RAMIN (*GONYSTYLUS BANCANUS*) IN MALAYSIA

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Forest Research Institute Malaysia (FRIM). This document is prepared only for *Gonystylus bancanus* found in Malaysia. There is no stocking data and hardly any biological information available for other species, apart from the geographical distribution. All other *Gonystylus* spp. are dryland species and these are managed according to the Selective Management System (SMS) as outlined below.

I. Background information on the taxa

1. BIOLOGICAL DATA

1.1 Scientific and common names

Gonystylus bancanus (Miq.) Kurz (Thymelaeaceae). Common name: ramin. Vernacular names: Indonesia: gaharu buaya, medang keladi. Malaysia: melawis.

1.2 Distribution

Its phytogeographical region comprises Sumatra, Peninsular Malaysia (Johore, Pahang, Selangor and Terengganu), Sabah, Sarawak (Malaysia), Brunei and Kalimantan (Indonesia) on the island of Borneo. As can be seen, its phytogeographical distribution is continuous. Since the species is somewhat restricted to peat swamp forests, its geographical distribution within Malaysia naturally follows the location of swamp forests (Fig. 1). In Sarawak, the mixed swamp forest is the most extensive of the five peat swamp forest types (Lee & Chai 1996).

In 2005, the size of peat swamp forests (PSF) in Peninsular Malaysia was estimated to be 300,000 hectares (ha) while that of Sabah and Sarawak were 120,000 ha and 940,000 ha, respectively. In Peninsular Malaysia, the largest peat swamp forest lies in the state of Pahang (200,000 ha; Anon 2008b) followed by Selangor (76,134 ha in 2005).

A 2004 land use map showed fragmentation within the Selangor and Pahang peat swamp forests as a result of various land developments. Wong (2005) similarly reported a large degree of fragmentation within PSFs in Sarawak.

1.3 Biological characteristics

1.3.1 *General biological and life history characteristics of ramin*

Gonystylus bancanus is reported to flower and fruit regularly in the primary PSF in Pekan Forest Reserve (FR), Pahang, Peninsular Malaysia (Shamsudin & Ng 1995, Shamsudin 1996). In her work at the same location, Nurul Huda (2003) noted that there was flowering activity followed by fruiting throughout the 19 months' observation period spanning February 2000 to August 2001 with no clear indication that drought or the onset of drought triggered flowering. This result contrasted with that of Dibor (2005) who showed that, during 2002-2003, ramin in Lingga (Sri Aman) and Naman FR (Sibu), Sarawak had an irregular flowering season with one heavy fruiting season followed by sporadic or no fruiting in the following years.

Dibor (2005) reported that the period from flowering to fruit development and ripening was about 3-4 months. Predation by birds, flying foxes, squirrels, hornbills, monkeys and other mammals occurred throughout the stages of fruit development while fallen seeds were eaten by tortoises and catfish that inhabit patches of shallow stagnant water. Seed batches collected from the 1994 fruiting episode in Pekan FR had 63% germination with the earliest germination taking place 9 days after sowing; germination is hypogeal type with non-emergent cotyledons (Shamsudin 1996). Germination on the forest floor during the same period was poor due to rapid insect and fungal infestation. Seedling regeneration on the forest floor, observed from 1992 to 1996, was also poor. This was attributed to the high predation on young and immature fruits on trees by bats and squirrels, predation on freshly germinated seedlings (Dibor 2005), and poor forest floor germination (Shamsudin 1996). These observations and results contradicted those of van der Meer *et al*. (2005b) who noted abundant regeneration where remnant ramin trees had developed into new seed trees.

Lee *et al*. (1996), Truong (2005) and van der Meer *et al*. (2005b) showed that seedlings and saplings are relatively shade intolerant, surviving better and growing most rapidly in partial sunlight. This result is supported by Ismail (2001) who showed that ramin planted in an open, *Imperata cylindrica*-dominated, regularly burnt peat swamp area in Compartment 101, Raja Musa FR, Selangor had 73.4% survival eight months after planting using the open planting method. A study conducted in areas that had been logged 20 years ago in Naman FR and Batang Reserve (Sarawak) showed that seedling survival rate in the first year was 92–94% (Palmer 1971). These results support the feasible option of planting ramin on a large scale in heavily degraded peat swamp areas.

The mean relative growth rate recorded for seedlings of initial height 10 to 200 cm in a primary 5-ha plot in Compartment 156, Pekan FR was 0.56 cm year^{-1} (Nurul Huda 2003). Plants observed six years after planting in an open, non-peat swamp area had a mean diameter increment of 0.8 cm year^{-1} and height increment of 52 cm year^{-1} (Shamsudin & Ismail 1999). In an enrichment planting in Kalimantan, seedlings were reported to have an average height growth of 12.5 cm year^{-1} and annual diameter increment of 0.5–0.7 cm among young trees, attaining 1 cm under optimal conditions (Soerianegara & Lemmens 1993). These results indicate that under natural primary forest conditions, seedlings and saplings can be expected to grow relatively slowly.

A study on the regeneration pattern of ramin in a 5-ha plot in Compartment 156, Pekan FR showed that mean density of seedlings was highly concentrated in the vicinity of adult trees with the highest mean occurring within 10 m radius from the tree (Nurul Huda 2003). Shamsudin (1996) also showed that individuals in size class 5-10 cm dbh had a tendency to clump near mother trees. The inference that ramin has a limited seed dispersal is supported by Dibor (2005) who observed that seeds dispersed by mammals were taken a very short distance from the mother trees. However, no such relationship was reported for ramin in Lingga (Sri Aman, Sarawak) (Truong 2005, Kunne 2005). Kunne (2005) in his work on ramin at Lingga, situated between the Batang Lupar and Batang Lingga Rivers in Sarawak, showed that the distribution pattern of seedlings and saplings around eight mother trees demonstrated no significant difference between distances from mother tree to seedlings and from mother tree to saplings. There were no significant differences in the density at different distances from a mother tree. Analysis of the distribution patterns using a complete spatial random test showed that seedlings had a cluster distribution and saplings a random distribution. Only a small number of seedlings survived and developed into saplings. A similar distribution trend was observed by Shamsudin (1997). Understanding clumping patterns is important to management as the impact of harvesting would be greater on clumped individuals if harvesting is not closely supervised. Individuals clumping at shorter distances from seed trees would be more prone to damage (Shamsudin 1997).

The Fourth National Forest Inventory (NFI 4), conducted in Peninsular Malaysia between 2002 and 2004, provides *G. bancanus* stocking estimates in the virgin, logged-over and stateland PSFs (Table 1; Anon 2008a). 40.7% of the total number of trees were between 15-30 cm diameter at breast height (dbh), 30.4% were between 30-45 cm dbh, and 28.9% were >45 cm dbh. The estimated timber volume for trees >45 cm dbh was 70.3% of the total volume (Table 1).

A study on the population structure of ramin within a 5-ha plot in a primary PSF showed that density of individuals declined rapidly from size class 1-10 cm to size class 10-40 cm dbh but increased in the 40-60 cm dbh size class before declining again in higher dbh classes. Very few individuals attained 100 cm dbh. The density of individuals above 40 cm dbh was 4 trees per ha and the total volume was estimated at 12.7 m3 ha-1 (Shamsudin 1997).

Table 1. *Gonystylus bancanus* stocking in virgin, logged-over and stateland PSFs.

Forest Class	Diameter Class 15–30 cm		Diameter Class 30-45 cm		Diameter Class >45 cm		Total	
	Stems	Volume (m^3)	Stems	Volume (m^3)	Stems	Volume (m^3)	Stems	Volume (m^3)
Virgin PSF	211,029	111,994	284,893	330,692	369,520	1,515,645	865,442	1,958,331
Logged over PSF	405,205	136,849	178,921	150,079	70,095	214,886	654,221	501,814
State land PSF	5,699	3,487	0	0	1467	4744	7,166	8,231
Total	**621,933**	**252,330**	**463,814**	**480,771**	**441,082**	**1,735,275**	**1,526,829**	**2,468,376**

Source: Anon 2008a

In a more specific example, the Malaysia/UNDP/GEF project (2001-2006) showed that ramin in the *Gonystylus-Calophyllum* subtype in Pekan FR represented an average volume of 40.1 m^3 ha^{-1} for size classes >50 cm dbh (Blackett & Wollesen 2005). In this subtype and Koompassia-Gonystylus-Durio subtype, the volume is concentrated in the larger diameter classes, which would be expected in a mature natural forest. The estimated number of ramin trees according to dbh classes and forest subtype is given in Table 2.

Table 2. Number of ramin trees per hectare by diameter class and forest subtype.

Forest subtype	Diameter Class (cm)				
	15-29	30-44	45-59	60-74	75+
Gonystylus-Calophyllum	0	8.1	9.6	4.6	0.4
Koompassia-Gonystylus-Durio (MXD-1)	1.9	1.4	3.5	2.4	2.3
Koompassia-Gonystylus-Durio (MXD-2)	2.3	2.8	3.0	1.5	1.1
Litsea-Gonystylus (MDG-2)	15.0	3.3	4.2	1.7	0
Mixed Zone	2.5	3.8	1.3	0	0

In a pre-felling inventory study in the North Selangor PSF, the Malaysia/DANCED project (1997-1999) found that the number of ramin trees per hectare by dbh classes >15 cm dbh, >30 cm dbh and >45 cm dbh were 9.3, 5.4 and 2.9 respectively (Bach 2000).

Analysis of ramin growth in logged-over PSF showed a mean annual dbh increment of 0.57 ± 0.36 cm s.d. (Thai *et al*. 2004). The analysis also showed that highest dbh increment of 0.79 cm was observed for class 30-39 cm. Dbh class <20 cm dbh had 0.40 cm increment while class 20-29 cm had 0.64 cm increment. Increment for classes >40 cm declined to 0.49 cm. Similar trends in mean annual dbh increment have been recorded for Sarawak with lower increment figures (Sia 2005).

Between 1987 and 2001, data from 64 growth and yield plots (YP) established in Sarawak's mixed PSF (logged and silviculturally treated) between the years 1971 and 1987 showed that ramin stocking in the plots had declined (Sia 2005). In 2001, Sia (2005) noted that at most sites, ramin had just one stem ha^{-1} or fewer for the 10-20 cm dbh class. In sites such as Naman FR, Pulau Bruit FR, Simunjan FR and Sebuyau FR, the number of trees in the 30-50 cm dbh class was double the number in the 10-30 cm dbh class. Volume was correspondingly reduced drastically, e.g., Batang Lassa PF saw a volume reduction of 90% between 1964 and 1976. The volume of ramin from YPs ranged from 0.9 to 30.1 m^3 ha^{-1} (Table 3). A similar reduction was recorded more recently by Tan (2008). He noted that in the unlogged transects at Sebuyau PF, only one tree per ha was recorded in the size class >10 cm dbh. Saplings in these transects had an average dbh of 1.66 cm.

Table 3. Ramin density and volume at each locality at the first assessment in or after 1986.

Locality	Ramin density		Volume (m^3ha^{-1})	%Total
	Stem/ha	%total		
Pulau Bruit PF	21	2.3	28.4	43.4
Naman FR	24	3.0	27.1	21.0
Simunjan FR	16	2.0	30.1	48.5
Triso PF	2	0.2	5.8	6.9
Sebuyau PF	14	1.4	27.0	33.8
Saribas FR	3	0.5	6.4	7.8
Daro FR	6	0.6	8.2	9.6
Tatau PF	19	1.7	5.5	4.4
Batang Lassa PF (YPs 30-36)	4	0.7	1.7	2.4
Loba Kabang PF	2	0.2	2.7	6.4
Bawan FR (YPs 43-48)	8	0.7	6.6	15.1
Bawan FR (YPs 65-72)	4	0.4	3.8	8.1
Batang Lassa PF (YPs 73-79)	7	0.7	2.9	8.8
Retus PF	1	0.1	0.9	3.4

Source: Sia 2005; PF = Protected Forest; FR = Forest Reserve

Although the difference was statistically insignificant, the mean annual dbh increment during 1987-2001 for trees >30 cm dbh in disturbed YPs was 0.44 cm yr^{-1} compared to 0.29 cm yr^{-1} from relatively undisturbed YPs (Sia 2005). Mean dbh increment peaked in the 30-40 cm dbh class where the mean was 0.45 cm yr^{-1}, three times the rate in size class 10-20 cm dbh (0.16 cm yr^{-1}).

Ramin in relatively undisturbed plots had a mean mortality rate of 1.1% ha^{-1} yr^{-1}. About a third each of this mortality occurred in the 10-20 cm and 40-50 cm dbh classes, respectively (Sia 2005). Harvesting activities were not thought to be factors leading to mortality. Of the fourteen YP sites, mortality exceeded recruitment in eleven sites. At these sites, mortality rates exceeded recruitment rates by two times or more.

Tan (2008) noted that in Sedilu FR, regeneration about 30 years after harvesting was poor. Ramin individuals were present in only five of the eight transects and in four of these (one unlogged), there were no trees >10 cm dbh. In addition, the number of seedlings <1 cm dbh was not significantly larger than the number of saplings (1-10 cm dbh). Clearly, ramin in these transects can be expected to have very limited or hardly any reproductive activity in the medium term as there are no trees >10 cm dbh to act as source mother trees. The population dynamics of ramin showed that the low number of trees in the smaller dbh classes would not be sufficient to replace larger trees by in-growth (van der Meer *et al*. 2005b). Tan (2008) and van der Meer et al. (2005b) attributed the loss of mother trees to the low diameter cutting limit and the change in the manner of harvesting PSF species.

1.3.2 *Habitat types*

The species is mostly restricted to the tropical lowland peat swamp forests. In Sabah and Sarawak, it occurs in the mixed peat swamp forests. It is rare in the lowland freshwater swamp and heath forests up to 100 m altitude. In a study on soil nutrients, a positive relationship was found between percentage nitrogen in the soil and the presence of ramin (Truong 2005). This is consistent with the findings of Tuah *et al.* (2000).

1.3.3 *Role of the species in its ecosystem*

The role of the species in unknown but the role of PSF in maintaining the hydrological and substrate balance and overall ecological integrity of the forest ecosystem is well recognised and documented.

1.4 Population

1.4.1 *Global Population size*

The Peninsular Malaysian data is insufficient to extrapolate the global population size of the species since little is known about the regeneration pattern and size class distribution within the larger extent of PSFs in Sumatra and Borneo.

1.4.2 *Current global population trends*

The population is decreasing.

1.5 Conservation status

1.5.1 *Global conservation status (according to IUCN Red List)*

VU A1cd (2007)

1.5.2 *National conservation status for Malaysia*

VU A4c (2007)

1.5.3 *Main threats within Malaysia*

Habitat Loss/Degradation (human induced) and associated threats such as fire, presence of drainage and irrigation canals and long-term intrinsic factors resulting from the alteration of hydrological regimes, etc. Other threats include unsustainable harvesting of its resources and the presence of canals for log transport.

2 SPECIES MANAGEMENT IN MALAYSIA

2.1 Management measures

2.1.1 *Management history*

Harvesting in the production forests of the Malaysian PSFs follows the Selective Management System (SMS). SMS was established in 1978 to recognize the importance of a balance between harvesting sustainability and long-term conservation. It was also designed to achieve harvesting sustainability with minimum development costs and optimise harvesting under prevailing conditions. All production forests of the Permanent Reserved Forests (PRFs) in Peninsular Malaysia are managed through the SMS. Details of this system were progressively improved to incorporate Reduced Impact Logging (RIL) (see 3.2.1) and independent third party certification of Permanent Reserved Forests (PRFs). This system is currently intertwined with the Malaysian Criteria and Indicators for Forest Management Certification, a market-linked tool to promote and encourage sustainable forest management as well as to provide assurance to buyers that the timber products they purchase come from sustainably managed forests. Prior to the SMS, Malaysia practised the Malayan Uniform System whereby the mature commercial trees in a primary forest were cleared in a single felling followed immediately by systematic silviculture treatments to release natural regeneration obtained from advanced growth (Wyatt-Smith 1995).

No harvesting is permitted in areas gazetted as Totally Protected. Areas gazetted under total protection include, among others, Virgin Jungle Reserves, Class 1 forests, water catchment areas (e.g. Batang Jemoreng PF, Setuan FR, Balingian FR and Batang Lassa PF in Sarawak), areas above 1,000 m elevation, National Parks (e.g. Mt. Kinabalu, Maludam, Loagan Bunut and Taman Negara National Parks), State Parks and Wildlife Reserves and Sanctuaries.

2.1.2 *Purpose of the management plan in place*

The ultimate aim of SMS is to ensure sustainable management and harvesting of finite resources with conservation of the habitats' biological diversity and controlled damage to the ecosystem.

2.1.3 *General elements of the management plan*

The Selective Management System (SMS) stipulates that harvest quotas be set annually (annual coupe). This quota is determined for every five years by the National Forestry Council which is chaired by the Honorable Deputy Prime Minister. The allocation of the annual felling coupe for the Permanent Reserved Forests (PRFs) is based on forest inventory data, net area of production forest, and prescribed silvicultural management practices. For the period 2006–2010, the annual coupes for the PRFs in Peninsular Malaysia, Sabah and Sarawak, including all dryland and wetland forest types, have been set at 36,940 ha, 60,000 ha and 170,000 ha respectively, which are about 1.2%, 2.0% and 2.8%% of their respective production forest areas. Annual coupe is calculated based on harvestable production area; the annual volume to be removed should be less than or equal to mean annual increment.

In Malaysia, the cutting cycle under SMS (otherwise known as forest harvesting rotation) is approximately 30 years with an expected net economic outturn of 40-50 m^3 ha^{-1}. Growth rates, residual stand, and the required final stand determine the length of the cutting cycle. Higher growth rates and residual stand content are expected to lead to shorter cutting cycles and higher annual coupes (Thang 1988). With respect to PSFs and ramin, the cutting cycle is extended to between 40 to 60 years. The rotation period used to determine the harvest quota for ramin is 50 years.

SMS adopts a selective cutting approach based on minimum diameter limit. Different minimum cutting limits are applied for different timber groups. For example, *Neobalanocarpus heimii* (Dipterocarpaceae, *chengal*) has a cutting limit of 60 cm dbh, other dipterocarp species are harvestable at 50 cm dbh, while non-dipterocarps are cut at 45 cm dbh. Ramin, which is included in the non-dipterocarp group, has a minimum cutting limit of 45 cm dbh in Peninsular Malaysia. Pahang State however sets the prescribed cutting limit even higher at 50 cm dbh. In general practice, trees of a much higher diameter (>70 cm dbh) are removed. Sarawak operates on an empirical harvesting period rotation of 45 years with a minimum cutting diameter of 40 cm dbh.

The State Forestry Department is required to prepare and implement a 10-year Forest Management Plan, a 5-year Forest Development Plan and an Annual Forest Operation Plan. These plans provide guidelines for the management, conservation and sustainable development of forest resources in the State and Districts. Apart from these Plans, a specific management plan has been prepared for the PSFs of Selangor, southeast Pahang, Loagan Bunut (Sarawak) and Klias Peninsula (Sabah). The integrated management plan for Selangor was prepared in collaboration with DANCED (1999; Bach 2000); southeast Pahang (Anon 2008b), Loagan Bunut (Anon 2007a) and Klias Peninsula (Anon 2007b) were prepared in collaboration with UNDP/GEF/Danida (2001-2005). A Ramin Technical Report for Sarawak was prepared in collaboration with the Netherlands (van der Meer *et al*. 2005a).

In Sarawak, a forest concession area has a Forest Management Plan which describes how the management unit is to be harvested. Prior to issuing a license, an inventory of the forest area is carried out to determine the minimum diameter cutting limit and annual permissible harvest. A selective diameter cutting system with an empirical cutting cycle of 60 years was revised to 45 years in 1970. The minimum cutting limit for ramin is 40 cm dbh. Within a year of logging, the first silvicultural operation is carried out. This entails poison girdling of defective trees and trees of no commercial value. Sampling of stocking density, species composition and degree of competition are carried out to determine subsequent silvicultural operations. Following such sampling, YPs are established to monitor stand development and predict the next cut (Lee & Chai 1996).

2.1.4 *Restoration or alleviation measures*

Several restoration trials have been undertaken in Peninsular Malaysia (Ismail *et al*. 2007). Trials in secondary PSFs in Selangor showed that line planting with a maintenance of planting lines once every three months gave better results in terms of ramin survival and basal diameter increment compared to open planting. Survival was 81% nine months after planting and average basal diameter increment was 0.5 cm. Total height increment was 8.9 cm. Similar restoration trials in Pahang PSFs had 72% survival three months after planting. Restoration trial in recently logged forest (c. two years) in Pekan FR showed a large degree of variation in survival percentage ranging from 61 to 82%. Causes of mortality included tree fall and drought.

The first *in situ* PSF gene bank was established in the Klias Peninsula, Sabah. Six gene bank plots, i.e., four at Luagan and two at Tamalang Along, were established in 2005.

There have been no other specific restoration measures taken for ramin apart from the above. Several of the recommendations made in the integrated management plans have been adopted by the respective States. These recommendations mainly pertain to issues regarding ecosystem functioning and environmental quality. Examples are the development of an integrated database management system, preparation to gazette stateland PSFs in Sabah, the initiation of two pilot community-based conservation initiatives promoting protection of peatland (Anon. 2007b), and the classification and zonation of the southeast Pahang PSFs and area consolidation (Anon 2008b).

2.2 Monitoring system

2.2.1 *Methods used to monitor harvest*

Subsequent to the identification and approval of areas to be licensed for harvesting, several operations are necessary before the license can be issued (Table 4). In this regard, the boundary earmarked for logging is marked, checked and approved on the ground. A pre-felling inventory with 10% sampling intensity using systematic line plots is carried out one to two years before harvesting to collect information on trees of all sizes from seedlings to mature trees. The results of the pre-felling forest inventory are analyzed and based on the prescribed cutting limits for the different groups of trees, all trees to be felled are marked and its felling direction determined. Trees that cannot be logged are also marked, including mother trees, protected trees and trees along the boundary of buffer strips. The residual stand after harvesting should contain at least 32 sound trees per hectare of class 30-45 cm. Tree marking is implemented to control output and prevent illegal felling and excessive removal from the timber stand.

Table 4. SMS: sequence of operations practiced in Peninsular Malaysia.

Year	Operation
n-2 to n-1	Pre-felling forest inventory of 10% sampling intensity using systematic line plots to determine appropriate cutting limits (cutting regimes)
n-1 to n	Tree marking incorporating directional felling • Marking of trees to be felled • Marking of seed/mother trees • Marking of protected trees • Marking of trees for road construction • Demarcating boundary of buffer zones for permanent watercourses
n	Felling of trees
n1/4 to n 1/2	Forest survey to determine damage to residuals and royalty on short logs and tops
n+2 to n+5	Post-felling forest inventory of 10% sampling intensity using systematic line plots to determine residual stocking and appropriate silvicultural treatments
n+10	Forest inventory to determine regeneration status of the forest

It has been the practice of the Department to conduct monthly monitoring of forest harvesting operations to prevent over-cutting in the licensed area and thus violating one of the principles of sustainable management. The procedures for monitoring harvesting operations are regularly updated to strengthen the monitoring process in order to minimize the loss of forest biological diversity during harvesting and decline in environmental qualities. At the completion of the harvesting operation, a closing report is required. The procedures for monitoring harvest operations are contained in the document entitled 'Checking and Monitoring Forest Harvesting', while those for the preparation of the Closing Report on forest harvested are contained in 'Preparation of Closing Report on Forest Harvesting'. Each document outlines the steps to be taken and indicates the people responsible for implementation.

2.2.2 *Confidence in the use of monitoring*

As can be seen, the forest harvesting plan is based on projections of growth and yield and regeneration patterns. The accuracy of data and projections of the ability of the forest to grow is crucial in the formulation of sustainable forest management. To assess population dynamics and develop population projection models, the Forestry Department has established two types of permanent sample plots (PSPs) to monitor growth parameters and study the response of forest growth under various cutting options with respect to stocking density of healthy residual trees, growth, mortality and recruitment rates. These PSPs are designated as growth plots and growth and yield (YP) plots. Growth plots are established in logged-over forest areas of varying ages to monitor the growth of harvested forests, while growth and yield plots are established in areas which have been harvested based on pre-determined cutting regimes to enable the Department to study the responses of forest growth under various cutting options. For the PSFs in Peninsular Malaysia, two growth plots in Sungai Karang FR, Selangor were established in 1993-1994. These plots monitor the growth of residual trees in logged-over PSFs. Two more PSPs were subsequently established and monitored, one each in the state of Pahang and Selangor. Periodic remeasurement in these PSPs will continue indefinitely. In Sarawak, 64 YPs were established between 1971 and 1987 (see section 1.3.1).

2.3 Legal framework and law enforcement

In Malaysia, the National Forestry Policy 1978 laid the foundation for the development of the forestry sector. It was revised in 1992 in recognition of the role of forests in providing a multiplicity of goods and services. The revised policy has had direct impacts on the management of forests through the establishment of permanent forest estates (PFE), large-scale forest plantations, importation of logs, greater incentives for downstream processing, promoting the utilization of lesser-known species and small-diameter logs, and manufacturing of value-added products. The Policy and the National Forestry Act 1984 provide Malaysia with a strong policy framework and legislation to support sustainable forest management. Both the Policy and Act provide a sufficient basis for protection against harmful activities, promote establishment of wildlife parks and reserves, and reduce activities that may cause detrimental impacts to the environment. Apart from these, there are many other policies, Acts, Enactments and Ordinances that indirectly affect the management and harvest of ramin in Peninsular Malaysia, Sabah and Sarawak.

In Peninsular Malaysia, the National Forestry Act 1984 was amended in 1993 to tighten the provisions and measures to safeguard and protect forest resources. With respect to encroachment and illegal logging, the penalty for the commission of any forest offence has been increased from the maximum penalty of RM10,000 (± US$2,940) or imprisonment for a term not exceeding three years or both to a maximum penalty of RM500,000 (± US$147,060) and imprisonment not exceeding 20 years with a mandatory imprisonment of not less than one year. The amended Act has also enacted provisions for the Police and Armed Forces to undertake surveillance of forestry activities to curb illegal logging, encroachment of forest areas and timber theft. This provision has proven to be very successful in slowing illegal logging activities and timber theft. In 2000, Malaysia reported a decline in the average number of illegal logging over recent years. In this regard, Malaysian forestry statistics (trade reports) are widely recognized as among the strongest in the tropics (Johnson 2003).

The International Trade in Endangered Species Act 2008 [*Act 686*] passed by the Parliament on 24 December 2007 provides for the administration and management of international trade in endangered species to ensure that the trade does not threaten the survival of any species of wild fauna and flora. The Act shall be gazetted soon and regulations are being drafted to ensure its smooth implementation.

As mentioned in section 2.1.1., no harvesting is permitted in areas gazetted as Totally Protected.

Long before ramin was listed under Appendix II, Sarawak imposed several restrictions to control its harvest and trade. The Ramin Logs Prohibition of Export Order 1980 and the Ramin Shorts and Ramin Squares Prohibition of Export Order 1991 were proactively enforced. These Orders attempt to minimize wholesale export of unprocessed logs and encourage more local downstream processing. As required by

CITES, export permits were issued by the relevant authorities in addition to an export license issued by the Controller of Wild Life, Schedule of Timber Shipment and Sales Contract. Further nation-wide measures such as the administrative ban on imports of all types of logs and large squares and scantlings (LSS) from Indonesia have been put into place since 2002 and 2003, respectively. The ban was later incorporated into the Customs Prohibition (Amendment) Order 2006; it is now an offence to import Indonesian logs and LSS into Malaysia. Particularly for Sarawak, only five entry points have been authorized for timber products to ensure effective monitoring and control of log movements to and from the state. Authorization of imports is subjected to valid documentation such as the Indonesian transport permits (SKSHH) and customs documentation (PEB).

In Sabah, the Sabah Forest Enactment 1968 (amended 1992) provides the empowerment instrument in forest resource management. Section 5 of the Enactment outlines the establishment of different forest classes, several of which are given totally protected status.

At the regional level specific to ramin, Malaysia, Indonesia and Singapore, through the Tri-National Task Force on Ramin, are attempting to curb the trade of illegal ramin. Close cooperation between Management Authorities, Scientific Authorities, Customs, enforcement agencies, trade and foreign affair-related Ministries at the national and regional levels ensure an efficient and effective networking. Malaysia has also established MY-WEN in support of the ASEAN Wildlife Enforcement Network (ASEAN WEN) initiative.

3 UTILIZATION AND TRADE FOR MALAYSIA

3.1 **Type of use** (origin) **and destinations** (purposes)

Ramin timber is widely used to make decorative cabinets, furniture, and interior decoration such as wall panelling, light flooring, door and window frames, mouldings, skirtings, ceilings, partitions, stair treads and counter tops. Ramin is also used to make toys, turnery, broom handles, venetian blind slats, dowels, picture frames and drawing boards. Ramin is suitable for veneer, plywood and blockboard manufacture. However, the timber is susceptible to decay and can only be used indoors. The resin is used by local communities as incense, while pounded fruits are used to poison fish. A concoction of roots is administered after childbirth.

Major importing countries include the USA, Europe, Japan, Australia and Taiwan. All derivatives are obtained from wild specimens.

3.2 Harvest

3.2.1 *Harvesting regime*

As can be seen from section 2.1.3, the cutting limit for ramin applied in Pahang is much higher than the one prescribed for the entire country. This cutting limit is currently being reviewed in a study in Pahang PSF. In addition, at least 32 sound commercial trees per hectare for diameter classes of 30 cm dbh and above should be retained.

Following the tree marking exercise (see 2.2.1), a forest harvesting plan is prepared. The plan also contains a map showing pre-determined feeder roads (railways or canals) and skid trails to be constructed to comply with various specified guidelines. Once the forest harvesting plan is approved by the Department and the premium paid by the license holder, a forest logging license is issued and harvesting commences.

Reduced Impact Logging (RIL) is the implementation of a collection of forest harvesting techniques that results in lowering the level of damage to residual trees and environmental quality. Harvesting in the PSFs is carried out using traxcavator and canal systems. Logs are hauled to the river or main road for transportation to outside landing sites or sawmills. In Pahang, Reduced Impact Logging (RIL) employing a modified excavator with a long arm and cable winching capabilities has been used for several years. This equipment winches logs from a distance of 150 m to the feeder road where they are stacked for transportation. In Sarawak, logging using heavy machinery has replaced the 'kuda-kuda' method, thought to be labor intensive but more environmental friendly (Lee & Chai 1996). A revision of the logging damage factor for peat swamp forest is being looked into as long-haulage machinery that causes less damage to the site and residual trees is introduced. RIL has also been implemented in Sabah (Marsh et al. 1996, Anon 2001) and Sarawak (Jonathan *et al*. 1999).

3.2.2 *Harvest management/control* (quotas, seasons, permits, etc.)

The National Forestry Act stipulates that all movement of logs must be accompanied by a removal pass. The removal pass is issued by the Forestry Department officer as proof that all fees have been paid and that the logs were harvested from licensed area. This paper-based system is one of the control mechanisms in place to monitor harvesting operations and the movement of logs. To enhance ramin conservation through stricter harvesting control, logs of *Gonystylus bancanus* are to be recorded at the species level in the removal pass.

Malaysia also subscribes to the permit requirement of CITES.

3.3 Legal and illegal trade levels

The ramin export quota for Peninsular Malaysia and Sabah in 2007 was 20,000 m^3; the quota was 3,178 m^3 for Sarawak. About 6,394 m^3 of ramin products, parts and derivatives were exported from Peninsular Malaysia and 5,674 m^3 of sawn timber and 4,319 m^3 in dowel/moulding from Sarawak in 2007. Products exported consist of sawn timber (35%), dressed timber (25%), picture frames (15%), mouldings (10%), baby cots (10%) and various products of finger-jointed S4S, venetian blind, baby crib, louver doors, wood frame, basinet and furniture (5%). The reduction in export was due to the temporary suspension of export to the European Union and Australia. The EU ban was subsequently lifted on 07 December 2007 while the Australian ban is still in effect.

II. Non-detriment finding procedure (NDFs)

1. IS THE METHODOLOGY USED BASED ON THE IUCN CHECKLIST FOR NDFS?

_X_ Yes ___No

2. CRITERIA, PARAMETERS AND/OR INDICATORS USED.

The criteria, parameters and/or indicators used to make the non-detriment finding for *Gonystylus bancanus* are:

- habitat preference to peat swamp forests;
- extent of the PSF areas and demarcation of PSF into areas belonging to the State and areas under private ownership;
- density and demography of populations in various Permanent Sample Plots (PSPs), Growth and Yield Plots (GYPs), and plots laid out for national forest inventories (NFIs);
- flowering phenology and reproductive behaviour;
- germination, seedling and sapling establishment, growth rates in primary and logged-over areas;
- annual coupe and harvesting regimes/limits employed under the Selective Management System and Sustainable Forest Management;
- suitability of the Reduced Impact Logging (RIL) method; and
- pattern and level of exploitation for international trade.

3. MAIN SOURCES OF DATA, INCLUDING FIELD EVALUATION OR SAMPLING METHODOLOGIES AND ANALYSIS USED

The main sources of data for NDF are data from the Third and Fourth NFIs, PSPs, GYPs, academic research, pre- and post-felling inventories in targeted areas. These are sample-based and field-evaluated. For the plots established under PSP, GYP and NFI, the published data is data that has been analysed. National Forest Inventories are conducted only for Peninsular Malaysia. See literature cited.

4. EVALUATION OF DATA QUANTITY AND QUALITY FOR THE ASSESSMENT.

The evaluation of data quantity and quality for the assessment of *G. bancanus* NDF is fairly good because data quantity, particularly with respect to growth and yield and harvest management, is not lacking. However, biological aspects such as reproductive capacity and natural regeneration patterns in primary and disturbed PSFs are not sufficiently enumerated. Quality of current analysis and assessment may be somewhat compromised due to the loss of long-term data resulting from factors such as the loss of PSPs.

5. MAIN PROBLEMS, CHALLENGES OR DIFFICULTIES FOUND ON THE ELABORATION OF NDF.

As can be seen from this example, Malaysia has had for many decades a long-term commitment of political will, financial resources and the use of forestry technologies to ensure that its forest resources are sustainably managed. To embark on a similar scale for any taxa in the Appendices is indeed an uphill task.

The elaboration of an NDF for *G. bancanus* is, to Malaysia, a straightforward process. The taxonomy of the genus *Gonystylus* is well defined and morphological characters are reliable. What makes this process complicated is that the trade in timber is undertaken by groupings and not by species. Apart from the use of sophisticated fingerprinting methods, resource-intensive tagging systems, and or the on-site monitoring of harvests, there is currently no method allowing quick and reliable identification of species used in any timber products.

6. RECOMMENDATIONS

Major importing countries should help finance inventory activities and the formulation and implementation of action plans and management measures in Range States. To ensure a degree of autonomy, the funds should be channelled through the CITES Secretariat.

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Fig. 1. Geographical distribution of *Gonystylus bancanus* in Malaysia.