish a registration system for the artificial propagation of agarwood producing trees and recommends exporting states to establish a registration system of exporters who export pure or mixed oil of agarwood. Samples of the labels used and the lists of relevant exporters should be communicated to the Secretariat by exporting states, and then be provided to all the parties through a notification.

The industries processing the wood and extracting oil and other extracts are also not registered with any authority at present, and the quantum of extraction, price, grading is all kept secret and it is with great difficulty that information could be gathered. Without clear accounting of production of various products from agarwood, there can be unsustainable extraction and use of the timber, clearly threatening the species in cultivation, and subsequently can threaten whatever is left in wild, to meet the requirements of the market.

II Related advice:

1. Harvesting of *Aquilaria malaccensis* from wild needs to be discouraged and checked. The remnant stands need to be identified and protected as genetic conservation stands, as these are the last repositories of genetic variation within the species. Where they are located within the forest areas, the legislative protection afforded through the relevant sub-national laws would suffice. However, wherever these stands are located in community forests, as in the northeast region, they should be declared as Community Conservation Areas, and the communities should be given the responsibility of protecting those stands, with a clear understanding of the need to maintain the genetic diversity. The communities can be encouraged to collect seeds from such stands, raise nurseries and carry out enrichment planting in the forest areas.

2. Harvesting from plantations both homesteads maintained in semi-natural state and the monospecific plantations may be allowed, subject to the following conditions:

a) Registration of the plantations with any government department concerned, as may be decided by the sub-national legislations, is required to keep record of the growing stock, in order to fix and revise export quota in future. Registration with the forest department, preferably online, with simplified procedures is recommended. The management authority is advised to issue necessary advisory/ instructions in this regard to the subnational units (State governments).

b) The industries processing the timber need to be registered with the concerned government agency, preferably the Industries department, which should keep stock of the production of various products derived from agarwood, which would help in fixing and revising the export quota in future. The management authority is advised to issue necessary advisory/ instructions in this regard to the subnational units (State governments).

c) These would be in conformity with the CoP decisions of CITES related to registration of plantations and traceability of the products.

3. Cultivation of *Aquilaria malaccensis* needs to be promoted incentivizing production of quality planting stock, raising of plantations in areas those are unfit or unremunerative for agriculture, raising of agarwood as a part of agroforestry system or as shade crop for tea. Cultivation must be undertaken with quality planting material. Exclusive seed sources in the form of Seed Production Areas (SPA), Seedling seed orchards (SSO) or Clonal seed orchards (CSO) need to be created at

district level, in non-forest areas to serve as source of seeds for production of quality planting stock. These seed sources should be created keeping in view the intra-specific variations, and should be used exclusively for planting in non-forest areas, and not to be used for enrichment planting in forest areas, which may alter the provenance variations, causing what is called the "genetic pollution". For enrichment of the forest areas, which once supported the species, the local remnant populations must be used as seed source.

4. There is need for research on various aspects of the species, viz.,

(i) Intraspecific variation in phenology, morphology, physiology, biochemistry and genetics

(ii) Biochemistry of agarwood formation and the role of the host, pathogen and the insect borer in the composition of the resin and oil.

(iii) Development of agarwood based agroforestry systems, including introduction in the shifting cultivation areas.

(iv) Cultivation practices of the species, including silviculture (spacing, pruning, thinning, tending operations), integrated nutrient management, integrated pest and disease management, and fixation of rotation for harvest, both in the native range and the areas where the species is introduced.

(v) Artificial induction of agarwood in those areas where natural infection does not occur, including identification of effective strains of microbes, and development of formulations that can be easily used by the farmers on their own to induce infection.

(vi) Improving the method of extraction of oil, in order to enhance the quantity and quality of oil.

(vii) Scientific methods of grading of agarwood chips and oil, so that the farmer and the industry get the right price for the product.

(viii) Production of value added products from the agarwood, viz., cosmetics, medicines, handicrafts, incense, in order to improve employment potential from the sector.

The management authority is advised to encourage and fund research on all those aspects through the Indian Council of Forestry Research and Education.

5. The management authority is advised to develop robust mechanisms for collection of statistics, as there is lot of discrepancy in the statistics of population of the species, which is the raw material, as well as the data on production, domestic trade and international trade. The CITES Trade Database has information as reported by the Importers as well as Exporters, and this statistics wherever India is either an importer or exporter, does not tally with the figures provided by the

corresponding exporter or importer. Secondly, the CITES Trade Database maintains statistics of all possible products of agarwood, but the Trade Database of the Ministry of Commerce and Industry, Government of India provides data only on the agarwood chips (including dust) and agar oil. All the other products are included within broad classes of similar products. Management authority can make a complete list of products made from CITES-listed species, and examine possibilities of having them separated from the ITC-HS codes for similar products that are bulked together. This listing will also help in identification of any new product into the market, and examining its possibility for claim of Access and Benefit Sharing (ABS) under the Biological Diversity Act, 2002, as the new product will not be a Normally Traded Commodity, exempted under the said legislation.

6. The management authority is also advised to conduct awareness programmes on CITES among the various agencies involved in cultivation, processing, marketing and trade of various species listed in CITES Appendices, and also the regulatory agencies controlling the export, as there is total lack of understanding even among the agencies that are required to enforce CITES at subnational levels, this often leading to attempts to bypass the provisions of CITES. The management authority may get these programmes conducted through the Scientific authorities of CITES.

7. The export quota, is usually fixed under CITES annually from 1st January to 31st December. However, in order to align with the financial year of India, the following export quota is recommended at present for the financial year 2021-22, taking into consideration the growing stock available in non-forest lands, the number and capacity of the agarwood processing units, and the proportion normally used for production of agarwood chips and agar oil, and also the trend in the exports for the last 10 years:

Agarwood chips and powder (HS Code 12119080): 25000 Kg per annum

Agar oil (HS Code 33013010) : 1500 kg per annum

8. Though CoP15 has recommended annual revision, considering the need for proper registration and documentation of the cultivated sources, the registration of processing industries and traders/ exporters, development of traceability mechanism and product catalogue which is likely to take time, it is recommended that the quota suggested may be considered for revision after three years, in 2024.

9. For facilitating legal trade and ease of doing business, it is also recommended that the CITES export permits may be issued from all the Integrated Regional Offices of the Ministry of Environment, Forest and Climate Change, and the Guwahati airport may also be permitted for allowing exports, as it is the only international airport in the Northeast region, which has a substantial population of agarwood.

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d. All Sanchi Growers Association of Assam (Mr Bikash Borah)
e. Upper Assam Sanchi Farmers and Traders Association (Mr Rustom Bora)
f. Naga Fragrance Pvt. Ltd. (Dili Solomon)
g. Assam Agarwood Trade Association (Mr Soumitra Goswami)
h. Mr Dhruba Jyoti Baruah, Dhubri- agarwood planter
i. Ajmal R&D Centre (Mr Jyotibrata Mitra)

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