

**HEART OF THE MATTER: AGARWOOD USE AND TRADE
AND CITES IMPLEMENTATION FOR *AQUILARIA MALACCENSIS***

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Agarwood collector in central Vietnam

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EXECUTIVE SUMMARY

Agarwood, eaglewood, *gaharu*, aloeswood - these are just a few of the names for the resinous, fragrant and highly valuable heartwood produced by *Aquilaria malaccensis* and other species of the Indomalaysian tree genus *Aquilaria*. The wealth of names for this dark and heavy wood (its Chinese name literally means 'wood that sinks') reflects its widespread and varied use over thousands of years. Agarwood's use as a medicinal product has been recorded in the *Sahih Muslim* which dates back to approximately the eighth century, and in the Ayurvedic medicinal text the *Susruta Samhita*. Its use as a perfume has been recorded in the *Old Testament*. These and other uses continue today. Agarwood is used in Ayurvedic, Tibetan and traditional East Asian medical practices. Both agarwood oil and incense are used for their fragrant properties, notably in the Middle East. Agarwood incense is used in religious ceremonies by Buddhists, Hindus and Muslims, while a revival of the 'Koh doh' incense ceremony in Japan has rekindled interest in agarwood in that country. In Taiwan, agarwood is an aromatic ingredient in *Chu-yeh Ching* and *Vo Ka Py* wine. Although less common, agarwood may also be carved into sculptures, beads and boxes, these sometimes also being used for religious purposes.

Accounts of international trade in agarwood date back as early as the thirteenth century, India being one of the earliest sources of agarwood for foreign markets. Agarwood is currently traded in large quantities. Over 700 t of agarwood from *Aquilaria malaccensis* were reported in international trade in 1997, with exports from Indonesia and Malaysia taking the lead among approximately 20 reported countries of export/re-export. Although overall trade volumes may appear small in 'timber trade' terms, they are not small in monetary terms. Agarwood chips and segments may sell for several hundred to several thousand US dollars per kilogramme. The price of oil distilled from agarwood is generally between five and ten thousand US dollars per kilogramme, but can be significantly more for agarwood oil of exceptionally high quality.

Unfortunately, the demand for agarwood currently far exceeds the available supply, which is naturally restricted owing to the nature of its formation - agarwood is only found in a small percentage of *Aquilaria* trees of those species known to produce it. Although research into the origins of agarwood are ongoing, it appears that the fragrant resin that permeates the heartwood of some *Aquilaria* trees is produced as a response to wounding and/or a fungal infection. It is this resinous wood, or 'agarwood', that is sought, the non-impregnated wood being considered too soft to be useful for construction. Agarwood is harvested by felling and then splitting trees open. External signs of the presence of agarwood are not always obvious. As a result, *Aquilaria* trees are often cut down indiscriminately in the search for those containing agarwood. The high value of agarwood products is also stimulating illegal harvest and trade in several range countries.

Populations of eight *Aquilaria* species have already declined to the point where they are considered threatened according to IUCN Red List Categories. Of these, six species are considered at risk from over-exploitation for agarwood.

In view of evidence of unsustainable harvest and trade, inter-governmental action has been taken to bring the international trade in one of these species, *Aquilaria malaccensis*, within sustainable levels. *A. malaccensis* was listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) with effect from February 1995. This listing obliges all CITES member countries exporting or re-exporting *A. malaccensis* parts and derivatives (e.g. wood, chips, oil) to issue CITES documents for those shipments exported. In the case of exports from range States, the Convention

stipulates that such permits should only be issued once the exporting government has confirmed that the agarwood to be exported was obtained both legally and in a manner not detrimental to the survival of the species.

The CITES Plants Committee considered it a priority to review the implementation of the CITES listing for *Aquilaria malaccensis* during the 1998-2000 triennium. TRAFFIC was contracted by the CITES Secretariat to undertake such a review in 1998. TRAFFIC's research initially focused specifically on CITES implementation. However, as several different *Aquilaria* species are in trade and agarwood is extremely difficult to identify to the species level, TRAFFIC's research was broadened to encompass a more general review of agarwood use and trade. Information was gathered through interviews with government authorities, other agarwood researchers and traders; compilation and analysis of CITES and Customs trade data; and a review of available legislation and literature. Market surveys and visits to harvest sites and processing centres were undertaken in several countries.

The results of TRAFFIC's research are reported in the TRAFFIC Network report *Heart of the Matter: Agarwood Use and Trade and CITES Implementation for Aquilaria malaccensis*. Some of the key findings of this report are summarized below.

Agarwood trade and trade controls for *Aquilaria malaccensis*

The international trade in agarwood involves wood, wood chips, powder, oil, and, although not identified in available trade data, almost certainly finished products such as perfumes, incense and medicines. The classification (grading) of agarwood, and therefore its value, depends not on the species involved, but on a complex set of factors related to the size, resin content, fragrance, and colour of agarwood offered for sale and, in the case of oil, to its purity. The country of origin is also an important factor that determines agarwood's value.

Based on available trade data, Indonesia and Malaysia appear to be the main sources of agarwood (from all species) in international trade. CITES-reported exports of *A. malaccensis* from Indonesia topped 920 t from 1995 to 1997. These exports were likely to have included other *Aquilaria* species in addition to *A. malaccensis*. Over 340 t of *A. malaccensis* were reported as exported from Peninsular Malaysia during the same period. CITES annual report data for exports from Sabah and Sarawak were not available at the time of writing. However, according to information received from Sarawak's CITES Management Authority, nearly 530 t of *A. malaccensis* were exported from Sarawak in 1998 alone. As with Indonesia, reported exports from Malaysia are likely to have included species in addition to *A. malaccensis*. Vietnam is also an important source of agarwood in trade, with Taiwan's Customs data showing the import of over 500 t of agarwood from Vietnam from 1993 to 1998. Vietnam is not believed to be a range country for *A. malaccensis*, and it therefore seems likely that these shipments involved other species, e.g. *A. crassna*. Both Cambodia and Thailand are reported to have exported over 300 t of agarwood to Taiwan from 1993 to 1998; only the latter is a range State for *A. malaccensis*. Further research is required to document the role in the trade of Lao PDR and Myanmar, which have also been identified as agarwood source countries.

Most of the agarwood in international trade is destined for consumers in the Far and Middle East, with key final export destinations from 1995 to 1997 including Saudi Arabia, the United Arab Emirates, Hong Kong and Taiwan. Few import data are available, however, with most consumer countries failing to report *A. malaccensis* imports in CITES annual report data. Much of what is known regarding end destinations comes from exports reported by Indonesia and Malaysia, and imports and re-exports reported by Singapore. The

latter country plays an extremely important role in the trade, importing agarwood originating from south and south-east Asia, of which almost certainly the vast majority is re-exported, some in a more highly processed form, e.g. oil. Singapore reported the re-export of almost 800 t of *A. malaccensis* from 1995 to 1997, approximately 70% of the amount of agarwood reported as exported to Singapore by Indonesia and Peninsular Malaysia during this same period (1113 t).

Once a major supplier of agarwood to international markets, India now acts primarily as a processing centre for agarwood from other range States, with natural stocks largely depleted by overexploitation.

All of the *Aquilaria* range States for which information was collected for this study have enacted some form of harvest and/or trade controls. The Governments of Indonesia Peninsular Malaysia and Sarawak (but not Sabah) require that *A. malaccensis* exporters obtain CITES export permits. However, it does not appear that adequate 'non-detriment findings' required by the Convention are made prior to issuance of these permits. Information on the status of the species in the wild is generally scarce, limiting these governments' ability to determine whether exports are being maintained within sustainable levels.

Efforts to adhere to CITES requirements are further hindered by difficulties in identifying the species in trade. Visual identification of wood to the species level is difficult and beyond the capacity of most enforcement personnel. Identification of products such as oil would seem to be impossible without the use of laboratory techniques. As a result, enforcement authorities in Indonesia and Malaysia appear not to differentiate between agarwood from *A. malaccensis* and that from other *Aquilaria* species in trade.

Illegal harvests and trade further undermine efforts to manage the exploitation of *Aquilaria* species. There are reports of illegal agarwood harvest and/or trade in India, Indonesia, Lao PDR, Malaysia, Myanmar, Papua New Guinea and Vietnam. Illegal harvests from protected areas have been reported in Indonesia, for example, and from government agarwood plantations in India.

With the prospect of continued demand in the face of declining supplies, projects are underway in several countries to increase agarwood production via cultivation of *Aquilaria* species (e.g. in India, Indonesia, Vietnam) and through seeking to artificially induce *Aquilaria* trees to produce agarwood (e.g. in Indonesia, Vietnam). In general, such efforts do not yet appear to have succeeded in producing agarwood in commercial quantities sufficient to offset demand for wild stock. However, agarwood is being produced by *A. malaccensis* plantations in India and a programme to induce agarwood production in cultivated *Aquilaria* trees in Vietnam is reported to have succeeded on an experimental basis.

As noted above, six *Aquilaria* species are already considered threatened by overexploitation. Unless further actions are taken to control agarwood harvests and trade, it seems likely that wild populations of *A. malaccensis* and other agarwood-producing species will continue to decline. The negative impacts of such declines will be felt not only in terms of biodiversity loss but also in terms of the reduced availability of what is clearly a highly valued and valuable forest resource.

Action is urgently required on a number of fronts to reduce the current patterns of overharvest and illegal trade. Much more needs to be known regarding the status and biology of those species in trade, especially in countries known to be exporting large volumes of agarwood, e.g. Cambodia, Indonesia, Malaysia, Thailand and Vietnam. Increased research effort in these and other range countries should be given high priority. More needs to be known regarding the flow of benefits from agarwood harvests and trade in order to increase the opportunities and incentives for better management of harvests and trade. More effective harvest and trade controls, including improved CITES implementation and better tools for the identifi-

cation of species in trade are also required. Specific attention should be paid to the making of non-detriment findings for *A. malaccensis* in Indonesia and Malaysia and identification of the species in trade from these and other *A. malaccensis* range countries, such as Thailand. Given that numerous other *Aquilaria* species are also threatened by overexploitation for trade, the inclusion of these species and possibly the entire genus in the CITES appendices should be considered. Further study of the potential for artificially increasing agarwood production should also be incorporated into plans for the sustainable management of these species.

Co-operation among the stakeholders affected by *Aquilaria* conservation, harvest and trade is required if such efforts are to be successful in ensuring the future of both *Aquilaria* species and the agarwood they produce. A workshop to provide an opportunity for stakeholders to share information and experience would be an important first step in promoting such co-operation.

Credit TR.P. Vietnam, 1996



Forester in Vietnam experimenting with agarwood formation in *Aquilaria* spp.

BACKGROUND

Aquilaria malaccensis and agarwood production

Aquilaria malaccensis is one of 15 tree species in the Indomalayan genus *Aquilaria*, family Thymelaeaceae, (Mabberley, 1997). It is a large evergreen tree growing over 15-30 m tall and 1.5-2.5 m in diameter, and has white flowers (Chakrabarty *et al.*, 1994). *A. malaccensis* and other species in the genus *Aquilaria* sometimes produce resin-impregnated heartwood that is fragrant and highly valuable. There are many names for this resinous wood, including agar, agarwood, aloeswood, eaglewood, *gaharu* and *kalamabak*,



Leaves of *Aquilaria malaccensis* tree

this wood being in high demand for medicine, incense and perfumes across Asia and the Middle East.

Distribution and habitat

Aquilaria malaccensis is widely distributed in south and south-east Asia. There are differing accounts of the countries in which it occurs. According to Oldfield *et al.* (1998), *A. malaccensis* is found in 10 countries: Bangladesh, Bhutan, India, Indonesia, Iran, Malaysia, Myanmar, Philippines, Singapore and Thailand. The supporting statement accompanying India's proposal to list this species in the appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) also names Lao PDR and Vietnam as range States. The status of *A. malaccensis* in these two countries requires confirmation, Oldfield *et al.* (1998) noting that they are range States for *A. crassna*, which is also heavily exploited for agarwood. There is also a question regarding whether *A. malaccensis* occurs in Iran (T. Soehartono, *in litt.* to TRAFFIC International, 25 April 2000; H. Heuveling van Beek, TRP, *in litt.* to TRAFFIC International, 2 May 2000).

Aquilaria species have adapted to live in various habitats, including those that are rocky, sandy or calcareous, well-drained slopes and ridges and land near swamps. They typically grow between altitudes of 0-850 m, in locations with average daily temperatures of 20-22°C (Afifi, 1995; Keller and Sidiyasa, 1994; Wiriadinata, 1995).

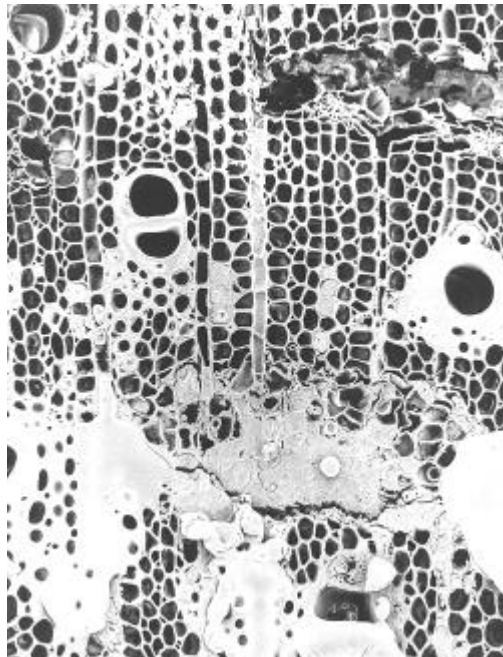
Conservation status

Aquilaria malaccensis is considered 'Vulnerable' according to the current IUCN Red List Categories, and has been included in *The World List of Threatened Trees* (Oldfield *et al.*, 1998). Considerable harvest pressure was noted in range States such as Indonesia, Malaysia and Thailand at the time when the species was proposed for inclusion in Appendix II. Very little recently published information is available regarding the status of this species. Information collected during this study indicates that overexploitation remains a significant concern. A report by Chakrabarty *et al.* (1994) documenting India's trade in agarwood concluded that *A. malaccensis* is highly threatened in that country due to exploitation of the species for commercial purposes.

Seven other *Aquilaria* species are also considered threatened according to the IUCN Red List Categories, five of which are considered to be at risk from overexploitation for agarwood: *A. beccariana* (Vulnerable); *A. crassna* (Critically Endangered); *A. cumingiana* (Vulnerable); *A. hirta* (Vulnerable) and *A. microcarpa* (Vulnerable) (Oldfield *et al.*, 1998).

Production of agarwood

Three hypotheses exist regarding agarwood formation, namely that it is the result of pathological, wounding/pathological and/or non-pathological processes (Ng *et al.*, 1997). According to Ng *et al.* (1997), studies have not provided conclusive evidence for any of these hypotheses. Oldfield *et al.* (1998) states that resin production is in response to fungal infection, and Heuveling van Beek (TRP, *in litt.* to TRAFFIC International, 2 May 2000) that it is in response to wounding. He adds that fungal infection can increase resin production as a host response to increased damage due to fungal growth. *Aquilaria* trees are naturally infected by a variety of fungi including: *Aspergillus* spp., *Botryodiplodia* spp., *Diplodia* spp., *Fusarium bulbiferum*, *F. laterium*, *F. oxysporum*, *F. solani*, *Penicillium* spp., and *Pythium* spp. (Anon., 1998a; Santoso, 1996, cited in Soehartono and Mardiatuti, 1997; Wiriadinata, 1995). The ecological interaction between the host tree and the wound and/or the fungi in order to produce agarwood is poorly understood. Other factors such as the age of the tree, differences in the tree caused by seasonal variation, environmental variation and genetic variation of *Aquilaria* spp. may also play an important role in agarwood formation (Ng *et al.*, 1997).



Photograph showing cell structure within an *Aquilaria* tree; white areas indicate resin deposits.

Credit: Robert Blanchette, "Join agarwood research program University of Manobo and TRP"

Not all *Aquilaria* trees produce agarwood, Gibson (1977, cited in Ng *et al.*, 1997) estimating that only approximately 10% of wild *Aquilaria* spp. produce resin. Gianni (1986, cited in La Frankie, 1994) suggested that only one-tenth of mature trees above 20 cm diameter at breast height (dbh) produce agarwood. According to Chakrabarty *et al.* (1994), infected trees produce resin from the age of 20 years onwards, Sadgopal (1960, cited in Soehartono, 1997) suggesting that the best yields are obtained from trees aged 50 years and over. Recent studies undertaken by The Rainforest Project (TRP) in Vietnam have shown that agarwood formation can occur in cultivated trees as young as three years of age, as confirmed by chemical analysis (H. Heuveling van Beek, TRP, *in litt.* to TRAFFIC International, 2 May 2000).

The yield and qualities of the resinous agarwood produced also varies considerably (Hartadi, 1997; Ng *et al.*, 1997; Oetomo, 1995; Wiriadinata, 1995). Research conducted in West Kalimantan, Indonesia, demonstrates that the yield of *Aquilaria* resin does not correspond with tree diameter or timber volume, even when trees have similar indications of infection (Soehartono and Mardiatuti, 1997). Gianni (1986, cited in La Frankie, 1994) suggested that those trees above 20 cm dbh that produced agarwood provided approximately one kilogramme of agarwood per tree.

Harvesting

Agarwood is extracted from trees by felling and splitting them to reveal the resinous product. The roots of *Aquilaria* trees may also contain resin and if so are also harvested for trade.

As noted above, only a relatively small percentage of *Aquilaria* trees are likely to produce agarwood. Dying trees are thought especially likely to contain agarwood, indications that trees are dying including yellowish leaves, leafless branches with swollen spots along the branch and trunk and very dry bark. Although infected trees apparently exhibit certain of the symptoms outlined above, it is not possible to identify agarwood-producing trees in a reliable manner by visual inspection. Consequently, numerous uninfected *Aquilaria* trees are felled in the search for those containing agarwood (Hartadi, 1997; Lambert, 1992, cited in Anon., 1994; Ng *et al.*, 1997; Oldfield *et al.*, 1998). In some cases, this may also reflect the belief that trees may become infected once felled. Additionally, according to Heuveling van Beek (TRP, *in litt.* to TRAFFIC International, 2 May 2000) many trees produce very small amounts of low-grade agarwood that is difficult to detect if the harvester is searching only for high-grade dense deposits.

Dayak communities in Indonesia believe that dying seedlings and saplings (indicated by yellowish leaves) testify to infection of the mother tree. They appear to be able to identify infected trees by differentiating between the sound made by knocking on infected trunks and the sound made by knocking on non-infected trunks (Soehartono and Mardiasuti, 1997).

INTRODUCTION

International attention was drawn to concerns regarding the status and trade of *Aquilaria malaccensis* in 1994, when the Government of India, a range State for the species, submitted a proposal to include it in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The proposal was accepted during the Ninth Meeting of the Conference of the Parties to CITES (Fort Lauderdale, 1994), the listing taking effect from 16 February 1995.

The Appendix II listing requires that CITES Parties issue CITES permits prior to the export or re-export of this species, and that importing countries that are Parties to CITES confirm that such permits have been issued and are presented at the time shipments are imported. CITES authorities in exporting range States are obliged to ensure that exports are maintained within levels that are not detrimental to the survival of the species, and that specimens to be exported have not been obtained in violation of the laws of that country (further information on CITES requirements can be obtained from <http://www.cites.org> or by contacting the CITES Secretariat).

The CITES Plants Committee determined that a review of the implementation of the CITES Appendix II listing for *Aquilaria malaccensis* was a priority under the CITES significant trade process for plants for the period 1998-2000. The CITES Secretariat subsequently contracted the TRAFFIC Network to undertake such a review in key range States. As had been suspected and as research confirmed, it was not possible to study the trade in agarwood from *A. malaccensis* in isolation from the combined trade of all agarwood-producing species. TRAFFIC's research was therefore extended beyond the original emphasis to incorporate the wider issues of agarwood harvest, use and trade.

An interim report of TRAFFIC's findings was submitted to the Ninth Meeting of the CITES Plants Committee in June 1999, and the final project document submitted to the CITES Secretariat and subsequently circulated to all *A. malaccensis* range States in September 1999. In consideration of the findings of TRAFFIC's research, the Eleventh Meeting of the Conference of the Parties (Nairobi, 2000) directed the Plants Committee to undertake further work to resolve species identification problems, identify measures to improve trade reporting, and determine whether other *Aquilaria* species merited inclusion in CITES Appendix II.

The final project document formed the foundation of the present report, which incorporates comments on the project document received from range States.

METHODS

Research for this project was undertaken by staff and consultants working for TRAFFIC East Asia, TRAFFIC India, TRAFFIC Southeast Asia and TRAFFIC International. Where unspecified, information provided was collected by TRAFFIC staff and consultants.

Information was collected from CITES Management and Scientific Authority staff via questionnaires and interviews (both in person and via telephone) and from other government personnel (e.g. Customs, police, forestry departments). Information was also collected from other agarwood researchers, State companies, traders (importers, exporters, wholesale suppliers and retailers) and trade associations. Market visits were conducted in India (Mumbai (formerly known as Bombay) and north-eastern States); Indonesia (Jakarta); Lao PDR (Vientiane); Malaysia (Kuala Lumpur); Thailand (Bangkok); Singapore and Vietnam (Hanoi and Ho Chi Minh City). Visits were also made to harvest sites and processing centres in India, Lao PDR and Vietnam. The larger part of this field work took place from January to March 1999. Legislation and published references were also reviewed as available.

CITES annual report data for *Aquilaria malaccensis* were analysed for the years 1995-1997, the latter year being the last for which relatively complete data were available. These data are compiled by the World Conservation Monitoring Centre from annual reports submitted by CITES Parties, which document their international trade in CITES-listed species. CITES annual reports are required to be submitted by the Parties to the CITES Secretariat by 31 October of the year following that in which the trade took place. However, late submission of annual reports is not uncommon and in some cases annual reports are not submitted at all. Data contained within CITES annual reports may be based on CITES permits issued (some of which may not be used), CITES permits used, or on actual trade volumes. As a result of these and other factors, while they may provide useful information regarding trade patterns and trends, CITES data do not provide an accurate reflection of actual trade volumes. Customs data for India, Indonesia, Malaysia and Taiwan were also compiled and analysed. As with CITES data, these data help illuminate the trade, but may not provide an accurate picture of actual trade or trade volumes.

Where agarwood prices have been obtained in currencies other than US dollars, they have been converted to that currency using the average interbank exchange rate for the period 1 January to 31 March 1999, based on rates provided by an on-line currency converter (OANDA, 2000). The following conversion rates were used: INR1 (Indian Rupee) = USD0.02353; IDR1 (Indonesian Rupiah) = USD0.00011; MYR1 (Malaysian Ringgit) = USD0.26311; THB1 (Thai Bhat) = USD0.02695. The costs of export taxes, licences, harvesting permits etc., have been converted to US dollars at the same rates. Where historic agarwood prices have been obtained, their value has been converted to US dollars at the corresponding

average yearly interbank exchange rate unless otherwise stated. The converted rounded values of certain historic agarwood prices have been adjusted for inflation to 1998 levels, this being the latest full year available for inflation rates at the time of writing. Such adjustments were made according to the US Gross Domestic Product Deflator inflation index, using an on-line calculator (NASA, 2000). The inflation index is based on the inflation rate during the US Government Fiscal Year (1 October-30 September).

For the purpose of this report the word 'agarwood' is used when the information does not relate specifically to *Aquilaria malaccensis*. *Aquilaria malaccensis* (*A. malaccensis*) is used only when the product in trade has been specifically identified as *A. malaccensis*.

AGARWOOD USE AND TRADE

Forms of agarwood in trade

Unless otherwise specified, information in this section was obtained from Heuveling van Beek and Phillips (1999).

Agarwood is traded in several raw forms, ranging from large sections of trunk to finished products such as incense and perfumes. Branch or trunk sections are the largest forms in trade and may be one to two metres in length and weigh more than 10-20 kg. Such large sections command a high price, being relatively costly to transport and not easily adulterated. They are rarely in trade, however, because of the difficulties in actually finding large sections of resinous wood. Traders interviewed suggested that large pieces of agarwood were now only available from Indonesia. Large agarwood branch or trunk sections are bought primarily by customers from Japan, apparently for use in personal shrines. Large agarwood sections are also found in temples, monasteries and other religious buildings. Such large sections seldom, if ever, provide uniform quantities and qualities of resinous material, but the shape of the wood is thought to play a part in customer selection. Segments and smaller pieces of agarwood, ranging in size from branch or trunk sections to chips or flakes, are the most sought after by consumers from the Middle East.

Agarwood chips and flakes are the most common forms of agarwood in trade. Only 10-20% of a large slab or piece of agarwood can be drawn into chips and flakes, with the remainder sold as powder/dust or used for oil distillation. The distinction between agarwood powder and flakes is largely a question of size. Flakes include shavings or pieces that have broken off during harvesting and transport, as well as small pieces produced deliberately. Agarwood powder is normally a fine powder of even particle size and should not be confused with the much cheaper waste powder, which is a by-product of oil distillation (see below). Powder is very susceptible to adulteration, and is often mixed with powder from healthy *Aquilaria* wood. Not surprisingly, agarwood powder is generally much less expensive than chips or flakes, with prices varying from around USD20-60/kg.

Agarwood oil is a highly valuable and frequently traded product. Oil is produced by steam distillation of generally low-grade agarwood chips and powder. Although distillation is a cost-effective method of using secondary agarwood products, oil yields are generally very low and the extraction process is reported to be very tedious and time-consuming. The major constituents of agarwood oil are sesquiterpenes (Jantan, 1990), the chemical structure of which makes them very difficult, and hence extremely expensive, to synthesize (D. Erhardt, Senior Chemist, TRP Agarwood Project, pers. comm. to Heuveling van Beek, cited in Heuveling van Beek and Phillips, 1999). Although synthetic agarwood compounds are used to produce poor-quality fragrances and incense sticks, there are currently no synthetic substitutes for high-grade

incense or oil. Synthetic agarwood oil sells for less than USD100/kg (Heuveling van Beek and Phillips, 1999).

Grading of agarwood in trade

Agarwood is not a uniform product, but instead possesses different characteristics. It is classified according to various grading systems that differ according to the product in trade and country in which trade is taking place. The grade (and hence value) of agarwood and agarwood derivatives such as oil is determined by a complex set of factors including: country of origin; fragrance strength and longevity; wood density; product purity; resin content; colour; and size of the form traded.

The type and number of agarwood grades used within a given country may vary widely. One large dealer in Singapore, for example, usually offers flakes or chips from five or six countries, the agarwood from each country divided into three to five grades (Heuveling van Beek and Phillips, 1999). The chemical components of different grades have been studied (Ishihara *et al.*, 1991, cited in Ng *et al.*, 1997). Yoneda *et al.* (1984, cited in Ng *et al.*, 1997) suggested that the chemical profile of agarwood varies according to species. Whether or not this is the case, it is primarily the country of origin and quality of wood, and not necessarily the species from which agarwood is derived, that is of greatest importance to consumers and hence traders.



Credit: Tommy Soehartono

A registered trader drying and sorting agarwood chips in Jakarta, Indonesia

One Dubai-based agarwood dealer interviewed in Mumbai considered that the best quality of agarwood was obtained (assuming supplies existed) from the following range States, in order of decreasing value: Bhutan, India, Myanmar, Lao PDR, Cambodia, Vietnam, and Indonesia. A similar order of preference was given by the largest agarwood-trading company in India with respect to agarwood destined for the Middle Eastern market, although the company reported agarwood from Assam to be the most sought after (Heuveling van Beek and Phillips, 1999). Ng *et al.* (1997) reported that the highest-quality agarwood is that obtained from *Aquilaria baillonii* (Cambodia), *A. crassna* (Thailand), *A. grandiflora* (Hainan, China) and *A. agallocha*, which they considered to be a variant of *A. malaccensis* found in Bangladesh, Bhutan, Myanmar, and, in India, in Assam and the north-eastern border districts. Consumers and traders in Taiwan believe that the highest qualities of agarwood are sourced from Sumatra, Borneo and from some other islands in the Malay Archipelago (TRAFFIC East Asia-Taipei *in litt.* to TRAFFIC International, 2 May 2000).

Heuveling van Beek and Phillips (1999) have observed that consumers in different countries have different priorities for assessing the qualities of agarwood, which relate to its intended use. Customers from the Middle East consider fragrance to be the most important quality and in India a significant quantity of agarwood oil is used for perfumery, hence odour quality is of prime importance. Consumers from Taiwan buy substantial quantities of agarwood for medicinal purposes and in such cases it is not the fragrance of agarwood but the quantity and composition of resinous material in the wood that is of greatest importance (Heuveling van Beek and Phillips, 1999).

Within Taiwan, the quality of agarwood is assessed according to whether or not it sinks in water. The Chinese word for agarwood (*Ch'en Hsiang/Chenxiang/Chen Xiang*) literally means 'wood that sinks'. Agarwood pieces which sink are assumed to have a higher resin content (and hence be of a higher grade) than those which float. Agarwood's 'performance' in water is cited to consumers as a reflection of its quality, though the sinking test is rarely demonstrated for the customer. 'Floating' pieces are more common in Taiwan than 'sunken' pieces because they are less expensive. Burning a small sample of the agarwood is the most popular method of further determining the grade of 'sunken' or 'floating' pieces, since resin can be seen to exude with a bubble-like appearance when the wood is burnt. This also gives the consumer an opportunity to assess the fragrance before purchase (TRAFFIC East Asia-Taipei, *in litt.* to TRAFFIC International, 2 May 2000). The highest grade is known as *Chi-Nan* and is virtually unavailable, believed to be a result of over-harvesting. On the very rare occasions that it is offered for sale, it is reported to cost over USD11 500/kg. The second-best quality (*Hui-An*) is sourced from Vietnam.

It was reported that many agarwood collectors bury immature agarwood in the soil for several months to encourage decomposition. This gives it a blackened flaky consistency, and the resulting product can be sold as low-grade agarwood (Heuveling van Beek and Phillips, 1999).

According to Heuveling van Beek and Phillips (1999), agarwood oil is graded based on the quality of raw materials, the method of distillation and the skill used in processing. It is said to be now virtually impossible to find pure agarwood oil (although a supposedly pure sample was received by TRP from a large international agarwood-trading group in Dubai). Traders have quoted prices for pure agarwood oil as high as USD30 000/kg, such oil only being made to order. Grade-two oil costs approximately USD15 000/kg, but generally oil prices are between USD5000/kg and USD10 000/kg. However, cheaper oils, adulterated with perhaps a mixture of sandalwood and sesame seed oil, can be bought for a few hundred dollars per kilogramme. Few traders nowadays, if any, can assess oil quality or purity and it is unlikely that there is much consistency between oil batches. Only one large agarwood-trading company appears to be capable of testing oil purity using gas chromatography and high performance liquid chromatography.

Uses of agarwood

Agarwood has three principal uses: medicine, perfume and incense. Smaller quantities are used for other purposes, such as carvings. These uses are described in more detail below.

Use in medicine

Agarwood has been used for medicinal purposes for thousands of years, and continues to be used in Ayurvedic, Tibetan and traditional East Asian medicine, for example (Chakrabarty *et al.*, 1994; Fratkin, 1994). The *Sahih Muslim*, which dates back to approximately the eighth century, refers to the use of agarwood for the treatment of pleurisy and its use is referenced in the Ayurvedic medicinal text the *Susruta Samhita*. Agarwood is prescribed in traditional East Asian medicine to promote the flow of *qi*, relieve pain, arrest vomiting by warming the stomach, and to relieve asthma (Anon., 1995a). High-grade agarwood powder is prescribed in Chinese medicine (Yaacob, 1999) and is also used in the production of pharmaceutical tinctures (Heuveling van Beek and Phillips, 1999). Burkill (1966) reported that Malaysians used agarwood mixed with coconut oil as a liniment, and also in a boiled concoction to treat rheumatism and other body pain. Chakrabarty *et al.* (1994) report that the often-discarded uninfected wood is used as *Kayu gaharu lemppong* by Malaysians to treat jaundice and body pains. Bull (1930, cited in Chakrabarty *et al.*, 1994) notes agarwood's use as a complex ointment for smallpox and for various abdominal complaints. Agarwood is also prescribed for dropsy, as a carminative, a stimulant, for heart palpitations, and as a tonic

taken particularly during pregnancy, after childbirth and for diseases of female genital organs (Chakrabarty *et al.*, 1994).

Use in perfume

The use of agarwood for perfumery extends back several thousands of years, and is referenced, for example, in the *Old Testament* several times using the term 'aloes'. Both agarwood smoke and oil are customarily used as perfume in the Middle East (Chakrabarty *et al.*, 1994). In India, various grades of agarwood are distilled separately before blending to produce a final 'attar'. *Minyak attar* is a water-based perfume containing agarwood oil, which is traditionally used by Muslims to lace prayer clothes (Yaacob, 1999).



Agarwood perfume, chips and powder in Malaysia, 1999

Credit TRAFFIC, Awang Anok

Agarwood perfumes are seldom pure agarwood oil, but instead use an alcoholic or non-alcoholic carrier, such as sandalwood oil. The cheapest agarwood perfumes are either synthetic or a blend of oils, each with different qualities and fragrances. Although there are several commercially available synthetic agarwood fragrance compounds, they can produce only low-quality agarwood fragrances, owing to

the chemical structure of natural oil (Heuveling van Beek and Phillips, 1999). Agarwood essences have recently been used as a fragrance in soaps and shampoos (Kadir *et al.*, 1997, cited in Schippmann, 1999). Agarwood is said to have been highly prized by European perfumers in the mid-1990s (cited in Chakrabarty *et al.*, 1994).

Use in incense

Agarwood incense is burned to produce a pleasant aroma, its use ranging from a general perfume to an element of important religious occasions. Irregular chunks of agarwood, usually a few centimetres long and weighing 10-200 g, may be cut or broken into smaller pieces and then burned, usually in a specially made incense burner (Heuveling van Beek and Phillips, 1999). Agarwood powder and dust cannot be burned directly in incense holders, but can be used to make incense sticks or coils for indoor fragrance, and are used for religious purposes by Muslims, Buddhists and Hindus (Yaacob, 1999).

Taiwanese consumers purchase agarwood for the manufacture of incense sticks, which are used in

Credit TRAFFIC East Asia-Taipei/Michael Song



Agarwood incense sticks on display in Taiwan, 1998

prayers during many traditional festivals and ceremonies to bring safety and good luck (TRAFFIC East Asia-Taipei, *in litt.* to TRAFFIC International, 2 May 2000). Both Indians and Chinese have used agarwood as an essential ingredient of incense sticks in the past, but in the present day incense sticks generally do not contain agarwood, although Indian traders report that high-quality Indian incense sticks destined for export may have a drop of agarwood oil added to them (Chakrabarty *et al.*, 1994). Agarbattis are incense cones, which also originally contained agarwood powder but seldom do so now because of the high price of agarwood. Instead, the light cream/brown powdery waste material obtained from oil distillation (with little or no resin content) is used to provide a basic carrier for other, cheaper, fragrant ingredients. This waste agarwood powder sells for around USD5/kg.

Japanese incense products are very different, with most of the highest-grade products made using natural raw materials which include ground agarwood extracts combined with other ingredients such as sandalwood and benzoin and then carefully moulded and baked. Pure agarwood is also burned as incense in Japan. The user breaks pieces off and burns small pieces as required, hence large sections of wood will last several years (Heuveling van Beek and Phillips, 1999). In Japan, a revival in the ancient art of *Koh doh*, the incense ceremony, has revitalised interest in agarwood (Katz, 1996).

In Malaysia, Muslims burn agarwood splinters or chips to produce incense during special religious occasions, particularly at gatherings, and agarwood incense has been recorded in use there during Ramadan prayers (Chakrabarty *et al.*, 1994). Some Malay tribes fumigate paddy fields with agarwood smoke to appease local spirits (Chakrabarty *et al.*, 1994).

Agarwood incense is used for various purposes in the Middle East, especially during prayers (Yaacob, 1999). Agarwood chips and splinters are also burned in bathrooms and incense is used as a customary perfume. Party hosts place agarwood chips over hot charcoals, the aroma signifying the end of a party.

Other uses

Burkill (1966) reported that grated agarwood has been used in Malaysia for cosmetic purposes, particularly during sickness and after childbirth. The use of agarwood bark as a writing material has also been documented extensively and agarwood is used for chronicles of important and sacred religious books. Use as a substitute for paper is also known from the mountaineers of Annam (Vietnam) and from China (Chakrabarty *et al.*, 1994). Twine is reported to be made from *Aquilaria* in Malacca (a province of Malaysia) (Chakrabarty *et al.*, 1994).

Although it may be possible to use healthy *Aquilaria* wood to make simple ornamental boxes, this wood is typically too light and fibrous (rather like balsa wood) to be suitable for furniture, construction or even carving. Some foresters in India have suggested using *Aquilaria* wood for constructing tea-boxes (Chakrabarty *et al.*, 1994). *Aquilaria* bark was reportedly used for this purpose during the nineteenth century (Heuveling van Beek and Phillips, 1999). There is a considerable number of craft shops offering religious 'agarwood' sculptures, usually Buddhist figures. Although a proportion of immature agarwood is used in this trade, most statues are not made with agarwood, owing to its soft and flaky properties, which make it unsuitable for carving. Instead, tropical hardwoods are treated to resemble agarwood. The wood



Agarwood incense burner with a piece of *Aquilaria* wood alongside

is blackened by injecting oil or tar into tree trunks and may also be impregnated with agarwood perfume (Heuveling van Beek and Phillips, 1999). Agarwood is used to produce statues and religious objects (e.g. statues of Buddha) in Taiwan (TRAFFIC East Asia-Taipei, *in litt.* to TRAFFIC International, August 1999).

As with carvings, most agarwood rosary and ‘worry beads’ offered for sale are fake, owing to the cost of shaping and drilling perfectly round beads of authentic agarwood. Instead, other dark woods may be submerged in agarwood oil for several weeks until the fragrance of agarwood has been absorbed and these are then used in place of agarwood. Authentic agarwood bead necklaces cost approximately USD1500/kg (Heuveling van Beek and Phillips, 1999).

Agarwood is used as an aromatic ingredient of *Chu-yeh Ching* and *Vo Ka Py* wine in Taiwan (TRAFFIC East Asia-Taipei, *in litt.* to TRAFFIC International, May 1999). Agarwood powder is known to be sprinkled on clothes and skin as an insect repellent effective against fleas and lice (Heuveling van Beek and Phillips, 1999). The *Sahih Muslim* refers to the use of agarwood for fumigation purposes.

Agarwood may also be added to funeral pyres (Chakrabarty *et al.*, 1994) and is used in the preparation of bodies for burial (Yaacob, 1999). In Malaysia, it is used as a libation ingredient poured at gravesides (Chakrabarty *et al.*, 1994).

INTERNATIONAL TRADE IN AGARWOOD AND AGARWOOD PRODUCTS

The main product of *Aquilaria* species in international trade is the fragrant agarwood and its derivatives. Agarwood from *Aquilaria* species, including *A. malaccensis*, is traded under several names including agar, aloeswood, eaglewood, *gaharu* and *kalamabak*. The variety of trade names increases the difficulty of trade monitoring. Agarwood is mainly traded as wood, wood chips, powder and oil. Although not identified in CITES trade data, finished products such as perfumes, incense and medicines are also traded internationally (and domestically).

One of the earliest supplies of agarwood is believed to have originated from the Indian hills of Assam, sourced from *Aquilaria agallocha* (Burkill, 1966). This species is considered a synonym for *A. malaccensis* (e.g. see Anon., 1994; Anon., 1998a; Ng *et al.*, 1997; Schippmann, 1999), although some believe *A. agallocha* to be a distinct species (e.g. see Debnath *et al.*, 1995). The trade extended rapidly to the West and East, expansion to the East resulting in the discovery of new sources of agarwood. During this period of trade expansion, whilst the main source of agarwood from Malaya was *A. malaccensis*, in Sumatra and Borneo, agarwood was derived from *Gonystylus* spp. (Burkill, 1966). The first known account of international trade in agarwood was compiled by a Chinese Customs official in 1200 A.D., and shows agarwood to have been supplied to China from Borneo, Sumatra, Java, the Malay Peninsula and Cambodia (Chakrabarty *et al.*, 1994). More recent agarwood trade patterns are summarised below.

International trade in *Aquilaria malaccensis*

CITES annual report data for trade in *Aquilaria malaccensis* are summarized in **Table 1**. Thus far, CITES annual reporting for trade in *A. malaccensis* has been inconsistent and, in the case of many consumer countries, non-existent. The accuracy of CITES annual report data for trade in *A. malaccensis* is compromised not only by lax reporting, but also by the difficulty in identifying agarwood to species level. More than one agarwood-producing species of the genus *Aquilaria* occurs and is harvested in key *A. malaccensis*

range States. Identification of agarwood to species level is beyond the abilities of most enforcement staff: the distinguishing characteristics of agarwood in trade are not species-related, but relate rather to the quantity and type of resin content. As a result, agarwood declared as *A. malaccensis* could be composed of other *Aquilaria* species, and agarwood not declared as such could yet contain material from the species.

The Government of Indonesia has responded to this situation by requiring CITES export permits for most agarwood exports, with the result that reported exports of *A. malaccensis* from Indonesia are likely to include not only that species, but also agarwood from other *Aquilaria* species. It seems likely that some exports from Malaysia covered by CITES permits also include species other than *A. malaccensis*. Alternatively, it is also possible that *A. malaccensis*, declared as other species, is being exported without accompanying CITES permits. As explained in **Methods**, the data that follow should, therefore, be considered as general indicators of the trade in agarwood, and specifically in *A. malaccensis*, rather than as accurate reflections of trade volumes.

Of the 14 known or possible range States for *Aquilaria malaccensis*, all but two - Bhutan and Lao PDR - are Parties to CITES. Of the 12 Party range States, four - Indonesia, Malaysia, Singapore and Thailand - have recorded exports/re-exports of *A. malaccensis* in their CITES annual reports. CITES annual report data for this period for both Malaysia and Thailand are likely to under-reflect total export volumes of the species from these two countries. In the case of Malaysia, CITES annual reports had only been submitted by Peninsular Malaysia at the time of writing. Export data for Sarawak, which is known to export significant quantities of agarwood, and for Sabah, were therefore unavailable. Sarawak is believed to have submitted annual reports for the period from 1995 to 1997 to the CITES Secretariat in March 2000. These data were not available for this report with the effect that Sarawak's CITES-reported trade is not shown below. CITES annual report data show the export of less than one tonne of *A. malaccensis* from Thailand from 1995 to 1997, in contrast to the over 177 t of agarwood imported from Thailand recorded in Taiwan's Customs statistics during this same period. Although these Customs data are not specific to species, it seems likely that at least some of this trade involved *A. malaccensis*.

Of the 15 Parties to which *Aquilaria malaccensis* was exported between 1995 and 1997, according to CITES annual report data, only five recorded *A. malaccensis* imports. These Parties were Canada, India, Hong Kong, Japan and Singapore (see **Table 1**). Those Parties reported as export destinations but which did not report corresponding imports were Bangladesh, China, Egypt, Indonesia, Republic of Korea, Morocco, Saudi Arabia, Spain, Thailand and United Arab Emirates (see **Table 1**). Of these, three had not provided CITES annual reports for the years in which exports had been reported (Bangladesh, Egypt and Saudi Arabia). Four non-Parties (Bhutan, Kuwait, Oman and Qatar) were recorded as export destinations, as was Taiwan.

CITES annual report data show a total net trade of agarwood in raw and semi-processed form (i.e. timber, chips and powder) of over 1350 t from 1995 to 1997. This trade is only a fraction of the total world trade in agarwood, as demonstrated by Customs import data from Taiwan, which show imports totalling approximately 2050 t of agarwood during this same period. Information is insufficient to identify the percentage of these imports likely to have involved *Aquilaria malaccensis*.

Table 1
Importers and/or exporters of *Aquilaria malaccensis* from 1995 to 1997, according to CITES annual report data

Country/territory	CITES Party	Annual reports provided to WCMC (4/99)	Basis for annual reporting	Agarwood range State?	Annual reports show imports/exports re-exports	Reported trade of other Parties indicate imports/exports
Bangladesh	Yes	--	Actual trade	Yes	N/A	Yes (1995, 1996, 1997)
Bhutan	No	N/A	N/A	Yes	N/A	Yes (1995, 1996, 1997)
Cambodia	Yes ¹	--	?	No	N/A	Yes (1995)
Canada	Yes	1995, 1996, 1997	Permits issued ²	No	Yes (1996)	Yes (1996)
China	Yes	1995, 1996, 1997	Actual trade (imports); Permits issued (exports)	No	No	Yes (1995, 1996)
Egypt	Yes	1996, 1997	?	No	No	Yes (1995)
Hong Kong	Yes ³	1995, 1996	Permits issued	No	Yes (1995, 1996)	Yes (1995, 1996, 1997)
India	Yes	1995, 1996, 1997	?	Yes	Yes (1996)	Yes (1995, 1996, 1997)
Indonesia	Yes	1995, 1996, 1997	Permits issued (1995, 1996); Actual trade (1997)	Yes	Yes (1995, 1996, 1997)	Yes
Iran	Yes	1995, 1996, 1997	?	Yes	No	No
Japan	Yes	1995, 1996	?	No	Yes (1995)	Yes (1995, 1996, 1997)
Republic of Korea	Yes	1995, 1996, 1997	Permits issued	No	No	Yes (1995, 1996, 1997)
Kuwait	No	N/A	N/A	No	N/A	Yes (1995, 1996, 1997)
Lao PDR	No	N/A	N/A	Yes (?)	N/A	No
Malaysia - Peninsular Malaysia	Yes	1995, 1996, 1997	?	Yes	Yes	Yes
Malaysia - Sabah	Yes	--	?	Yes	N/A	?
Malaysia - Sarawak	Yes	--	?	Yes	N/A	?
Myanmar	Yes ⁴	--	?	Yes	N/A	?
Morocco	Yes	1995, 1996, 1997	Permits issued	No	No	Yes (1995, 1997)
Oman	No	N/A	N/A	No	N/A	Yes (1995, 1997)
Philippines	Yes	1995, 1996, 1997	?	Yes	No	No
Qatar	No	N/A	N/A	No	N/A	Yes (1995, 1996, 1997)
Saudi Arabia	Yes	--	?	No	N/A	Yes (1995, 1996, 1997)
Singapore	Yes	1995, 1996, 1997	Permits issued	No	N/A	Yes (1995, 1996, 1997)
Spain	Yes	1995, 1996, 1997	Actual trade	Yes	Yes (1995, 1996, 1997)	Yes (1995, 1996, 1997)
Thailand	Yes	1995, 1996, 1997	Actual trade (imports); Permits issued (exports)	No	No	Yes (1997)
United Arab Emirates	Yes	1997	?	Yes	Yes (1997)	Yes (1995, 1996, 1997)
Vietnam	Yes	1995	?	Yes (?)	No	Yes (1995, 1996, 1997)

¹ Cambodia's accession to CITES was effective 2 October 1997. ² Hong Kong submitted CITES annual reports under the UK's CITES membership until 1996; Hong Kong became a special administrative region of the People's Republic of China in mid-1997. ³ Myanmar's accession to CITES was effective 1 September 1997.

All CITES-reported trade was recorded as being for commercial purposes and recorded in terms of weight. Percentages by weight of the total amount of agarwood traded (from 1995 to 1997) for various forms of agarwood were: chips, 95.95%; timber, 2.99%; powder, 1.04%; and oil, 0.02%. Over 90% of *Aquilaria malaccensis* reported in trade was reported to be of wild origin. There are no records of artificially propagated *A. malaccensis* in trade. The origin of re-exported, pre-Convention stocks of *A. malaccensis* to 15 countries by Hong Kong and Singapore was generally not reported.

Countries of export for *Aquilaria malaccensis* in international trade

CITES annual report data indicate that Indonesia and Malaysia are the main sources of *Aquilaria malaccensis* in trade, with total CITES-reported exports of approximately 923 t and 341 t, respectively from 1995 to 1997 (see **Table 2**). Heuveling van Beek and Phillips (1999) similarly identify these two countries as the primary suppliers of agarwood to international markets. Indonesia's role as a supplier of agarwood to international markets is further confirmed by Customs data from Taiwan, which show imports of nearly 3000 t of agarwood (species unknown) originating from Indonesia between 1993 and 1998. Of this, approximately 1100 t were imported between 1995 and 1997. This contrasts with a reported total of 923 t of *A. malaccensis* exported by Indonesia to all destinations during that period. This discrepancy is not explained by re-exports of Indonesian agarwood by Singapore: CITES-reported exports/re-exports of *A. malaccensis* from Singapore to Taiwan from 1995 to 1997 totalled only 402 t. It is probable that some of Taiwan's reported imports from Indonesia represent agarwood from species other than *A. malaccensis*, but further information would be required to confirm whether this is the case.

As noted above, Malaysia's share of the trade may be larger than indicated by CITES data: close to 500 t of agarwood were recorded in CITES permit data as exported from Sarawak alone in 1998, significantly exceeding Malaysia's total CITES-reported trade in the product for the previous three years, which only reflects exports from Peninsular Malaysia (see below). Taiwan's Customs data corroborate CITES data in terms of Malaysia's status as agarwood exporter, recording approximately 190 t imported from that country from 1993 to 1998.

Although CITES annual report data do not show exports from India, Indian Customs data record exports of *Aquilaria* spp. from this country for 1995, 1996 and 1997. Taiwan's Customs data show imports of agarwood from India between 1993 and 1998 and these seem likely to have included *A. malaccensis*.

Table 2

***Aquilaria malaccensis* imports and exports (kg) from range States as reported in CITES annual report data from 1995 to 1997**

Range State	Year	Imports reported from range States	Exports reported by range States
Indonesia	1995	500	323 577
	1996	214 095	293 593
	1997	0	305 483
Peninsular Malaysia	1995	116 581	90 478
Malaysia	1996	157 713	163 107
	1997	90 830	87 230
Thailand	1997	216	244

Source: CITES annual report data compiled by WCMC and TRAFFIC International

Taiwan's Customs data also show Cambodia, Thailand and Vietnam as major countries of origin for agarwood, reported imports from each of these countries exceeding 300 t, from 1993 to 1998, with imports from Vietnam topping 500 t (see **Table 3**). It seems likely in the case of Cambodia and Vietnam that the exports involved agarwood species other than *Aquilaria malaccensis*, as the former country is not a range State and the latter country is unlikely to be one.

Table 3**Imports of *Aquilaria* spp. into Taiwan (kg)**

Country of origin/export/re-export	1993	1994	1995	1996	1997	1998	Total
Australia	0	0	100	0	0	0	100
Other Australasian countries	0	190	0	0	0	0	190
Cambodia	3 822	54 737	133 819	73 512	35 953	13 244	315 087
Canada	0	0	0	0	0	10 504	10 504
Hong Kong	200	60	0	0	37	0	297
India	375	21 074	27 500	1 908	6 279	545	57 681
Indonesia	661 265	491 190	482 874	336 946	302 032	555 229	2 829 536
Lao PDR	0	1 850	0	0	0	0	1 850
Madagascar	29	0	0	0	0	0	29
China	11 135	15 454	4 009	7 507	5 272	3 371	46 748
Malaysia	43 630	35 451	28 287	44 041	21 275	18 543	191 227
Pakistan	0	0	0	203	0	0	203
Singapore	32 821	34 276	46 179	8 063	9 442	3 067	133 848
South Africa	0	0	7 540	0	0	0	7 540
Switzerland	100	0	0	0	0	0	100
Thailand	539	83 124	68 342	67 028	42 680	65 570	327 283
USA	688	100	6	9	461	250	1 514
Vietnam	19 681	84 779	103 068	91 129	96 427	136 685	531 769
Total	774 285	822 285	901 724	630 346	519 858	807 008	4 455 506

Source: Taiwan Customs data compiled by TRAFFIC East Asia - Taipei

Lao PDR and Myanmar are also considered to be important sources of agarwood in international trade according to Heuveling van Beek and Phillips (1999). Available data did not show significant exports from these two countries. No trade appeared in CITES data, and Taiwan's Customs statistics showed the import from Lao PDR of under two tonnes of agarwood between 1993 and 1998 and no imports from Myanmar. Further research is needed to document more fully the role of these two countries in the trade.

More detailed information on exports of agarwood from range States for *Aquilaria malaccensis* is provided below under individual country sections.

Primary CITES-reported destinations for *Aquilaria malaccensis* in international trade

According to CITES annual report data, the top 10 export/re-export destinations for *Aquilaria malaccensis* chips, powder and timber between 1995 and 1997, were: Singapore (1113 t); Taiwan (402 t); Hong Kong (150 t); Saudi Arabia (129 t); United Arab Emirates (129 t); India (49 t); Japan (38 t); Oman (23 t); China (13 t); and Qatar (10 t) (see **Table 4**). A further 10 countries were recorded as export or re-export destinations for smaller amounts of *A. malaccensis* chips, powder and timber, totalling less than 10 t for the period. Singapore plays a central role as an entrepot in the agarwood industry, with the majority of *A. malaccensis* imported subsequently re-exported in its original or a more processed form. Saudi Arabia is reported as the destination for most of the oil (379 kg) recorded in CITES annual report data.

Table 4

Trade in *Aquilaria malaccensis* (kg) by country of import

Country	Year	Chips, powder and timber		Oil	
		Imports reported by country of import	Exports/re-exports to country of import reported by country of export/re-export	Import reported by country of import	Exports/re-exports to country of import reported by country of export/re-export
Bangladesh	1995		1 170		
	1996		1 646		
	1997		3 420		
Bhutan (NP)	1995		20		
	1996		72		
	1997		574		
Canada	1996*	125	125		
China	1995*	0	9 800		
	1996*	0	3 144		
Egypt	1995		9 000		
Hong Kong	1995*	25 855	40 275		
	1996*	47 256	57 357		
	1997		52 770		
India	1995*	38	14 454		
	1996*	0	15 184		
	1997*	0	19 364		
Indonesia	1996*	0	1 440		
Japan	1995*	6 629	11 159		
	1996*	0	22 302		
	1997		4 758		
Republic of Korea	1995*	0	375		
	1996*	0	80		
	1997*	0	135		
Kuwait (NP)	1995		1 532		
	1996		1 515		
	1997		2 994		
Morocco	1995*	0	197		
	1997*	0	301		
Oman (NP)	1995		12 788		2
	1997		10 613		
Qatar (NP)	1995		3 018		
	1996		1 285		
	1997		5 249		
Saudi Arabia	1995	N/A	39 885	N/A	377
	1996		13 307		
	1997		75 392		2
Singapore	1995*	116 581	345 677		
	1996*	375 882	417 130		
	1997*	91 046	350 158		
Spain	1997*	0	70		
Taiwan (NP)	1995		211 308		1
	1996		69 756		
	1997		121 302		
Thailand	1997*	0	3 566		
United Arab Emirates	1995		51 256		2
	1996		25 388		
	1997*	0	52 429		

* annual reports received; NP = non-Party

Source: CITES annual report data compiled by WCMC and TRAFFIC International

Taiwan was the largest final market for *Aquilaria malaccensis* reported in CITES trade data from 1995 to 1997. Readily available information on the use and trade of agarwood in Taiwan was therefore incorporated into this report to provide further information on Taiwan's markets. This included Taiwan's Customs statistics, which are relatively detailed, including Customs codes for several forms of agarwood. As a result, the role of Taiwan in the agarwood trade is comparatively well-documented, in contrast to that of several other important consumer markets that may in fact play a larger role in the international trade. Further research is required in order to assess the importance and nature of other consumer markets identified during this study.

TRAFFIC East Asia
Taipei/Michael Song



Agarwood chips photographed in Taiwan, January 1999

According to CITES annual report data, Taiwan was an export destination for *Aquilaria malaccensis* chips, powder and timber for each of the years from 1995 to 1997. Exports to Taiwan totalled approximately 402 t of chips, powder and timber from 1995 to 1997 (211 t in 1995, 70 t in 1996, 121 t in 1997) and one kilogramme of oil in 1995. Of this total, approximately 116 t were exported directly to Taiwan from Indonesia. All but approximately one tonne of the remainder was re-exported to Taiwan from Singapore, and was reported as having originated in Cambodia, Indonesia, Malaysia and Vietnam. Trade in *Aquilaria malaccensis* has been regulated in Taiwan since 1998 when all CITES Appendix II-listed flora were added to the Notes of the *Consolidated List of Commodities Subject to Import and Export Restriction & Commodities Entrusted to Customs for Import and Export Examination* (Document No. Trade (87)-07691) (Anon., 1999).

Taiwan's Customs data indicate that it is also a major market for agarwood from other species. Customs data contain three different categories (codes) for agarwood: 'TCM agarwood' (agarwood in virtually any form whether or not cut, crushed or powdered, intended primarily for pharmaceutical or perfumery purposes); 'Agarwood chops' (chipped or segmented pieces with a thickness exceeding six millimetres); and 'Agarwood timber' (all rough unprocessed agarwood, but which may have been squared) (TRAFFIC East Asia-Taipei, *in litt.* to TRAFFIC International, May 1999). These data primarily document imports by country of origin, though in some cases, as demonstrated by imports from Singapore, country of re-export has been recorded. Most of the agarwood imported into Taiwan is used for medicinal purposes and the manufacture of incense (TRAFFIC East Asia-Taipei, *in litt.* to TRAFFIC International, August 1999).

Taiwan's Customs data show that over 4450 t of agarwood were imported by Taiwan from 1993 to 1998, with no clear trends. Imports for 1995 to 1997, the period for which CITES annual report data were available for *A. malaccensis*, totalled approximately 2050 t (see **Table 3**). Customs data show that Indonesia was by far the most important country of origin for agarwood imported into Taiwan, with total imports from this country of over 2800 t from 1993 to 1998, over five times the import volume from the next-most important country, Vietnam, from which imports totalled just over 530 t. Thailand, Cambodia and Malaysia were also important sources of agarwood imported into Taiwan.

Most of the agarwood imported into Taiwan was in the form of 'TCM agarwood' and 'Agarwood chops'. Imports of 'Agarwood timber' of Indonesian origin declined from 82 t in 1995 to nine tonnes in both 1997 and 1998. 'Agarwood timber' of Malaysian origin has not been imported since 1995, when 126 kg were

imported. Further research is necessary to see if this reflects a change in the market or a decline in availability of large unprocessed agarwood sections, and hence potentially the decline in *Aquilaria* stocks.

It appears that Taiwan has also acted as a re-exporter of *Aquilaria malaccensis*, as 1996 CITES annual report data for Singapore show the import of approximately four tonnes of chips from Taiwan, this agarwood reported as originating in Indonesia.



Agarwood on display in a shop in Di Hua Street, Taipei, in 1998

Credit: TRAFFIC.A12m

Far fewer trade data were available for other agarwood markets. The Middle East is known to be a major agarwood consumer but CITES data are largely lacking for this region. Based on information on the value of raw products in trade collected through interviews in eight countries, Heuveling van Beek and Phillips (1999) consider that Saudi Arabia and the United Arab Emirates are the two main centres of agarwood consumption (taken to include grading, packing and processing as well as direct consumption), followed by Singapore (for re-export); Taiwan; Japan; India (for re-export); Thailand (for re-export); and Hong Kong (for re-export). It appears therefore that CITES annual report and available Customs data both under-reflect the importance of agarwood consumption in the Middle East and have the effect of artificially inflating the perceived role of Taiwan in the agarwood trade.

HARVEST, TRADE AND CITES IMPLEMENTATION WITHIN KEY *AQUILARIA* RANGE STATES

BHUTAN

Both *Aquilaria malaccensis* and *A. khasiana* are native to Bhutan (Kanjilal and Das, 1940, cited in Gupta, 1999; Oldfield *et al.*, 1998). Research conducted on the agarwood trade in neighbouring India indicates that Bhutanese agarwood is considered to be of high quality. One agarwood dealer based in Dubai, interviewed in Mumbai (India) considered that, of all range States for *A. malaccensis*, Bhutan was the source of the best-quality agarwood. However, supplies are restricted owing to the strict control over forest access and harvest and a ban on exports since 1991. Indian traders believe that there are vast tracts of highly-guarded natural forests containing *A. malaccensis* under the control of the Bhutanese Royal family. Chamling (1996) notes that although agarwood is still found in Bhutan's forests it is considerably less abundant than it once was owing to illegal harvest. CITES annual report data show Bhutan as the export destination for small amounts of agarwood during 1995, 1996 and 1997. Commercial production is no longer reported to occur in Bhutan (Chamling, 1996; Heuveling van Beek and Phillips, 1999).

Trial plantations established in Panbang and Samdrup Jongkha in the 1980s have been successful in terms of growth but not in terms of agarwood production (Chamling, 1996).

Bhutan is not a Party to CITES.

INDIA

Unless otherwise stated, information in this section was obtained from Gupta (1999).

Status and distribution

India is home to two *Aquilaria* species, *A. khasiana* and *A. malaccensis*. *A. khasiana* is found mainly in the Khasi Hills of Meghalaya (Kanjilal *et al.*, 1982). *A. malaccensis* is native to nine north-eastern States: Arunachal Pradesh, Assam, West Bengal, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. The species is typically found growing at altitudes of up to 1000 m, being localized mainly in the foothills and undulating slopes of evergreen and semi-evergreen forests (Chakrabarty *et al.*, 1994). The status of wild *A. malaccensis* has steadily deteriorated with few natural agarwood stocks remaining. According to information gathered by Forest Departments and the Regional Deputy Director of Wildlife Preservation, Eastern region, wild *A. malaccensis* is 'rare' in all of the above-mentioned States (apart from Sikkim and West Bengal where its status was not commented upon). Wild agarwood (known locally as 'agar') was heavily extracted from Arunachal Pradesh between the late 1950s and the early 1980s, virtually exhausting the natural stock. Wild *A. malaccensis* is considered almost extinct in Assam. Surveys undertaken by the Regional CITES Management Authority in Tripura indicate that the natural stock is almost exhausted in that State as well. In Mizoram, *A. malaccensis* grows sporadically in some of the catchment areas of main river tributaries such as Tuivawl. The lack of plantations in Mizoram and Meghalaya has resulted in much illegal harvesting from natural forests. *A. malaccensis* in Nagaland and Manipur is so depleted that a large proportion of the raw agarwood used by processing units in these two States is sourced from neighbouring countries.



Credit: Dr A. K. Gupta for TRAFFIC India

Aquilaria malaccensis trees in India

India's role in the agarwood trade

India was previously the centre of a thriving industry and trade based on agarwood derived from *Aquilaria malaccensis*. Products produced and traded included wood, chips, powder and oil, being used mainly for perfumes, incense, and medicines (including Ayurvedic). Prior to the 1991 export ban on wood and wood products (detailed below), Mumbai served as the main exporting centre to Middle Eastern countries. *A. malaccensis* harvested from north-east Indian States, predominantly Assam, was taken to Hojai in Assam where it was processed into chips, dust and oil. Importers and exporters previously supplied traders in Mumbai and Calcutta, primarily with Assamese agarwood, but suppliers have largely shifted their base to south-east Asian countries, particularly Singapore, owing to the scarcity of Indian agarwood. Traders interviewed reported that the decline in the trade started 15-20 years ago, coinciding with the decline in the availability of high quality Indian agarwood. Even with the decline in trade, however, there is still an agarwood chip, oil and powder processing industry in India. North-east India continues to dominate India's agarwood processing industry, with Assam and particularly Hojai still playing a major role, and Mumbai being the main location from which agarwood is traded and exported. Most of the established exporters in Assam have been involved in the agarwood trade for 90-95 years.

Some of the agarwood processed in India comes from domestic *Aquilaria malaccensis* plantations, both Government-owned and, to a greater extent, privately owned, however domestic production is small in comparison to imports. Traders reported obtaining supplies from the East Garo Hills (Meghalaya), Imphal (Manipur), Nagaland and upper Assam. They described these supplies as being of inferior quality owing to the young age of harvested trees, and hence suitable only for oil distillation. Agarwood from *A. khasiana* is apparently traded in the form of wood and chips. It is noted as being difficult to distinguish from *A. malaccensis*, but is not used to a significant extent in the production of oil.

India's agarwood industry relies primarily on imports from Singapore (the agarwood originating in Indonesia and Malaysia, according to Singapore's CITES annual reports) and, according to information collected from traders, from the neighbouring *Aquilaria malaccensis* range States of Bangladesh, Bhutan and Myanmar, as well as from Cambodia, Lao PDR, Thailand and Vietnam. Agents based in south-east Asian countries are reported to dispatch agarwood supplies to Mumbai periodically, usually accompanied by an agent. Some overseas suppliers are also said to be involved in supplying agarwood to traders and processors in India via air. There are no reports of suppliers based overseas flying agarwood out of India, although there are reports of Indian-based traders exporting agarwood this way.

The agarwood markets of Mumbai are mainly supplied by middlemen who have brought agarwood, mostly in the form of oil, but also as chips, from Assam. Some of the traders interviewed recounted importing and exporting agarwood via Mumbai. Traders are also reported to operate from other north-eastern towns such as Agartala, Imphal, Jorhat, Sibsagar and Silchar. The methods of agarwood shipment include by post (in parcels weighing less than 10 kg), by rail, either accompanied or unaccompanied, and occasionally by road.

According to Heuveling van Beek and Phillips (1999), Indian importers buy many tonnes of grade 5 or 6 agarwood powder for distillation purposes. Many large processing units are located in Assam, Chakrabarty *et al.* (1994) reporting that a total of approximately 200 agarwood oil distilleries operated in the towns of Hojai, Islamanagar and Nilbagan in Naogaon district in 1993. The number of distilleries in current operation is unknown, but interviews conducted suggested that there are currently far more processing units in Assam than in 1993. Unconfirmed local enquiries suggest that there may be more than

1500 processing units in Hojai alone, although, according to available information, the Industry Department has issued licences to only 29 (unlicensed processing units are presumably operating illegally). If this is confirmed, then the number of processing facilities will have increased dramatically following the effective date of the CITES-listing of *Aquilaria malaccensis*.

Surveys indicate that oil distillation is now also undertaken in Calcutta and that raw agarwood is processed into chips in Mumbai. Processing units are also found in Tripura, Arunachal Pradesh, Mizoram, Nagaland and Manipur, the last two alleged to be supplied primarily by smuggled stock from Myanmar and Bangladesh. Traders reported that agarwood is also processed into chips in Dubai by Indian labourers employed there.

Traders in Mumbai reported that agarwood adulteration was common and widespread, and that the most common chip adulterants were 'lodh' (possibly *Symplocos racemosa*) and 'astrang' (possibly *Mandragora officinalum*). Only expert traders can distinguish between genuine agarwood chips and adulterants. Agarwood oil is adulterated with lodh oil, five or six other chemicals and/or agarwood powder that imparts the fragrance of agarwood. Indian traders use the word *kalagasi* to describe *Aquilaria* wood that is mixed with resinous chips to increase weight and hence profit. Previous TRAFFIC India investigations (Anon., 1998a) suggested that the fact that agarwood prices in Delhi and Calcutta are significantly lower than in Mumbai indicates that the product has been adulterated with wood of species more common than *Aquilaria* spp. Agarwood can be skillfully mixed with iron shavings to increase the weight, this adulteration usually remaining undetected until the shavings are deposited during oil distillation. Carbon powder from spent batteries may also be mixed with *Aquilaria* wood to make it resemble high quality agarwood.

Markets and prices

Traditionally, the main perfume traders in Mumbai dealt either in scents derived from woods (oudhs) or in scents derived from flowers (attars). This division does not apply today, with most perfume traders in Mumbai stocking both oudhs and attars, commonly in addition to leather garments and textiles. Most retailers are either Indians or of Middle Eastern descent.

The locations of traditional perfume shops in Mumbai have gradually shifted from Nagdevi Street and Mohammad Ali Road, where they were located in the 1970s, to Colaba. Prominent traders have shops in Colaba and also maintain offices in Nagdevi Street and Mohammad Ali Road. This is reportedly in order to be close to hotels used by Middle Eastern visitors, the primary purchasers of agarwood perfumes. Shops were observed displaying glass cabinets containing various grades of agarwood chips and oil for purchase. The maximum quantity held by any one trader rarely exceeded 100 kg. Most retailers reported holding a licence for stocking a particular quantity of agarwood. Further clarification is required regarding licence requirements.

Virtually all traders estimated the profit margin to be 15% for domestic sales and 20% for international sales.

Agarwood chips in Mumbai are generally available for INR2000-5000/kg (USD47-118/kg). Traders said that chips can actually be obtained for anything between INR200-100 000/kg (USD5-2353/kg). It is very likely that those priced at INR200 are almost certainly fake, heavily adulterated and contain virtually no resin. Chips of the highest grade ('double super') are reportedly available at the border with Myanmar for up to INR60 000/kg (USD1412/kg), rising to INR100 000/kg (USD2353/kg) in the Mumbai market.

Agarwood chips available in a Mumbai medicinal plant market ranged from INR5000-6000/kg (USD118-141/kg). Their authenticity could not be verified. Agarwood oil of varying grades and content was offered for sale at INR20-3000/tola (1 tola=10 g, equating to USD0.5-71/tola or USD47-7059/kg).

North-eastern prices are typically higher than those in Mumbai. Agarwood chips cost INR10 000-50 000/kg (USD235-1177/kg) and dust can be obtained for INR7500-35 000/kg (USD176-824/kg). Manufactured products were also available for purchase. Perfume prices ranged between INR2000-4500/tola (USD47-106/tola or USD4706-10 589/kg), and incense was in the range of INR45 000-55 000/kg (USD1059-1294/kg).

Wholesale agarwood prices are fixed by certain forest divisions in the north-east. The Forest Department collects and reviews existing market prices for the various grades of agarwood from different Divisional Forest Officers to decide the price. The Principal Chief Conservator of Forests then approves these. **Table 5** shows the price ranges allocated by the Assam Forest Department to various grades between 1993 and 1998.

Table 5

Wholesale prices for *Aquilaria malaccensis* fixed by Assam Forest Department

Year	Grade	Price (INR/kg)	Price (USD/kg)	Price adjusted for inflation to 1998 dollars (USD/kg)
1993	1st class Black Agar	30 000	956	1 054
	2nd class Bantang	20 000	638	703
	3rd class Phutas, Kalaguchi	7 500	239	264
	4th class Dhum	100-250	3-8	3-9
1994	1st class Black Agar	65 000	2 072	2 231
	2nd class Bantang	15 000	478	515
	3rd class Phutas, Kalaguchi	7 000	223	240
	4th class Dhum	350	11	12
1998	1st class Black Agar	50 000	1 213	1 213
	2nd class Bantang	30 000	728	728
	3rd class Phutas, Kalaguchi	10 000	243	243
	4th class Dhum	450	11	11

Source: Gupta, 1999

Based directly on the agarwood prices in Indian rupees shown above (therefore not accounting for inflation), between 1993 and 1994 the prices of 2nd class and 3rd class agarwood decreased by 25% and 7%, respectively. However, both the lowest class (Dhum Agarwood) and the highest class (Black Agar) increased in price by between 40-250% and by 117%, respectively, in a single year. The timing of these changes in price corresponded to the submission of the CITES listing proposal for *Aquilaria malaccensis* by India.

Interviews conducted with traders, exporters and suppliers within India indicated that agarwood was available (and therefore available for export) in raw, partially processed and processed forms. The latter include medicine, incense and perfumes. The vast majority of agarwood is exported in the form of oil. Destinations reported by traders included Bahrain, Kenya, Kuwait, Oman, Qatar, Saudi Arabia and the UK.

Reported international trade

Records of trade in *Aquilaria malaccensis* included in India's CITES annual reports for the period 1995 to 1997 are limited to the import of 38 kg of *A. malaccensis* in 1995. However, CITES annual report data provided by Singapore indicate that far larger quantities of *A. malaccensis* have been re-exported to India. Approximately 14 t of chips in 1995, 15 t of chips and powder in 1996 and 19 t of chips and powder in 1997 were reported by Singapore as re-exported to India. These data are corroborated by trade data provided by India's Directorate General of Commercial Intelligence and Statistics, Calcutta, which show the import of 12 t of agarwood chips and dust from 1995 to 1996 and 24 t from 1996 to 1997. Data from the same source show the export from India of over 18 t of agarwood chips and dust from 1995 to 1996, and of nearly 20 t from 1996 to 1997. The species of agarwood in trade is not specified in these data, but it would seem likely that at least some of this trade included *A. malaccensis*. Imports of agarwood from India were not reflected in the CITES annual report data of other Parties.

Domestic harvest and trade controls

The *Indian Forest Act, 1927* regulates domestic harvests and both the intra- and inter-State transport of agarwood. Controls are implemented through a permit system that is managed by the Department of Forestry. Divisional Forest Offices maintain records of licences and permits issued to harvest agarwood from plantations; only a few individuals have obtained such permits. These individuals obtain separate permits to harvest and transport agarwood as and when the opportunity arises rather than setting up registered companies (S.K. Das, pers. comm. to TRAFFIC India, 1999).

Individual States within India have established various harvest control measures, including complete bans on harvests, harvests allowed under lease (*Agar Mahl*) and harvests restricted to private lands. Prior to the CITES listing, it was legal to extract *Aquilaria malaccensis* from most States. Harvesting from Arunachal Pradesh, Assam and Meghalaya is now prohibited by State bans (under the *Indian Forest Act, 1927*), while harvesting in Manipur is restricted by an administrative order. In Tripura, harvesting from government lands has been prohibited since 1994. Mizoram and Nagaland have leased out harvesting privileges (from 1990 to 1993 and from 1991 to 1992, respectively); it is unknown whether lease terms have been renewed (Chakrabarty *et al.*, 1994; Gupta, 1999).

In Tripura, landowners can harvest stock from their private plantations if they obtain a Harvest Permit issued by the Forestry Department. Such landowners can then apply, again to the Forestry Department, for a Transit Pass (TP) enabling them to transport their stock to a 'safer place' within Tripura. There was no record of TP holders ever having subsequently approached the Forest Department for a TP to transport the same consignments on to another Indian State.

In Manipur, a TP is issued for agarwood harvested from the East Garo Hills (Meghalaya) by the Williamnager Range Forest Officer at a cost of INR2000/50 kg (USD47/50 kg). Some suppliers and traders reported that, as well as a TP issued in Manipur, the Maharashtra Forest Department issue an additional TP for transport within Maharashtra.

In Assam, Lieu Transit Passes (LTPs) are issued by the Assam Forest Department to those who have legally transported agarwood from neighbouring States (primarily Manipur, Mizoram and Nagaland). LTPs are issued upon the presentation of a valid TP issued in another State. LTPs allow the transportation of agarwood to any destination within Assam. There are reports, however, of traders illegally harvesting

agarwood from, and managing to obtain a TP in, Nagaland, Manipur, Mizoram and Arunachal Pradesh. The TP obtained under false pretences is then used to obtain a LTP in Assam.

Processing units in Assam are required to be licensed by the Industry Department. The Industry Department does not liaise with the Forest Department regarding the availability and source of raw agarwood and it is not mandatory for processing units to declare their source of raw of supply.

The Forest Department of Tripura has the authority to issue licenses enabling the establishment of processing units. Although many traders have approached the Forest Department in this regard, all applications have been rejected, principally due to the lack of a regular source of raw agarwood.

The Forest Department is responsible for domestic seizures, while Customs authorities and the Border Security Force are responsible for seizures at borders and airports. In most cases, Customs and the Border Security Force turn over seized consignments to Forest Department officials for prosecution under the *Indian Forest Act*. Cases are referred to either the Court of Sub-divisional Judicial Magistrate or are adjudicated departmentally through the Forest Department. Departmental adjudication is typically used to penalize offenders with no previous history of forestry-related offences. A fixed compensation fee and a fine of at least twice the current market value of the seized consignment is imposed. If found guilty, offenders are subject to a fine and/or imprisonment.

The fate of seized consignments varies with each State. Goods seized in Assam are released into the custody of the Forest Department for public auction, and if the case was referred to court, the auction proceeds are allocated to the Government Treasury as per the court's directives. In Tripura, virtually all seized consignments are stockpiled by the Forestry Department who consider that auctioning stock offers the offender an opportunity to buy back their seized consignment. Customs authorities interviewed in Mumbai report that any seized consignments would be stockpiled.

International trade controls

CITES is implemented in India through a combination of the *Wildlife Protection Act, 1972/1991*, the Export and Import Policy (EXIM) (*Import and Export Control Order, 1955*) of the *Foreign Trade (Development and Regulation) Act, 1992*, and the *Customs Act, 1962*.

Indian-based importers of agarwood must present proof of legal origin (Legal Procurement Certificate) at the time of import to obtain a Transit Permit (TP), which is required for all forest products regardless of origin. Some agarwood shipments being imported into India have been seized at border posts under the *Indian Forest Act 1927*, presumably owing to lack of sufficient proof of legal origin.

The Additional Inspector General of Forests (Wildlife) of the Ministry of Environment and Forests is the central CITES Management Authority. There are also regional Management Authorities competent to issue CITES permits. The Deputy Director of Wildlife Preservation, Eastern Region, is the Authority responsible for all nine Indian range States of *Aquilaria malaccensis*. The Botanical Survey of India is the CITES Scientific Authority.

The export of *Aquilaria malaccensis* has been prohibited since 1991, when the export of all wood products (including log, timber, chip, powder, flake, dust etc.) of all species was banned through the EXIM policy in force at that time. The current EXIM policy (1993-2002) published by the Directorate General of

Foreign Trade, Government of India, permits the import of *A. malaccensis* (including chips, dust and oil), but maintains the 1991 blanket export ban on Indian-harvested wood products. However, it also specifically regulates the export of *A. malaccensis* via the Negative List of Export of Plants. The Negative List of Export of Plants (as set forth in *Notification No. 24 (RE-98)/1997-2002* dated 14 October 1998) being an amendment to the *ITO (HS) Classification of Export and Import Items 1997-2002*, specifically prohibits the export of 29 native flora species, including *A. malaccensis*. This includes the plants, plant portions, derivatives and extracts obtained from the wild. The export ban on all wild Indian flora species was recently re-communicated to Parties by way of CITES *Notification No. 1999/39*.

There are exceptions to the export ban, however, which allow the export of native species included in the Negative List. These include formulations, which are defined as products containing plant portions or extracts in unrecognisable and physically inseparable forms. Native wild *Aquilaria malaccensis* can therefore be freely exported in forms such as oil or medicine. Also, the export of Indian 'cultivated' varieties (i.e. agarwood derived from plantations) is permitted when accompanied by a Certificate of Cultivation. This is obtained from the Regional Deputy Director of Wildlife (CITES Management Authority), or the Chief Conservator of Forests or Divisional Forest Officers, in the State where the material was procured. A CITES export permit is also required, but none appear to have been issued.

Imported agarwood may be re-exported as value-added herbal formulations, if these are manufactured only from imported material. At the time of export, exporters are required to present an affidavit to Customs authorities stating that only imported plant material was used to produce the formulation being re-exported. Random sample tests are undertaken to verify the authenticity of affidavits, with action taken under the *Foreign Trade (Development and Regulation) Act 1992* against false affidavits. When export is allowed under the above conditions, it must occur only through the ports of Amritsar, Calcutta, Chennai, Delhi, Mumbai and Tuticorin.

Currently, although there are national controls, there are no CITES-related import or re-export controls for *Aquilaria malaccensis* or other CITES-listed medicinal plant species. As a result, CITES is not implemented for imports or re-exports of this species, i.e. CITES permits are neither required, nor provided for trade. TRAFFIC India has informed the Ministry of Environment and Forests, and the Director General of Foreign Trade in the Ministry of Commerce of its findings with regard to the trade and trade controls for *A. malaccensis*, and recommended that the EXIM Policy be amended to reflect CITES requirements for import and re-export controls.

Illegal harvests and trade

Interviews demonstrate that some traders and private landowners are under the misconception that any *Aquilaria malaccensis* tree can yield high-quality agarwood. This has led to the premature harvest of trees of seven to eight-year-old plantations, particularly in Tripura. People in Tripura are aware of the high market value of *A. malaccensis* and, according to a government official, since the species was listed in CITES, Forest Department plantations have been illegally plundered (S.K. Das, *pers. comm* to TRAFFIC India). Illegal extraction of young plantation trees occurred primarily just before or within a very short time of the CITES listing.

Limited information was available on illegal trade from government officials contacted. However, available records of government seizures indicate illegal trade in agarwood likely to involve *Aquilaria malaccensis*. For example, four shipments of agarwood dust, totalling 68 t, were blocked from export in

Mumbai by Inspectors of the Regional Deputy Director, Wildlife Preservation Office during the period 1994 to 1998 and referred to Customs for prosecution purposes under the EXIM policy (S. Panda, RDD Western Region, Wildlife Preservation Office, Mumbai, *pers. comm.* to TRAFFIC India, 1999). A number of smaller shipments of agarwood and oil have also been seized. When Customs authorities were interviewed in Mumbai dock, however, they stated that no seizures had occurred since 1994.

Seizures (reportedly of agarwood obtained from Surajnagar in Sylhet District) made by the Border Security Force at the border with Bangladesh confirm an India-Bangladesh trade route. Records of additional seizures made in Tripura are held by the Offence Report Registers of the Forest Department; records of individual cases relating to agarwood were unavailable. No records of seizures made in Manipur, Nagaland, Meghalaya and Arunachal Pradesh were found. However, traders interviewed said that seizures have occurred in the latter two States, which resulted in the public auctioning of the seized consignments.

Several reports of seizures were received from traders. For example, one importer interviewed reported the seizure of agarwood chips worth INR300 000 (USD9561), imported from Bangkok into Mumbai in 1994. Traders alleged that wood was smuggled across the north-eastern border, particularly from Myanmar, which they claimed necessitates bribing enforcement agencies at the border. Manipur was indicated as the preferred entry point and traders particularly named Churachandpur District as the place to obtain a Transit Permit illegally for wood smuggled from Myanmar. It was said that this cost INR200/kg (USD5/kg). Smuggled wood from other south-east Asian countries such as Indonesia, Lao PDR, Cambodia and Vietnam is said to be flown into Calcutta, Chennai, Mumbai and Delhi. According to traders interviewed, the majority of agarwood smuggled into India is destined for processing in Hojai.

Some traders admitted illegally exporting agarwood, stating that this was a relatively risk-free process, since Customs formalities were easily 'negotiated'. Two traders gave separate accounts of bribing Customs officials in order to evade legal action. The use of couriers to export agarwood illegally was said to be widespread, with some retailers saying that they used couriers to export up to 20 kg of chips. Some traders thought that the export ban had discouraged Middle Eastern consumers from purchasing large quantities of agarwood from India, who instead would only purchase up to five kilogrammes, an amount easily concealed within personal baggage. Small vials of oil (six to seven centimetres in length) are also easily hidden.

Cultivation

As indicated above, both government-owned and private agarwood plantations have been established. The Silviculture Division of Arunachal Pradesh has converted large areas of degraded forests into commercial agarwood plantations. These are the source of most of Arunachal Pradesh's illegal stock, despite their being too immature to yield commercially valuable agarwood. The upper Assam climate provides particularly suitable growing conditions and large-scale plantations exist in this State. Owners of private plantations in Assam have also attempted artificial fungal inoculation of two- to three-year-old *Aquilaria malaccensis* plants, but it is not known how effective this has been at stimulating agarwood production. The Research and Development Department of an international agarwood trading company maintains that private Assam plantations have been fulfilling 70-80% of the world's demand for agarwood, but this seems very unlikely based on available trade data. Other traders interviewed also believed that private plantations could meet the demands of existing processing plants and they were therefore confident regarding continuance of the agarwood trade. However, evidence of imports into India indicates that this is not the case. One large agarwood trading company has distributed *A. malaccensis* seedlings worth approximately

INR100 000 (USD2353) to villagers in Hojai and surrounding villages during the past three years, enabling them to plant their own *A. malaccensis* trees on their property and on other small tracts of land. Surveys undertaken by the CITES Management Authority in Tripura estimate that approximately 450-500 ha of private agarwood plantations exist in the north district. Government plantations also exist in Tripura, where the Forest Department first created plantations in the 1960s. There has been little effort to create agarwood plantations in either Mizoram or Meghalaya. Some government plantations can be found in Nagaland and Manipur, but there are few private plantations in these States.

INDONESIA

Status and distribution

Six *Aquilaria* species are known to occur in Indonesia: *A. beccariana*, *A. cumingiana*, *A. filaria*, *A. hirta*, *A. malaccensis*, and *A. microcarpa* (Soehartono, 1997). All of these species produce agarwood, and all but *A. filaria* are categorized as threatened according to the IUCN Red List Categories (Oldfield *et al.*, 1998). Indonesia is also home to other species that produce aromatic resinous substances, e.g. several *Gonystylus* species (Oldfield *et al.*, 1998). The range of *A. malaccensis* is restricted to Sumatra and Kalimantan (Ding Hou, 1960, cited in Wiriadinata, 1995). The species is considered virtually extinct in West Kalimantan by Soehartono and Mardiasuti (1997). Other *Aquilaria* species are found in Irian Jaya, Kalimantan, Maluku, Sulawesi, Sumatra and West Nusa Tenggara (NTB), being patchily distributed throughout natural forests (Afifi, 1995; Levang and de Foresta, 1994; Soehartono and Mardiasuti, 1997; Wiriadinata, 1995). In Kalimantan, it was reported that four species of *Aquilaria* are found scattered on ridges and slopes of well-drained land (Keller and Sidiyasa, 1994). In 1997, collectors reported that agarwood-producing trees (*Aquilaria* spp.) could be found in several Kalimantan reserves and national parks: Bukit Baka National Park; Gunung Palung National Park; Bintuang Karimun Reserve; Mandor Reserve; and Gunung Niut. Traders confirmed that *Aquilaria* spp. occur in these areas, with the exception of Mandor Reserve, where they are thought extinct. Excessive exploitation has increased the difficulty in finding *Aquilaria* in Gunung Palung and Gunung Niut (Soehartono and Mardiasuti, 1997).

The National Forestry Inventory (NFI) Database shows that *Aquilaria* species have adapted to various habitats in certain regions of West Kalimantan. Although widely distributed, the densities of *Aquilaria* are very low. The NFI Database gives approximate populations of *Aquilaria* species as 1.87/ha in Sumatra, 3.37/ha in Kalimantan and 4.33/ha in Irian Jaya (Soehartono and Mardiasuti, 1997). Considerable difficulties have been noted in finding *Aquilaria* trees of 30 cm dbh and greater in regions of Kalimantan (Sidiyasa *et al.*, 1986). According to the CITES Scientific Authority (Indonesian Institute of Science - LIPI), surveys of *Aquilaria* have not been undertaken in all regions (Oetomo, 1995), so that population data are unavailable for *Aquilaria* spp., including for *A. malaccensis*.

Aquilaria spp. are threatened in Indonesia owing in part to the indiscriminate felling of infected and uninfected trees, which is driven by continuing demand and large profits. A number of secondary threats generally applicable to most forest species are also applicable to *A. malaccensis*, e.g. habitat degradation and loss resulting from forest fires, forest conversion to plantations (including forest plantations), logging and land mining concessions, and the creation of settlement areas for transmigratory peoples (Soehartono and Mardiasuti, 1997).

Harvesting

The search for agarwood, locally known as *gaharu*, has widened from unprotected forests to reserve areas and also across the Papua New Guinea-Irian Jaya border, as indicated in part by collectors' and traders' knowledge of the location of *Aquilaria* trees in particular reserves (see **Status and distribution**). When agarwood-producing trees were discovered in Kayan Mentarang Nature Reserve, East Kalimantan in 1991, collectors (some in helicopters) flocked to the Reserve, demonstrating the strength of the demand. The practice of using helicopters to search for agarwood is known to have continued until at least 1997 (Hartadi, 1997). Sumatran harvesters are known to have trespassed in Kerinci Seblat, Gunung Leuser and Bukit Barisan Selatan Nature Reserves (Hidayat, 1996). Hartadi (1997) notes the shift in collecting habits of indigenous people (such as the Dayak Tribe of East Kalimantan), from subsistence to commercial harvesting. This is owing in part to competition from large numbers of collectors brought in by agarwood traders and middlemen. Soehartono and Mardiasuti (1997) provide an account of the process of agarwood harvesting, collection and the structure of the agarwood trade in West Kalimantan. This includes tree selection, the practical process of felling, a description of the different collector types (both local and non-local) and their relationship with traders. Searching for and/or harvest of agarwood may be either a temporary or permanent occupation. Collectors dependent on agarwood for their income are often 'tied' to a middleman through a credit system. Middlemen typically have links with 50-100 collectors and may be independent (they can sell to any trader in any region), or they may be dependent upon a single trader, who is often a family relative.

Agarwood is used locally for medicinal purposes, but based on information compiled during this study, it appears that the majority of agarwood harvested is exported. The main export destination according to CITES annual report data is Singapore, followed by Taiwan.

Markets and prices

Agarwood grade classifications vary slightly with locality and also from one middleman or collector to another. The government has never issued a standard grading classification that was acceptable to trading companies and collectors alike (Oetomo, 1995; Soehartono and Mardiasuti, 1997).

In 1997, in the Apau Kayan area of East Kalimantan, 'super grade A' agarwood was quoted as selling for IDR1 250 000/kg (USD450/kg) (Hartadi, 1997). In NTB, the best grade of agarwood was quoted at approximately IDR1 500 000/kg (USD540/kg) in 1997 (Anon., 1997b). In 1999, in Jayapura, 'super grade' agarwood was for sale for approximately IDR3 500 000/kg (USD385/kg), but at the time of the first monetary crisis in November 1997, the same grade sold for approximately IDR7 500 000/kg (Priyadi, 1999).

In West Kalimantan, the one trading company in operation quoted prices paid to middlemen (who typically link collectors with traders) and those which they themselves charged (**Table 6**) (Soehartono and Mardiasuti, 1997). The prices shown in **Table 6** were originally obtained in Indonesian rupiahs, but were converted in 1995/6 at USD1:IDR2361. **Table 7** shows a range of Indonesian agarwood prices obtained from the former chief of the former agarwood trade association *Asosiasi Pengusaha Damar, Gubal Gaharu dan Kemedangan Indonesia* (APDGKI - the Indonesian Traders Association of Resin-Gaharu and Garrowood).

Table 6

Agarwood prices paid to middlemen and the selling price set by one trading company in West Kalimantan, November 1996

Grade price	Prices paid to middlemen (USD/kg)	Selling price (USD/kg)	Quality indicators
Super A	200-300	300-400	Very black, heavy with much resin
Super B	150-200	250-300	Black, heavy with moderate amounts of resin
Super C	100-150	200-250	Fairly black, heavy with moderate amounts of resin
Sabak	75-100	150-200	Less black, moderately heavy with less resin
Kemedangan bungkus	15-17	20-25	Very brown, less resin
Teri padat	10-12	15-17	Debris of Super A and B
Teri timbul	7-10	10-15	Debris of Super C and Sabak
Teri layang	5-7	10-15	Debris of Kemedangan bungkus
Kemedangan kropos	4-5	7-10	Yellowish brown, light and very little resin

Source: Soehartono and Mardiasuti, 1997

Table 7

Agarwood grades and prices ranges

Specification	Grade	Price (IDR/kg)	Price (USD/kg)
Gubal gaharu	Super	1 000 000-1 500 000	450-675
	A B	500 000-900 000	225-405
	B C	250 000-500 000	113-225
	T G	250 000-500 000	113-225
	CI	100 000-250 000	45-113
	Sabah	60 000-150 000	27-68
	Tri A	100 000-250 000	45-113
	C 2	40 000-100 000	18-45
	TA 1	25 000-40 000	12-18
	TA 2	15 000-25 000	7-12
Kemedangan	TA 3	5 000-15 000	3-7
	Abu	500-3 000	0.2-1.4
	TRI B	50 000-100 000	23-45
	TRI C	15 000-50 000	7-23
	TRI MD	5 000-15 000	2-7
Abu	Super	100 000-150 000	45-68
	Biasa	40 000-100 000	18-45
	Kerokan	10 000-40 000	5-18

Source: Oetomo, 1995

Reported international trade

Indonesia's CITES annual reports show the total export of approximately 923 t of chips to seven countries during the period 1995 to 1997: approximately 324 t in 1995, 294 t in 1996 and 305 t in 1997. Most exports were destined for Singapore (781 t) followed by Taiwan (116 t). The remaining destinations were in the Middle East. Corresponding CITES import data for this three-year period were provided only by Singapore (214 t) and Japan (0.5 t).

Singapore also reported the re-export of approximately one tonne of chips to Indonesia in 1996 and imported a total of approximately four tonnes of Indonesian *Aquilaria malaccensis* via Malaysia and

Taiwan in 1995 and 1996. During the period 1995 to 1997, Singapore reported the total re-export of approximately 581 t of Indonesian agarwood to various countries, the largest reported importer being Taiwan (229 t). Of this total, approximately 105 t were reported as pre-Convention stocks.

According to CITES annual report data, Taiwan was the largest end-consumer of *Aquilaria malaccensis* exported from Indonesia: 345 t of Indonesian *A. malaccensis* was reported exported or re-exported to Taiwan. This is less than a third of Taiwan's total *Aquilaria* imports from Indonesia according to Taiwan's Customs statistics, which totalled approximately 1122 t. As noted under the section on **International trade**, this could reflect trade in agarwood of species in addition to *A. malaccensis*.

Harvest and trade controls

The use of agarwood is regulated via *Decree No. 8* of 1999 concerning the *Uses of Wild Flora and Animals*. *Aquilaria malaccensis* is not included in the government's list of protected fauna and flora (*Decree No. 7* of 1999). However, some local governments (such as Paniai District in Irian Jaya) have taken further steps to conserve their *Aquilaria* stocks by prohibiting searching and felling of *Aquilaria* spp. (Anon., 1995b).

Agarwood is considered a forest product and therefore control of harvest and domestic transport is the responsibility of the Ministry of Forestry and Regional Forestry Offices. Permits are required to harvest *gaharu* and other products from State forests in Kalimantan, as set out in *Forestry Regulation No. 28* of 1985. An exception is made for local communities dependent on forest resources for their livelihoods (Soehartono and Mardiasuti, 1997). Where trees belong to local villagers, middlemen seek the approval to fell them from the villagers and hire a collector to return to fell and collect the agarwood at a later stage. Local forest authorities at each *kabupaten* (district) are entrusted to administer permits for all activities within their own forest authority.

Large collecting groups of 20-30 people are said usually to obtain harvesting permits from the local forest authority to harvest from natural forests. Registered traders are thought almost certainly to obtain permits to avoid unnecessary difficulties when shipping consignments to other islands. However, smaller groups of two to four collectors are said to obtain harvesting permits rarely, owing to the small likelihood of being caught by forest authorities. Obtaining a permit is said to be a lengthy process (taking up to one day) and is considered inconvenient by the collector unless they reside close to the local authority office from which the permit must be obtained (Oetomo, 1995; Soehartono and Mardiasuti, 1997).

Before agarwood consignments are shipped to other regions within Indonesia, traders are required to pay a forest resource tax known as the Iuran Hasil Hutan (IHH), which varies according to the weight and grade of the consignment (Oetomo, 1995). The fees are IDR20 000/kg (USD2/kg) for both *Damar gaharu* (resin) and *Gubal gaharu* (inner part of agarwood), and IDR15 000/kg (USD2/kg) for *Kemedangan gaharu* (*Decree of Minister of Forestry No.606/Kpts-IV/1996*). Traders are also required to obtain a wood transport permit known as a *Surat Angkutan Kayu Olahan* (SAKO) from the local forest authority in order to transport agarwood to another region.

Under the auspices of the Ministry of Forestry, the Department of Protection and Nature Conservation (PKA, formerly known as the Directorate General of Forest Protection and Nature Conservation, PHPA) is Indonesia's CITES Management Authority. Agarwood exporters must be licensed and registered with PKA in order to apply for CITES export permits. To obtain a trading licence, companies must already have acquired several documents including a Business Permit and a Certificate of Inspection and to have been

recommended for licensing by the Regional Forestry Office. In 1995, all registered agarwood traders and other related businesses in Indonesia united to form a single association, the *Himpunan Pengusaha dan Budidaya Gaharu Indonesia* (HPBGI - the Indonesian Association for Gaharu Industry and Cultivation). The HPBGI was formed by the merger of 150 members of the Association of Gaharu Indonesia (APGINDO) in Jakarta and 50 members of APDGKI in Riau (Anon., 1995c). In the early 1990s, three companies were registered in West Kalimantan, but by 1997 only one company was operating (Soehartono and Mardiasuti, 1997). This company has links to 14 middlemen throughout the region. Thirty registered companies were in operation in Irian Jaya during the period 1994 to 1995 (Anon., 1995d), but this had fallen by half in 1997 (Anon., 1997a). In NTB, there is reportedly only one company in operation (Anon., 1997b).

According to Soehartono (1997) and information received from PKA, PKA, in consultation with LIPI, began establishing annual harvest quotas for *Aquilaria malaccensis* following the species's listing in CITES Appendix II. The harvest quota is distributed among Regional Forest Offices located in regions having the potential to produce *gaharu*, who in turn distribute the quota among registered *gaharu* traders. According to the annual list of harvest quotas produced by PKA, the harvest quota is allocated not only to regions in Kalimantan and Sumatra (highlighted in bold in **Table 8**), but also to regions on islands where *A. malaccensis* does not occur, but where other *Aquilaria* species do, e.g. Irian Jaya.

PKA began issuing total annual export quotas for *Aquilaria malaccensis* in 1996: 300 t in 1996, 270 t in 1997, 150 t in 1998 and 270 t in 1999 (see **Table 8**). Export quotas for 1998 and 1999 were disseminated to the Parties via CITES *Notification No. 1998/36* and *No. 1999/47*. Quota levels are determined by PKA in consultation with LIPI. Data provided by each Regional Forestry Office (*Kanwil*) are reported to be taken into account (Priyadi, 1999). As mentioned above, population data for *A. malaccensis* and other *Aquilaria* species are lacking (Oetomo, 1995). Research for this report finds no evidence to suggest that export quotas are based on population data, but rather that they are based on subjective information.

Table 8

Annual export and harvest quotas (kg) for *Aquilaria malaccensis* from 1996 to 1999

Year	Total export quota (kg)	Total harvest quota (kg)	Provincial distribution of <i>Aquilaria malaccensis</i> quotas harvest
1996	300 000	300 000	Jambi 40 000; Central Sulawesi 18 750; Southeast Sulawesi 18 750; North Sulawesi 18 750; Sulsel 18 750; South Sumatra 40 000; North Sumatra 70 000; West Sumatra 50 000 ; West Nusa Tenggara (NTB) 25 000
1997	270 000	300 000	Irian Jaya 70 000; Kalimantan 70 000 ; Maluku 30 000; NTB 40 000; Sulawesi 40 000; Sumatra 50 000
1998	150 000	150 000	Kalimantan 75 000; Sumatra 75 000
1999	270 000	300 000	Aceh 30 000; East Kalimantan 30 000; South Kalimantan 30 000 ; Lampung 30 000; Maluku 30 000; East Nusa Tenggara 30 000; Riau 30 000; South Sulawesi 30 000; North Sulawesi 30 000; West Sumatra 30 000

Source: Anon., 1996-1999 and CITES *Notification No. 1999/47*

According to Indonesia's CITES-reported exports, 1995 exports were approximately six tonnes under the export quota for that year, but in 1997, total exports exceeded the export quota by almost 36 t.

Ministry of Forestry staff inspect both imports and exports. Although they check, for example, permit validity and that the permit volume tallies with the actual trade volume, they have acknowledged that few officers can actually differentiate between *A. malaccensis* and other *Aquilaria* species (P. Subijanto, PKA, pers. comm. to TRAFFIC Southeast Asia, 21 April 1999). Noting that government authorities were not yet able to identify agarwood products in trade (normally chips and powder) to species level, Soehartono (1997) comments that, in practice, CITES regulations and procedures are applied to the export of any agarwood products, regardless of the species involved. Therefore, it is likely that CITES export permits are likely to be issued for other *Aquilaria* species in addition to *A. malaccensis*. Research conducted during this study indicates that exports from Irian Jaya (most likely to involve *A. filaria*) are exempted from CITES requirements (P. Subijanto, PKA, pers. comm. to TRAFFIC Southeast Asia, 21 April 1999).

Illegal trade

There are concerns regarding uncontrolled and indiscriminate felling of *Aquilaria* trees and demand and harvesting are believed to have increased in response to high export prices (WWF, 1994, cited in Soehartono, 1997) and recent economic uncertainties in Indonesia. Government resources to control exploitation and trade are insufficient given the large forest areas (Soehartono, 1997). According to Soehartono and Mardiasuti (1997), agarwood is described as rare in Kalimantan, where prices paid to collectors have declined owing to a drop in quality. Extraction from protected areas (parks and reserves) has been reported in Kalimantan (Hartadi, 1997; Soehartono and Mardiasuti, 1997) and Sumatra (Hidayat, 1996). The profitability of the *gaharu* trade has led to the creation of the so-called 'gaharu mafia'. Three of a gang of 10 so-called mafia members are reported to have been gaoled after having been arrested in a nature reserve in Bandar Lampung (Sumatra) in 1995 (Anon., 1995e). Uncontrolled exploitation is also reported in other provinces, indicating significant illegal trade. For example, seven tonnes of *gaharu* originating in Irian Jaya were reported in the national press to have been seized in Jakarta in 1997, but this was only a fraction of the hundreds of tonnes reportedly smuggled out through Irian Jaya since the previous year, according to the Governor (Anon., 1997c). In Irian Jaya there have also been reported instances of military personnel stealing agarwood from local people (Anon., 1998b). Traders from India alleged that Indonesian agarwood was illegally imported into India by air. Forest resource tax (IHH) documents may be manipulated to show a wood product other than agarwood, with a lower IHH tariff. At least 11-15 t of agarwood have been seized during attempts to export it illegally in this manner (Anon., 1996a; 1996b; 1996c).

The Indonesian monetary crisis has greatly elevated agarwood prices and hence increased the level of illegal harvesting. Irian Jaya in particular has witnessed an upsurge in the search for agarwood (thought to be *A. filaria*) and harvesting by locals. Papua New Guineans are also said to have crossed the national border into Irian Jaya to sell their agarwood to middlemen and traders (Priyadi, 1999). In Papua New Guinea, the CITES Management and Scientific Authority for Plants has received reports from field officers since approximately 1997 that *Aquilaria* harvested in Papua New Guinea, primarily in Vanimore, is being illegally brought into Irian Jaya for export. The lack of staff makes the Papua New Guinea-Irian Jaya border difficult to police, but further investigation by officials in Papua New Guinea into this activity is anticipated (O. Giddens, Papua New Guinea CITES Management and Scientific Authority for Plants, pers. comm to TRAFFIC Oceania, June 1999).

Cultivation

Successful efforts to cultivate *Aquilaria* species have been initiated in several provinces and some traders have established plantations, e.g. in Riau (Sumatra), Lombok and Bogor (Java) (Wiradinata, 1995). Research is underway on the inoculation of *Aquilaria* trees with agarwood-producing fungi. Research is also ongoing regarding the ecology of agarwood-producing species, including the *in-situ* study of their natural regeneration (Soehartono and Mardiasuti, 1997).

LAO PDR

TRP reports that *Aquilaria* is found in southern Lao PDR, particularly in the Dong Ha Sao, Xe Piane and Dong Ampham regions. Although Lao PDR is not a range State for *A. malaccensis*, *A. baillonii* and *A. crassna* occur here (Heuveling van Beek, TRP, *in litt.* to TRAFFIC International, 2 May 2000; Heuveling van Beek and Phillips, 1999; Le Cong, 1996; Oldfield *et al.*, 1998).

Collectors in Lao PDR are considered inexperienced agarwood harvesters and discard all but the dark resinous sections. There appear to be no formal agarwood traders in Vientiane, the capital of Lao PDR. Interviews with the Institute of Medicinal Plants indicate that agarwood is known to Lao PDR herbalists but is rarely used. There is no oil distillation undertaken in this country as far as is known (Heuveling van Beek and Phillips, 1999).

According to Heuveling van Beek and Phillips (1999), Lao PDR is reported by traders to serve as a source of agarwood for many Vietnamese traders, who transport agarwood eastwards, and for Thai traders, who transport agarwood westwards. At least one Thai trader was killed in an agarwood dispute in Vientiane Province four years ago and there have been varying reports of Thai contractors harvesting large volumes of agarwood under the guise of clearing trees in areas to be flooded by dams. There is little control of the harvesting of agarwood and these activities have been undertaken without Lao PDR authorities being aware of agarwood's value and rarity. There were no reports of trade northwards towards Kunming Province of China.

One company based in Mumbai (India) approached the government for rights to clear all the trees around artificial lake sites. Lao PDR agarwood stocks are reported by Indian traders to be smuggled into India by air. Two poachers have been shot in the Dong Ha Sao region for smuggling agarwood. In 1995, a company obtained permission from the government to buy four to five tonnes of agarwood seized by Customs (Heuveling van Beek and Phillips, 1999).

Lao PDR is not a Party to CITES and trade with this country is not detailed in the CITES annual reports of other Parties.

Cultivation

TRP has experimented with agarwood formation in a small plantation belonging to the Agricultural Service. A number of agarwood seedlings were recently planted at the National University of Lao PDR.

A UNDP/Australian-funded rural development project found that villagers involved in harvesting agarwood were attempting cultivation, albeit unsystematically (Pereira, 1995). The project spanned four years, with more than 1000 trees planted at various locations, producing a stock of trees of unknown resin potential over 4.5 m high and with girths of 20-30 cm. Discussions are underway between the project's managers and TRP with respect to undertaking a more comprehensive agarwood project.

MALAYSIA

Status and distribution

Three species of *Aquilaria* are found in Malaysia: *A. hirta*, *A. malaccensis* and *A. rostrata*. A significant number of research studies have been conducted on *A. malaccensis*, but none on *A. hirta* or *A. rostrata* (Ng *et al.*, 1997).

Aquilaria malaccensis is well distributed throughout Peninsular Malaysia, except for the States of Kedah and Perlis. It is confined mainly to plains, hill slopes and ridges up to 750 m in both primary and secondary Malaysian lowland and hill dipterocarp forests (Jantan, 1990). Although *A. malaccensis* enjoys good geographical coverage, its occurrence is rather rare. La Frankie (1994, cited in Soehartono and Mardiasuti, 1997) studied the population dynamics of *A. malaccensis* in Pasoh Forest Reserve. He suggested a typical lowland Malaysian forest density of 2.5/ha and found that the growth rate varied between 0-1.95 cm/year.

Harvesting

Malaysia has a long history in the trade in agarwood. Agarwood has long been collected by the indigenous peoples of the interior of Peninsular Malaysia to supplement their income. Other local people are also involved in collecting, particularly in the State of Kelantan. Agarwood is referred to as *gaharu* or *garu* wood in Malaysia, the Sanskrit word *garu* meaning heavy. It has been reported that Malaysian agarwood can also be sourced from some *Gonystylus* spp., which are more prevalent in peat-swamp forests. The aromatic wood from *Gonystylus* spp., together with other fragrant woods, is also traded under the name *gaharu*, which further complicates efforts to study trade volumes and trends in *Aquilaria* spp.

Markets and prices

The majority of agarwood harvested is exported, with only relatively small quantities of agarwood being used locally, primarily for the production of incense. Muslims use agarwood incense during important religious occasions, especially at gatherings. *Aquilaria malaccensis* is also used occasionally for medicinal purposes. The main forms of agarwood in trade in Malaysia are wood sections, flakes, chips, incense and occasionally powder (Yaacob, 1999). Finished products such as perfume are also traded.

Non-resinous wood harvested from *Aquilaria* is categorized as a light hardwood that is not durable and is easily stained by fungal growth. It is therefore not a popular trade material. However, its lightness makes it suitable for light indoor construction, packing, jewellery boxes, and veneers.

Research undertaken by the Forest Research Institute of Malaysia (FRIM) has identified five to seven grades of agarwood for Peninsular Malaysia. There are at least two grading systems in use, one for middlemen and harvesters and another for middlemen and traders (Dr C.Y. Shyun, Medicinal Plants Division, FRIM, *in litt.* to TRAFFIC International, 8 May 2000). According to Heuveling van Beek and Phillips (1999), as a general rule Malaysia produces eight grades of agarwood: grades one to three are dark, highly resinous and sink in water, whereas grades four to eight are brown to light brown and float in water. Agarwood is often adulterated with kerosene or other coloured oils to resemble higher grade agarwood.

Raw materials are processed in Malaysia as well as consumed for domestic use (Heuveling van Beek and Phillips, 1999). There is at least one processing plant in Malaysia. One agarwood trader interviewed in Singapore said he owned a distillation facility in Malaysia; oil reportedly distilled in Malaysia was observed for sale in Singapore (Heuveling van Beek and Phillips, 1999). Within Malaysia, the production of agarwood oil via steam distillation is considered too time consuming and has been replaced by hydro-distillation (Dr C.Y. Shyun, Medicinal Plants Division, FRIM, *in litt.* to TRAFFIC International, 8 May 2000). CITES annual report data do not show any oil exports from Malaysia.

Chakrabarty *et al.* (1994) stated that the lowest grade of Malaysian agarwood (not necessarily *Aquilaria malaccensis*) could be obtained for USD19/kg in the Middle East. The high grades, normally reserved for exclusive buyers, are said to cost up to USD9589/kg. More expensive grades are also available and can sell for as much as USD27 400/kg.

Ng *et al.* (1997) reported that, in 1991, south-east Asian countries exported approximately MYR48.3 million (approximately USD17.6 million) worth of agarwood to Saudi Arabia, of which approximately 26% was sourced from Malaysia. Trade data compiled by Ng and Azmi (1997) show that the value of agarwood chips alone (therefore representing only a small part of the actual trade in agarwood and its products) exported from Malaysia was MYR393 065 in 1995 (USD156 746, or USD164 787 adjusted for inflation to 1998 values) and MYR546 289 in 1996 (USD217 144, or USD223 897 adjusted for inflation to 1998 values).

Reported international trade

Within Malaysia, Peninsular Malaysia, Sabah and Sarawak have their own wildlife trade legislation and CITES-implementing authorities, with each producing separate CITES annual reports. Reports for Sarawak and Sabah for the period 1995 to 1997 had not been submitted at the time of writing. Therefore, Malaysian CITES annual report data represent only Peninsular Malaysia. The Government of Peninsular Malaysia has not indicated their basis for their CITES annual reporting, i.e. whether this is based on permits issued, permits used or actual trade.

CITES annual report data for Peninsular Malaysia show the export of approximately 341 t of agarwood chips from 1995 to 1997 (approximately 90 t in 1995, 163 t in 1996 and 87 t in 1997). All but nine tonnes were destined for Singapore. Singapore's annual reports show corresponding imports from Malaysia during each of these years. Sixty-eight tonnes of agarwood were reported as exported in 1998, a further decline from 1996 export levels. Exports for the months January to March 1999 totalled approximately 21 t (E.N. Abdullah, Assistant Wildlife Ranger Department of Wildlife and National Parks, Peninsular Malaysia, pers. comm. to TRAFFIC Southeast Asia, March 1999).

According to CITES annual report data for 1995 to 1997, the main end-destination for agarwood of Malaysian origin (i.e., including wood re-exported from countries such as Singapore) was Hong Kong, which was the final destination for approximately 86 t. Other significant end-destinations were India (25 t) and Saudi Arabia (17 t), followed by Egypt (9 t), United Arab Emirates (5.99 t), Oman (2.23 t), and Japan (1.35 t). Kuwait, Qatar, Bangladesh, Thailand, Bhutan and Morocco each imported less than one tonne of agarwood reported as originating in Malaysia over the three-year period.

A review of Singapore's CITES annual reports for 1995 and 1996 shows imports of *Aquilaria malaccensis* from both Sarawak and Peninsular Malaysia. Customs data for Sarawak show the export of approximately 16 t of agarwood in 1995 and eight tonnes in 1996. Corresponding import data for Singapore show the

import of approximately seven tonnes of *Aquilaria malaccensis* from Sarawak in 1996. Customs data for 1997 were unavailable. According to Sarawak's CITES Management Authority, far larger quantities of *A. malaccensis* (approximately 528 t) were exported in 1998 (E.S. Bakar, Wildlife Ranger, Forest Department, Sarawak, *pers. comm* to TRAFFIC Southeast Asia, April 1999). Sarawak's 1998 annual report includes data for *A. malaccensis* as well as for "*Aetoxylon malaccensis*", the combined export weight being approximately 528 t. Therefore, it seems likely that *Aetoxylon malaccensis* is actually *Aquilaria malaccensis*, but this could not be confirmed. The main export destination in 1998 was Singapore.

Exports from Sabah are recorded as *gaharu* and these may comprise any *Aquilaria* (or even *Gonystylus*) species, making it impossible to determine the export volume of *A. malaccensis*. Exports are classified as log exports and sawn timber exports, both being measured in cubic metres. This makes comparison with export volumes measured in kilogrammes difficult. Additionally, data for some years are unavailable, with *gaharu* included in the category 'Other Timber'. Forestry Department records show the export of only 18.88 m³ of *gaharu* logs for the period January to November 1998. This is the only reported sawn timber or log export from 1995 to November 1998. The same data show a log production volume of 2901.71 m³ for 1997 to November 1998. *Gaharu* log production was classed as 'Other Timber' in 1995, and no production was reported in 1996 (E.A. Abi, Head of Economic, Industry and Statistic Division, Sabah Forestry Department, Sandakan, *in litt.* to TRAFFIC Southeast Asia, 1999).

Domestic harvest and trade controls

The government of each of Malaysia's States requires that special permits be obtained from the relevant State Forestry Department to harvest and trade agarwood. Harvesting from national parks or wildlife sanctuaries is prohibited in all States.

Within Peninsular Malaysia, the *National Forestry Act, 1984* prohibits the felling of *Aquilaria malaccensis* from State forests or Permanent Forest Estates. Harvesting from national parks or wildlife sanctuaries is prohibited by the *Protection of Wildlife Act, 1972*. Under the *National Forestry Act*, illegal removal of forest products is subject to fines of up to MYR2000 (USD526) and/or imprisonment up to 12 months. A 'Removal of Minor Forest Product' permit is required to harvest all *Aquilaria* spp. from Peninsular Malaysia. Permits cost MYR100 (USD26) and are renewable annually.

Felling of *Aquilaria malaccensis* in Sarawak is regulated under the *Wildlife Protection Ordinance, 1998* and the *Forests Ordinance, 1958*. Harvesting from national parks or wildlife sanctuaries is prohibited by the *National Parks and Reserves Ordinance, 1998* and the *Wildlife Protection Ordinance, 1998*. Illegal removal of Sarawak's protected plants can result in imprisonment of up to 12 months or fines of MYR10 000 (USD2631) (A.B. Othman, Director Crop Protection and Plant Quarantine Services Division, Department of Agriculture, Malaysia, *in litt.* to CITES Secretariat, 22 January 2000).

In Sabah, felling of *Aquilaria malaccensis* is subject to the *Forest Enactment, 1968*, whilst harvesting from State land (government forests and gazetted parks and their equivalents) is forbidden by the *Parks Enactment Act, 1984*. Convictions for illegally harvesting any forest materials in Sabah will result in fines of up to 10 times the royalty value. Illegal exporters are subject to fines not exceeding MYR500 000 (USD131 555) or imprisonment under the *Forest Enactment* and *C.F. Circular 1/83*. For more general offences such as the altering and counterfeiting of documents and permits relating to the provisions of the *Forest Enactment*, the fine is MYR5000 (USD1316). Under the *Wildlife Conservation Bill, 1997*, the

searching for and the harvesting of all CITES-listed plants requires a Plant Collection Licence issued by the Director of the Sabah Wildlife Department. Offences made against the *Wildlife Conservation Bill* incur a fine of MYR30 000 (USD7893) and/or imprisonment up to three years.

Additionally, collectors are charged a premium fee that varies with each State. For example, in Perak (Peninsular Malaysia) the collector's fee is MYR100/200/ha (USD26/200/ha) and an additional royalty fee of MYR18/t (USD5/t) applies to all *Aquilaria* spp. (E.N.M. Shah, State Deputy Director, Department of Forestry, Perak, pers. comm. to TRAFFIC Southeast Asia, April 1999).

International trade controls

A levy or royalty is imposed before traders can apply for CITES export permits. These charges vary with each State. CITES export permits are required for export from all but Sabah, where the Department of Forestry instead requires their own export permits to be used. It appears that Malaysia's CITES Scientific Authority, the Ministry of Science, Technology and the Environment, is not involved in making non-detriment findings for the export of *Aquilaria malaccensis*.

Offences in any State will result in seizure and confiscation by the relevant authority, with the goods subsequently either destroyed or auctioned, in accordance with State legislation. To date, no seizures have been made. This is believed to be linked at least in part to the difficulty of discriminating between *Aquilaria malaccensis*, other *Aquilaria* species and the wood products of other genera, with the effect that illegal shipments are not recognized.

In Peninsular Malaysia, the CITES Management Authority is the Department of Wildlife and National Parks (PERHILITAN). As well as issuing CITES permits for Peninsular Malaysia, the Department (in consultation with relevant agencies such as the Forestry Department) is responsible for reporting to national and international agencies. PERHILITAN is also accountable for monitoring trade via an enforcement unit that inspects shipments, and which occasionally acts on information received from the public. According to the Management Authority, shipments of agarwood are inspected by both themselves and the Malaysian Timber Council prior to export. They reported that some Malaysian Timber Council staff can identify the wood of different *Aquilaria* species, including *A. malaccensis*.

In Sarawak, the CITES Management Authority is the Forest Department. Exporters are required to register with the Sarawak Timber Industry Development Corporation. An annually renewable 'Licence to Sell and Deal' must be obtained, costing MYR100 (USD26) (E.S. Bakar, Wildlife Ranger, Forest Department, Sarawak, pers. comm. to TRAFFIC Southeast Asia, April 1999). Exporters must also complete a Customs Declaration Form before shipments are inspected by Customs and, occasionally, by the Forest Department. Trade data are maintained by the Forest Department, which states that it investigates any report of illegal trade. Staff commented that it was difficult to identify agarwood shipments to species level, and that they normally assumed that shipments presented for export comprised *Aquilaria malaccensis*.

The Sabah Wildlife Department (the CITES Management Authority for Sabah) is responsible for issuing CITES permits and works closely with the Sabah Forestry Department. The Forestry Department requires its own permit for export, but has not yet implemented a requirement that shipments be accompanied by CITES export permits. Export from Sabah (via blanket export regulations for all agarwood species) is regulated for both logs and processed timber and an Export Declaration Form must be completed for all exports.

Log exports require a letter of consent from the Sabah Forestry Department (limited to one letter per person) and this requirement applies to individual shipments. Exporters must apply for the relevant permit from the place where the logs were obtained. The Sabah Forestry Department applies individual exporter quotas to agarwood logs; these have no time limit. A royalty system is in place for log exports of all *Aquilaria* spp. (under the category of 'Other Timber'), this being MYR100/m³(USD26/m³) (E.H. Baharun, Economic Officer, Economic, Industry and Statistics Division, Sabah Forestry Department, pers. comm. to TRAFFIC Southeast Asia, March 1999). All log exporters must complete a Scaling Order Form in addition to the Customs Declaration Form.

In Sabah, an annual 'Licence to Export Processed Timber' is required to export processed agarwood. This costs MYR2500/yr (USD658/yr). No royalty fees are imposed on the export of processed agarwood (E.H. Baharun, Economic Officer, Economic, Industry and Statistics Division, Sabah Forestry Department, pers. comm. to TRAFFIC Southeast Asia, March 1999).

Sabah's CITES Management Authority noted their concern over miscommunications between relevant agencies, in that no CITES permits have yet been issued from Sabah. There are no CITES data for Sabah as a result. The Management Authority stated that they will bring the need for CITES export permits to be issued to the attention of the Department of Forestry (L. Ambu, Deputy Director, Sabah Wildlife Department, pers. comm. to TRAFFIC Southeast Asia, April 1999). Shipments are inspected by the Department of Forestry, all exports being classified as *gaharu* with no effort being made to identify the actual species. Staff noted that it is difficult to differentiate between the wood of different *Aquilaria* species.

Illegal trade

Agarwood oil is being distilled illegally in Peninsular Malaysia and this is thought to be undertaken primarily by Cambodians. People from Thailand and Cambodia are also known to enter Malaysia to harvest or purchase agarwood illegally (Dr C.Y. Shyun, Medicinal Plants Division, FRIM, *in litt.* to TRAFFIC International, 8 May 2000). A government staff person in the Department of Wildlife and National Parks reported that some exporters used courier services to export *Aquilaria malaccensis* (especially of higher grades) in order to avoid CITES permitting requirements (E.S. Bakar, Wildlife Ranger, Forest Department, Sarawak, pers. comm. to TRAFFIC Southeast Asia, April 1999).

No seizures of *Aquilaria malaccensis* have been reported. As noted above, this is likely to reflect, at least in part, the difficulties involved in distinguishing *A. malaccensis* from the five other native *Aquilaria* species.

Cultivation

One of the first attempts to cultivate *Aquilaria* occurred in 1928 (Lok and Zuhaidi, 1996). Natural mortality caused the original population density of this stock of 833/ha to decrease to 31/ha by 1995 and it is unknown whether any of these trees produce agarwood. Additional research has shown that *Aquilaria* can be artificially propagated and there are continuing laboratory experiments regarding artificial induction of agarwood formation. There is private sector interest in this area and a committee involving FRIM and private foreign companies has been established to look into agarwood research and development (Dr C.Y. Shyun, Medicinal Plants Division, FRIM, *in litt.* to TRAFFIC International, 8 May 2000).

MYANMAR

The harvest of agarwood from all *Aquilaria* spp. is prohibited under *The Protection of Wild Life and Wild Plants and Conservation of Natural Areas Law, 1994* (U. Tin Than, WWF-Thailand, pers. comm. to TRAFFIC Southeast Asia, March 1999). According to Indian traders, agarwood from Myanmar is in high demand owing to its high quality and, despite the ban, is obtained relatively easily via large-scale smuggling into Manipur, particularly through the district of Churachandpur. Indian processing units in Nagaland and Manipur are said by traders to be supplied partly from Myanmar (the remainder of supplies being from Bangladesh), because of a lack of local sources in India (Gupta, 1999).

Myanmar became a Party to CITES in November 1997. CITES annual report data do not show any trade in agarwood involving Myanmar.

PHILIPPINES

According to the CITES Management Authority, *Aquilaria malaccensis* is very rare in the Philippines and was once found in Camarines Province. Permits would be required to harvest and export both raw and processed agarwood under *Executive Order No. 247* (in effect from 18 May 1995) and *Act 3983* (in effect from 3 December 1932). The two laws are not specific to *A. malaccensis*, but regulate the harvest and trade of all protected wild plants. There are no records of trade in *A. malaccensis* from the Philippines, including in CITES annual report data. The Management Authority is concerned, however, that the over-exploitation and illegal trade of *A. malaccensis* and of other *Aquilaria* species occurring in other range States will lead to similar exploitation in the Philippines (N.M. Molinyawe, *in litt.* to CITES Secretariat, 19 October 1999).

SINGAPORE

Singapore is a range State for *Aquilaria malaccensis* (L. Fook, Singapore CITES Management Authority *in litt.* to CITES Secretariat, 20 October 1999; Oldfield *et al.*, 1998). As noted above, Singapore plays a commanding role as an international agarwood trading centre, with over 1113 t of *A. malaccensis* chips, powder and timber recorded in CITES annual report data as exported to Singapore from 1995 to 1997. Virtually all of this agarwood was reported as exported by Indonesia and Peninsular Malaysia. In contrast, Singapore reported the import of only 584 t of *A. malaccensis* from 1995 to 1997. Singapore reported the re-export of almost 800 t of *A. malaccensis* from 1995 to 1997, approximately 70% of the amount of agarwood reported as exported to Singapore during this same period, and approximately 200 t more than reported imports. Some of these re-exports were declared as pre-Convention stock. According to Heuveling van Beek and Phillips (1999), agarwood flakes and chips form the bulk of agarwood products traded in Singapore. These are generally sold by the [shipping] container load.

Markets and prices

The following information is based on interviews with six traders in Singapore by Heuveling van Beek and Phillips (1999). The traders were mostly located at a modern heavily-stocked warehouse complex near to the airport and container port. The close proximity to each other of most traders ensures competitive pricing; traders generally indicated that competition has increased during the last five years. Several companies have World Wide Web sites advertising the sale of agarwood products via the Internet. Most traders were supplied from throughout south-east Asia, with the larger traders appearing to have a series

of loyal agents based in all the main procurement areas. Some traders reported that they had their own export-handling companies in Malaysia or Indonesia. One mentioned that he owned a plantation, while another mentioned that he distilled his own agarwood oil in Malaysia. Other companies had set up offices in the Middle East, but many had closed down because of problems in obtaining payment and the general slowing of Gulf economies, whose 'petro-dollars' had previously widened the agarwood market.

As previously noted (see **Grading**), various agarwood grading systems are in use. Interviews conducted with traders in Singapore revealed that knowledge of valuation and grading is extremely complex, and a good buyer is said to be able simply to smell the wood and determine its country and province of origin and grade. Others need to burn portions of the product before making such an assessment. Traders separate out highly resinous products or products with particularly special fragrances to offer to buyers willing to pay high prices (Heuveling van Beek and Phillips, 1999).

Many traders use the practice of placing the wood in water to separate 'sunken wood' from floating woods or flakes, to meet the requirements of their customers from Taiwan. Prices for sunken wood in Singapore are approximately USD400-500/kg. Sumatran sunken wood sells for USD420/kg in Singapore, with sunken wood from Sabah being slightly more expensive at USD480-500/kg.

Traders generally felt that agarwood from Cambodia and Lao PDR was best, selling at USD2000-3000/kg for wood segments. Some Middle Eastern clients preferred wood from Myanmar, however, which has a distinct odour profile. Samples of agarwood oil distilled in Malaysia can be bought for USD8450/kg, and superior oil from Cambodia was valued at USD14 485/kg (Heuveling van Beek and Phillips, 1999).

International trade controls

There are no tax restrictions associated with trading *Aquilaria malaccensis*. CITES is implemented through the *Endangered Species (Import and Export) Act (Chapter 92A) Revised Edition, 1990*. The Primary Production Department (PPD) is the CITES Management Authority and Scientific Authority for Singapore. All traders wishing to import or re-export *A. malaccensis* must be licensed by the Singapore Trade Development Board.

CITES import and re-export permits are issued by the Phytosanitary and Plant Quarantine Section (PPQS) of the PPD. To obtain a CITES import permit for *Aquilaria malaccensis*, importers must first present a CITES export or re-export permit issued by the country of export or re-export. Most traders interviewed said that they could obtain export permits without too much difficulty. Re-exports from Singapore require a CITES re-export permit, with a phytosanitary certificate being issued only if required by the importing country (L.F. Keng, Singapore CITES Management Authority, *in litt.* to TRAFFIC Southeast Asia, 16 April 1999). Imports of all other *Aquilaria* spp. also require a plant import permit issued by the PPQS in addition to a phytosanitary certificate issued by the exporting country.

Without a valid CITES permit, *Aquilaria malaccensis* consignments are refused entry and are either confiscated or returned to the exporting country. The penalty for violating the *Endangered Species Act* is a fine of up to USD5000 and/or imprisonment of up to 12 months.

CITES import permits are examined by the PPD prior to the release of agarwood consignments and then scrutinized again when goods are being re-exported. Traders must show that quantities re-exported are less than or equal to quantities imported. Once CITES permits have been issued, the actual agarwood consign-

ments are rarely inspected (Singapore CITES Management Authority, pers. comm. to TRAFFIC Southeast Asia, 21 April 1999). An interview with the Management Authority indicated that few, if any, Customs officials can identify *Aquilaria malaccensis*, particularly when in flake, dust or powdered form. There are significant opportunities for under-invoicing and misrepresentation since only an expert can gauge a fair price and distinguish whether powdered and chipped packages of coloured wood are actually agarwood as opposed to other woods, such as sandalwood for example. The expertise required to accomplish this is typically greater than enforcement officers possess. A meeting with the head of the CITES Department in the PPD indicated that authorities had considerable difficulties adapting procedures developed for monitoring animal parts to the monitoring of botanical products (Heuveling van Beek and Phillips, 1999).

THAILAND

Status and distribution

Both *Aquilaria crassna* and *A. malaccensis* are native to Thailand, according to Oldfield *et al.* (1998), and *A. baillonii* may also occur here (Heuveling van Beek and Phillips, 1999). No information was available regarding the population status or distribution of *Aquilaria* spp. in Thailand.

Domestic trade

Agarwood is known as *gridsanah* (Dr C.Y. Shyun, Medicinal Plants Division, FRIM, *in litt.* to TRAFFIC International, 8 May 2000) and very little information is available regarding the domestic trade. Thai traders are known to have obtained agarwood from Vietnam, but harvesting and export restrictions in Vietnam have now led Thai traders to obtain their supplies from Lao PDR and Cambodia. At least one Thai trader is reported to have been killed in agarwood disputes in Lao PDR (Heuveling van Beek and Phillips, 1999).

Reported international trade

Thailand's CITES annual report showed only one export of *Aquilaria malaccensis*; 244 kg of chips to Singapore in 1997, with a corresponding import volume reported by Singapore. Additional trade is recorded in Singapore's annual reports. A total of approximately eight tonnes of agarwood in the form of chips and timber originating in Thailand has been re-exported to a variety of destinations via Singapore, the vast majority of re-exports occurring in 1995. In 1995 and 1996, a small percentage of this total, in the form of chips and timber, was traded as pre-Convention stock. According to Singapore's CITES annual reports, Thailand also imported approximately four tonnes of agarwood chips originating in Indonesia and Malaysia from Singapore in 1997.

Taiwan's Customs data show imports of approximately 327 t of agarwood of Thai origin between 1993 and 1998, increasing from less than one tonne in 1993 to approximately 66 t in 1998 (see **Table 3**). Thailand was the third-largest supplier of agarwood to Taiwan from 1993 to 1998, according to these data.

Harvest and trade controls

The government first attempted to control the agarwood trade in 1987 when a 20% export tax was established. This was later raised to 30% and, as a consequence, the majority of trade went underground and false invoicing and under-invoicing became commonplace in order to evade tax payment (Heuveling van Beek and Phillips, 1999).

CITES requirements for *Aquilaria malaccensis* are implemented in Thailand by the *Plants Act, B.E. 2535* of 1992, which prohibits the import, export and trans-shipment of all CITES-listed plants, except with the permission of the Agriculture Director-General. A 'conserved plant', as covered by the *Plants Act*, includes all CITES-listed plants and those announced by the Minister in a Ministerial Notification. Exceptions to the Act are controlled seeds, prohibited plants and reserved plants. The *Plants Act* regulates the artificial propagation of CITES-listed plants through a nursery registration system. Violation of this Act would result in a fine of up to THB3000 (USD81) and/or imprisonment of up to three months. According to the CITES Scientific Authority, the Government of Thailand has not issued any export permits since the end of 1997, because *A. malaccensis* is regarded as threatened in the country (Scientific Authority of Thailand, statement made at the Ninth Meeting of the CITES Plants Committee, June 1999).

Cultivation

There are reportedly some small-scale *Aquilaria malaccensis* research plots in Thailand. Dr Chang Yu Shyun, of the Medicinal Plants Division, FRIM (*in litt.* to TRAFFIC International, 8 May 2000) reports that a study on *A. crassna* was undertaken during the late 1980s at the Kesatsart University. The first plantation of *A. crassna*, known as the Gridsanah Botanical Gardens of Aloeswood, was established in 1994. The status of this and other plantations is unclear (Heuveling van Beek and Phillips, 1999).

VIETNAM

Unless otherwise referenced, the information below pertaining to Vietnam is based on Heuveling van Beek and Phillips (1999).



One of the few remaining full-grown *Aquilaria* trees in southern Vietnam

Credit TRP Vietnam

Status and distribution

Although Vietnam was named as a range State for *Aquilaria malaccensis* in the supporting statement to the 1994 CITES-listing proposal, Oldfield *et al.* (1998) and Heuveling van Beek (TRP, *in litt.* to TRAFFIC International, 2 May 2000) do not consider it a range State for this species. Vietnam is, however, a range State for *A. banaensae* and *A. crassna*, the latter one of 13 officially-listed endangered tree species in Vietnam (Heuveling van Beek and Phillips, 1999). It is considered Critically Endangered by Oldfield *et al.* (1998), the classification being largely based on the situation in Vietnam (other *A. crassna* range States are Cambodia, Lao PDR and Thailand). *Aquilaria* spp. are mainly located in the southern coastal forest fringes adjacent to the Cambodian border and the western part of Da Nang province along the Lao PDR border. Of particular importance are the coastal belts:

Quang Ninh; Ha Bac; Hoa Binh; Tuyen Quang; and Phu Quoc Island. The other main localities are in the central highlands, namely Ha Tinh, Kon Tum, Quang Nam-Da Nang, Binh Dinh, and Gia Lai.

The Ministry of Forestry and the National Forest Planning Institute in Hanoi appear to have little information on the present status of *Aquilaria* spp. The Canadian-funded provincial forest inventory studies do not include *A. malaccensis*, and the CITES Management Authority in Hanoi (The Forest Protection Department) lacks definitive information on tree population trends. The Centre of Resource and Environmental studies (one of Vietnam's two CITES Scientific Authorities) at the University of Hanoi prepared an agarwood paper on behalf of TRAFFIC. The report maintained there was no direct correlation between *Aquilaria* populations and the general rate of deforestation; approximate forest cover is currently 27%.

Domestic use

According to traders interviewed, agarwood has been used for medicinal purposes for centuries and is included in the Vietnamese pharmacopoeia. The traditional trade was in the hands of guilds in places such as Thua Thein and Hue. However, although most indigenous medicine producers interviewed reported that they used agarwood if it could be acquired at an acceptable price, prices in 1999 meant that few local medicines comprised agarwood.

Markets and prices

Interviews were conducted with several traders and official export houses. Numerous large branch and trunk sections were observed for sale, but the availability of quality agarwood chips and segments was extremely limited and much more expensive in comparison to prices in India, Indonesia and Singapore. Traders stated that higher prices reflected higher grades but this was not confirmed by interviews held with traders in Singapore. They could, however, be a consequence of the higher risks and costs associated with illegally transporting agarwood into Vietnam from Lao PDR and Cambodia and of exporting it illegally.

Grade-one and grade-two agarwood segments are offered for sale at USD3500/kg and USD2000/kg, respectively. In the mid-1980s, grade-one and grade-two segments were available for USD1200-1700/kg (USD1733-2455/kg, when adjusted to 1998 value). Grade-five segments can be bought for approximately USD200/kg and grade six (largely immature wood) can be bought for around USD100/kg. Wood sold for carving, although often fake, can still sell for up to USD400/kg, according to one sculpture trader. Grade-one powder is offered for around USD200/kg, grade-two for around USD100/kg and grades five and six sell for as little as USD25-30/kg. Medicinal agarwood (*Ky Nam*) is obtained from the roots of resinous trees and is highly sought after. *Ky Nam* was observed for sale in Ho Chi Minh City, primarily for export to Japan, for between USD2000-10 000/kg. Recent quotes for *Ky Nam* are up to USD15 000/kg (H. Heuveling van Beek, TRP, *in litt.* to TRAFFIC International, 2 May 2000).

Agarwood oil distillation is limited: surveys of the large essential oil distilleries revealed that they do not produce agarwood oil. However, there are one or two agarwood distilleries on the outskirts of Ho Chi Minh City (one managed by an immigrant from Taiwan) and also one or two reportedly in Da Nang Province. All of the oil distillers interviewed reported that agarwood prices have increased dramatically during the past five years. One Vietnamese distiller reported that production of one litre of agarwood oil required 500-1000 kg of low-grade agarwood and would sell for around USD7000. Recent (2000) quotes

for high-grade oil (available only to order) are USD15 000/litre (H. Heuveling van Beek, TRP, *in litt.* to TRAFFIC International, 2 May 2000).

There are reports of a company based in Ho Chi Minh City that invested over USD100 000 several years ago in the construction of a sophisticated distillation facility. The company had a buy-back arrangement with a Saudi Arabian importer who offered the fixed price of USD5000/kg for oil. The deal apparently collapsed and the unit has mostly remained idle.

The Essential Oil Enterprise in Hanoi is part of the Ministry of Science and Technology and Environment and is equipped with good laboratory and extraction facilities under a United Nations project. This enterprise has undertaken research on agarwood oil. It is likely to be the only facility in Vietnam capable of evaluating oil samples.

International trade

There appears to have been little international interest in the trade of Vietnamese agarwood before the Vietnam War (Nguyen van Minh, 1969). Trade in agarwood expanded rapidly between 1973 and 1990, with many of the main government trading agencies officially participating. The majority of exports involved three companies, but a number of other private and public companies also traded agarwood. Very few of these companies are reported to be involved in the trade today and there are reportedly two to three licensed agarwood traders in Ho Chi Minh City, Da Nang and Hanoi, and perhaps as many again operating illegally or semi-legally.

Before the 1991 harvest and trade ban (see below), the combined value of annual agarwood exports from Vietnam was estimated at USD10-15 million annually. Official trade data indicate an export growth from approximately five tonnes per year in the early 1970s to 50 t in the mid-1980s. More recent exports are estimated to have decreased to around 10 t annually. Declared unit values of these exports were very low (less than USD50-100/kg), suggesting significant under-invoicing.

CITES annual report data for Singapore show the re-export of 1.2 t of *Aquilaria malaccensis* chips, 0.7 t of powder and 0.5 t of timber in 1995. As Vietnam is not believed to be a range State for *A. malaccensis*, these shipments are likely to have contained other *Aquilaria* species. They were re-exported from Singapore to four different countries/territories. No additional trade involving Vietnam has been reported in CITES annual report data. Traders interviewed in Singapore reported that the majority of Vietnamese agarwood actually came from Lao PDR or Cambodia and this observation is supported by TRP (Heuveling van Beek and Phillips, 1999).

According to Taiwan's Customs data, Vietnam was second only to Indonesia as a source of *Aquilaria* spp., with approximately 532 t of agarwood imported from Vietnam from 1993 to 1998. These imports increased considerably over this six-year period, from approximately 20 t in 1993 to approximately 85 t in 1994, and reaching 137 t in 1998 (see **Table 3**).

Harvest and trade controls

The Government of Vietnam has undertaken several measures to regulate the trade in agarwood. These include the establishment of quota systems (licensed traders were each typically allocated a quota of one tonne of agarwood) and a blanket ban on the harvesting and trade of all *Aquilaria* spp. (*Decree No. 431 TN/XNK*, 30 April 1991, followed by *Decree No. 858 KH/XNK*, 5 August, 1991, which specifically

prohibits the harvesting of *A. crassna*). These controls were largely unsuccessful and resulted in the privatization of the official trading companies. Today, only the harvesting and trade of *A. crassna* is prohibited in Vietnam, by *Decree No. 18 (HDBT) Vietnam Wildlife Protection, 1992*. The Chairman of the Council of Ministers, in accordance with the Minister of Forestry, may permit the exploitation of *A. crassna* under special circumstances, such as scientific research. The export of agarwood oil is not prohibited.

Illegal trade

The CITES Management Authority is unaware of any agarwood seizures since 1991. However, there have been reports of several seizures of illegally harvested agarwood (likely to be *A. crassna*) in recent years, and it is reported that this confiscated wood is likely to have been reintroduced into the domestic agarwood market. It is thought probable that since the ban on the harvesting and trade of *A. crassna*, at least some of the agarwood traded has been *A. crassna* and has hence been illegal.

Cultivation

Government plantations exist in Ha Tinh, Kon Tum and Phu Quoc Island. One trader reported a joint venture with a Japanese enterprise to grow *Aquilaria* in Da Lat. TRP has successfully implemented a pilot project 'Sustainable Agarwood Production in Vietnamese Rainforests', which is being undertaken in two southern locations (Ba Nui and Phu Quoc), and which is now expanding to the central highlands of Kon Tum Province. TRP found that *Aquilaria* can artificially be induced to yield agarwood at a rate 10 times faster than in nature. These results indicate that agarwood plantations have the potential to be developed into agroforestry enterprises providing long-term and stable sources of agarwood, which could provide an opportunity to generate revenue for low-income families living in and around project areas.



Credit: TRP, Vietnam, 1998

Cultivated agarwood tree growing in Vietnam

CONCLUSION

Agarwood has been valued, used and traded internationally for more than 2000 years. Concerns regarding declining agarwood supplies and the impacts of trade on *Aquilaria* species, eight of which are considered to be threatened, are far more recent. The first CITES listing of an agarwood-producing species - *A. malaccensis* - did not take place until 1994. Implementation of this CITES listing thus far has been inconsistent and in some cases absent entirely. Exporting range States are not uniformly implementing CITES export permit requirements for *A. malaccensis*, do not appear to be making non-detriment findings, and in some cases are issuing CITES permits to cover shipments of *Aquilaria* species other than *A. malaccensis*. Only two consumer countries are regularly recording imports in CITES annual report data.

Despite the shortcomings described above, the inclusion of *Aquilaria malaccensis* in CITES Appendix II has increased the transparency of the international agarwood trade somewhat. In addition, it seems likely to have increased the ability of Indonesia and Malaysia to control their exports of *A. malaccensis* and other *Aquilaria* species. Concern remains, however, regarding excessive and illegal exploitation and trade of *Aquilaria* species, including *A. malaccensis*, for agarwood. With six *Aquilaria* species already considered to be threatened by overexploitation and no signs that demand for agarwood will decline, it is imperative that additional steps be taken by range States and consumers to improve CITES implementation for *A. malaccensis* and to address overexploitation and illegal trade in this and other *Aquilaria* species.

These findings were described in an interim report submitted to the CITES Plants Committee and a final project document distributed by the CITES Secretariat to range States. During the Eleventh Meeting of the Conference of the Parties to CITES, the Plants Committee was directed to continue its review of the genus *Aquilaria*. Specifically, the Plants Committee was directed to: address the problem of distinguishing between different *Aquilaria* species in trade; identify additional measures, besides improved identification, that may improve reporting accuracy for *A. malaccensis*; and determine whether other species in the genus qualify for inclusion in CITES Appendix II (Com. 11.26). This decision is an important step towards achieving the sustainable use and trade of *A. malaccensis* and other agarwood-producing *Aquilaria* species.

Available information indicates that, failing a change in current harvest and trade patterns, the availability of agarwood and wild populations of the species that produce it will continue to decline. Co-ordinated and co-operative action to reverse this trend is required on the part of range and consumer country governments, businesses engaged in agarwood harvests, trade and related industries, research institutions, conservation organizations, and others concerned with sustainable use of these and other forest species. To fail to act otherwise seems likely to further threaten *Aquilaria malaccensis* and other *Aquilaria* species, and to reduce both Asia's forest biodiversity and its forest-based economic opportunities.

SPECIFIC PROBLEMS IDENTIFIED AND POTENTIAL REMEDIAL ACTIONS

Approximately half of the 15 species of Aquilaria are considered to be threatened by habitat alteration and/or overexploitation for trade.

- Further research should be undertaken on the status of those *Aquilaria* species in trade and actual or potential threats from trade, habitat alteration and/or other factors.

*It does not appear that CITES authorities are making adequate non-detriment findings prior to issuing export permits for *Aquilaria malaccensis*.*

- Population assessments and research regarding harvest and regeneration rates should be undertaken in exporting range States in order better to inform the making of non-detriment findings, and the process for making such non-detriment findings strengthened.

*Five *Aquilaria* species in addition to *Aquilaria malaccensis* are at specific risk from overexploitation for international trade, but only *A. malaccensis* is listed in the CITES Appendices. In the recent Decision taken at the Eleventh Meeting of the Conference of the Parties to CITES, the Parties decided that if the results of the review of *Aquilaria* spp. determined that additional species should be listed in Appendix II, the Plants Committee should recommend which species should be included for reasons of threat by trade, and which for similarity of appearance to those species threatened by trade.*

- Taking account of the Plants Committee's findings, *Aquilaria* range States should consider preparing a proposal for the inclusion of all *Aquilaria* spp. in CITES Appendix II for submission to the Twelfth Meeting of the Conference of the Parties. In the interim, range States should consider including their populations of *Aquilaria* spp. other than *A. malaccensis* in CITES Appendix III.

*Agarwood is difficult to identify to species level, especially when traded as chips, powder or oil. The recent Decision taken at the Eleventh Meeting of the Conference of the Parties to CITES directed the Plants Committee to resolve how to distinguish *Aquilaria* species from each other when in trade, particularly when traded as agarwood.*

- The Plants Committee should be supported in its efforts to resolve identification issues. In addition, identification materials for the timber, flakes and powder of *Aquilaria* species in trade should be developed and provided to range and consumer country governments.

*The following CITES Parties identified as consumers of *Aquilaria malaccensis* did not record trade in their CITES annual report data: Bangladesh, China, Egypt, India, Indonesia, Japan, Republic of Korea, Morocco, Saudi Arabia, Thailand and United Arab Emirates. The Plants Committee was directed by the Eleventh Meeting of the Conference of the Parties to CITES to identify measures that might improve the accuracy of reporting of trade in *Aquilaria malaccensis*.*

- The above-mentioned Parties should identify any trade control problems and take action to implement the CITES-listing for this species more effectively, including by the recording of all international trade in their CITES annual reports.

According to CITES annual report data provided by countries of export/re-export, Aquilaria malaccensis was exported to the following non-Parties: Bhutan, Kuwait, Oman and Qatar.

- Governments in these non-Party countries should be encouraged to accede to CITES and, until such time as their accession becomes effective, to implement trade controls comparable to those required under the Convention.

Available trade data indicate that Hong Kong, Saudi Arabia, Singapore, Taiwan and the United Arab Emirates were the most important import markets for Aquilaria malaccensis in international trade from 1995 to 1997, each reported as the export destination for over 100 t of agarwood during this period.

- Governments in these and other major consumer markets should assist range State governments in controlling and monitoring the international trade in agarwood.
- Co-operation should be sought from agarwood traders in key consumer countries to implement CITES and other trade controls and bring the agarwood trade within sustainable levels.

It is not generally possible to assess accurately whether individual Aquilaria trees contain agarwood through visual inspection alone. As a result, current harvest methods often involve the chopping down of non-agarwood-bearing Aquilaria trees in the search for agarwood.

- Less destructive methods to detect agarwood formation should be developed and disseminated to agarwood harvesters. This may help reduce the destruction of non-infected trees and thereby reduce harvest impacts on *Aquilaria* populations.

Agarwood is a valuable forest resource providing revenues to local collectors, processors, traders, governments and industries. Co-operation among these different sectors is required to manage harvest and trade in a manner more effectively contributing to the long-term survival of the species and the ecosystems in which they occur. This, in turn, will contribute to the continued commercial availability of this resource.

- National and local governments in agarwood-trading countries, harvesters, traders, non-governmental organizations and others concerned with the use and conservation of *Aquilaria* species should be encouraged to collaborate in addressing issues such as unsustainable exploitation and illegal harvest and trade.
- A workshop involving the different agarwood ‘stakeholders’ should be convened in order to share and discuss information regarding the status, harvest and trade of *Aquilaria* species and potential actions required to address conservation and trade issues. Such a workshop could make a valuable contribution to the development of conservation and management plans aimed at sustainable use of *Aquilaria* species.

Agarwood markets are poorly documented and understood, with little information available regarding the relative benefits from trade accruing within range and consumer countries. This reduces the potential for designing and implementing activities to bring the trade within sustainable levels and enhance benefit sharing.

- Further studies of key agarwood markets and trade flows from harvest to final sale should be undertaken in an effort to increase the understanding of the trade and resulting benefit flows.

Based on the information available, the demand for agarwood is continuing to exceed available supplies. Efforts to increase agarwood production via cultivation and the use of artificial inoculation are underway in several range States.

- Additional research should be conducted within range States regarding the potential for these and other techniques to contribute to the production of agarwood. If successful, use of such techniques should be considered as part of sustainable management programmes for the species in trade.

Issues specific to individual *Aquilaria malaccensis* range States

India

*National legislation and regulations currently do not provide for effective CITES-related controls on imports and re-exports of *Aquilaria malaccensis* and other medicinal plant species. In addition, national export/re-export restrictions on agarwood are not clear to various government departments charged with controlling exports and regulating national trade.*

- The Government of India should modify national trade controls and ensure their effective communication to staff charged with CITES enforcement and traders.

*There are indications of continuing illegal trade in *Aquilaria malaccensis* across the border between India and Myanmar.*

- The Government of India should further investigate trade across the border with Myanmar and pursue enforcement actions as appropriate.

Indonesia

*The basis for harvest quotas, export quotas and non-detriment findings for *Aquilaria malaccensis* exports, and the extent to which export controls are being applied to agarwood exports in general, as opposed to *A. malaccensis* specifically, are unclear.*

- The Government of Indonesia should clarify existing trade controls and the volume of *Aquilaria malaccensis* exported, and ensure that adequate non-detriment findings are made prior to issuing CITES export permits.

Lao PDR

*There is conflicting information regarding the occurrence of *Aquilaria malaccensis* in Lao PDR.*

- Research should be undertaken to confirm whether Lao PDR is a range State for *Aquilaria malaccensis*.

*Although domestic use appears to be limited, Lao PDR has been identified as a source of agarwood in international trade by traders in at least three countries. This is likely to include *Aquilaria crassna*, which is considered Critically Endangered according to the IUCN Red List Categories. There appears to be little control of the harvest and trade of agarwood.*

- Further information is required regarding the status, harvest and trade of *Aquilaria* spp. from Lao PDR. Measures should be taken to reduce unsustainable harvest and trade practices if these are confirmed.

Malaysia

*The basis for non-detriment findings for *Aquilaria malaccensis* exports, and the extent to which export controls are being applied to agarwood exports in general, as opposed to *A. malaccensis* specifically, are unclear.*

- The Government of Malaysia should clarify existing trade controls and the volume of *Aquilaria malaccensis* exported and ensure that adequate non-detriment findings are made prior to issuing CITES export permits.

*CITES export permits are not currently issued for *Aquilaria malaccensis* exports from Sabah and CITES annual reports for Sabah have not yet been submitted for the years 1995 to 1997.*

- CITES Management Authorities in Sabah should ensure adherence to CITES export permitting and reporting requirements.

Singapore

Singapore plays a central role in the trade in agarwood and records large-scale imports and re-exports in CITES annual reports.

- CITES authorities in Singapore should be encouraged to pay special attention to the trade in *Aquilaria malaccensis* in order to assist range States with implementation of CITES trade controls.

Thailand

Reported agarwood imports to Taiwan from Thailand increased significantly in recent years, but this trend is not reflected in Thailand's CITES annual reports.

- The species in trade from Thailand should be identified and actions taken to improve CITES implementation if it is found to be *Aquilaria malaccensis*.

Vietnam

*There is conflicting information regarding the occurrence of *Aquilaria malaccensis* in Vietnam*

- Research should be undertaken to confirm whether Vietnam is a range State for *Aquilaria malaccensis*.

REFERENCES

- Afifi (1995). *Proses pengolahan pohon gaharu sampai siap diperdagangkan dan tata cara pembudidayaannya, serta proese gaharu pembentukan gubal*. In: *Lokakarya Pengusahaan Hasil Hutan Non Kayu (Rotan, Gaharu, dan Tanaman Obat)*. Departemen Kehutanan. Indonesia-UK Tropical Forest Management Programme. Surabaya, 31 July-1 August.
- Anon. (1994). *Analyses of Proposals to Amend the CITES Appendices*. Prepared by IUCN Species Survival Commission and the TRAFFIC Network for the Ninth Meeting of the Conference of the Parties to CITES. IUCN-The World Conservation Union, Gland.
- Anon. (1995a). *A Coloured Atlas of the Chinese Materia Medica Specified in Pharmacopoeia of the People's Republic of China (1995 Edition)*. Pharmacopoeia Commission of the Ministry of Public Health, P.R. China. Joint Publishing (H.K.) Co., Ltd., Honk Kong.
- Anon. (1995b). *Dilarang penebangan kayu gaharu*. *Angkatan Bersenjata (Indonesia)*, 22 Maret.
- Anon. (1995c). *Pengurus asosiasi pengusaha gaharu terbentuk*. *Suara Pembaruan (Indonesia)*, 11 May.
- Anon. (1995d). *Singkat Ekonomi*. *Suara Pembaruan (Indonesia)*, 8 October.
- Anon. (1995e). *Anggota mafia gaharu dibekuk*. *Merdeka (Indonesia)*, 12 Desember.
- Anon. (1996a). *Polisi perairan tahan 6 ton kayu gaharu*. *Suara Pembaruan (Indonesia)*, 23 July.
- Anon. (1996b). *Dikeluarkan, enam ton kayu gaharu yang ditahan di gudang 002 Tanjungpriok*. *Kompas (Indonesia)*, 25 July.
- Anon. (1996c). *Polisi periksa lima ton kayu gaharu*. *Kompas (Indonesia)*, 26 November.
- Anon. (1996-1999). *Annual Allowable Catch of Unprotected Species of Indonesian Wild Fauna and Flora for Trade*. Department of Protection and Nature Conservation, Indonesia.
- Anon. (1997a). *15 Pengusaha Mengolah Kayu Gaharu di Irja*. *Antara (Indonesia)*, 19 Maret.
- Anon. (1997b). *NTB Ekspor Gaharu*. *Bisnis Indonesia (Indonesia)*, 12 June.
- Anon. (1997c). *Ekspor Perdana Kayu Gaharu Irja*. *Kompas (Indonesia)*, 12 August.
- Anon. (1998a). *Medicinal Plant Significant Trade Study (CITES)*. India Country Report. TRAFFIC India and WWF-India, New Delhi. 103pp.
- Anon. (1998b). *Oknum Aparat yang Rampas Kayu Gaharu Ditindak Tegas*. *Suara Pembaruan (Indonesia)*, 26 July.
- Anon. (1999). *Taiwan Regulates CITES Plants*. *TRAFFIC Bulletin* 17(3): 95.
- Burkill, I. (1966). *A Dictionary of Economic Products of the Malay Peninsula*, I. Government of Malaysia and Singapore. The Ministry of Agricultural and Cooperatives, Kuala Lumpur.
- Chakrabarty, K., Kumar, A. and Menon, V. (1994). *Trade in Agarwood*. TRAFFIC India and WWF-India, New Delhi. 51pp.
- Chamling, K.D. (1996). *Traditional paper, essential oils, rosin and turpentine*. In: Anon. (1996). *Non-wood forest products of Bhutan*. FAO Regional Office for Asia and the Pacific, Bangkok.
- Debnath, B., Sil, S., Sinha, R.K. and Sinha, S. (1995). *Chromosome number and karotype of Aquilaria agallocha Roxb. (Thymelaeaceae)*. *Cytologia* 60: 407-409.
- Ding Hou, D. (1960). *Thymeleaceae*. *Flora Melesiana* Ser.1, 6(1): 1-15.
- Fratkin, J. (1994). *Chinese Herbal Patent Formulas: A Practical Guide*. Shya Publications, Colorado, USA. 356pp.
- Gupta, A. K. (1999). *Assessing the Implementation of the CITES Appendix-II Listing of Aquilaria malaccensis*. Unpublished report prepared for TRAFFIC India.
- Hartadi, I. (1997). *The hunt for gaharu*. *Conservation Indonesia*, July-September.
- Heuveling van Beek, H. and Phillips, D. (1999). *Agarwood: Trade and CITES Implementation in Southeast Asia*. Unpublished report prepared for TRAFFIC Southeast Asia, Malaysia.
- Hidayat, R. (1996). *Gaharu and Kampung Pengembara*. *Pancaroba. Musim. Panen*.

- Jantan, I. (1990). *Gaharu. Timber Digest* 107: December.
- Kanjilal, U.N., Kanjilal, P.C., Dey, R.M. and Das, A. (reprinted 1982). *Flora of Assam, IV*. Government of Assam, Assam, India.
- Katz, J. (1996). *Koh-Doh: The Japanese Way of Fragrance*. Copenhagen University thesis.
- Keller, P. and Sidiyasa, K. (1994). *Trees of Balikpapan-Samarinda Area, East Kalimantan, Indonesia: A Manual of 280 Selected Species*. The Tropenbos Foundation, Wageningen.
- La Frankie, J. (1994). Population dynamics of some tropical trees that yield non-timber forest products. *Economic Botany* 48(3): 301-309.
- Lambert, F. (1992). *In litt.* to IUCN Species Survival Commission, Cambridge.
- Le Cong, K. (1996). The History of Agarwood in Viet Nam. Paper Presented at the *International Conference of the Society of Ethnobiology*, Nairobi, Kenya.
- Levang, P. and de Foresta, H. (1994). *Economic Plants of Indonesia*. Seameo-Biotrop, Bogor.
- Lok, E. and Zuhaidi, A. (1996). The growth performance of plantation grown *Aquilaria malaccensis* in Peninsular Malaysia. *Journal of Tropical Forest Science* 8(4): 573-575.
- Mabberley, D. J. (1997). *The Plant Book*. The Press Syndicate of the University of Cambridge, UK. 858pp.
- NASA (2000). Gross Domestic Product Deflator Inflation Calculator.
<http://www.jsc.nasa.gov/bu2/inflateGDP.html>
- Ng, L. and Azmi, M. (1997). *Trade in Medicinal and Aromatic Plants in Malaysia (1986-1996)*. Forest Research Institute Malaysia Report No. 71, December.
- Ng, L.T., Chang, Y.S. and Kadir, A.A. (1997). A review on agar (*gaharu*) producing *Aquilaria* species. *Journal of Tropical Forest Products* 2(2): 272-285.
- Nguyen van Minh. (1969). *Duoc Tinh Chi Nam* Saigon, Vietnam.
- OANDA (2000). The Currency SiteTM. http://www.oanda.com/converter/cc_table
- Oldfield, S., Lusty, C. and MacKinven, A. (1998). *The Word List of Threatened Trees*. World Conservation Press, Cambridge, UK. 650pp.
- Oetomo, H. (1995). *Tinjauan terhadap pemasaran komoditi gaharu Indonesia di perdagangan Internasional*.
- Pereira, I. (1995). Notes On: Pepper (*Piper nigrum*), Mai Kessina (The Eagle Wood Tree), and Cardamom (*Elettaria cardamum*), UNDCP\DDSMS\LAO\89\550, Lao PDR.
- Priyadi, Y. (1999). *Agarwood: Trade and CITES Implementation in Indonesia*. Unpublished report prepared for TRAFFIC Southeast Asia, Malaysia.
- Schippmann, U. (Comp.). (1999). *Medicinal Plants Significant Trade Study: CITES Project S-109*. Unpublished report. 88pp.
- Sidiyasa, K., Sutomo, R. and Prawira. (1986). *Eksplorasi dan studi permudaan jenis-jenis penghasil gaharu di wilayah hutan Kintap, Kalimantan Selatan*. *Buletin Penelitian hutan*. 474: 59-66.
- Soehartono, T. (1997). Overview of trade in *gaharu* in Indonesia. In: *Report of the Third Regional Workshop of the Conservation and Sustainable Management of Trees*, Hanoi, Vietnam. WCMC IUCN/SSC. Pp. 27-33.
- Soehartono, T. and Mardiatuti, A. (1997). The current trade in *gaharu* in West Kalimantan. *Jurnal Ilmiah Biodiversitas Indonesia* 1(1).
- Yaacob, S. (1999). *Agarwood: Trade and CITES Implementation in Malaysia*. Unpublished report prepared for TRAFFIC Southeast Asia, Malaysia.
- Wiriadinata, H. (1995). *Gaharu (Aquilaria spp.) Pengembangan dan Pemanfaatan yang Berkelanjutan. In Lokakarya Pengusahaan Hasil Hutan Non Kayu (Rotan, Gaharu, dan Tanaman Obat)*. Departemen Kehutanan. Indonesia-UK Tropical Forest Management Programme. Surabaya, 31 July-1 August 1995.

