Forest Rehabilitation – The Malaysian Experience

by

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PART A
STATUS OF LAND USE AND FOREST (AND LAND) DEGRADATION

1. Historical Perspective of Forest Land Use and Land Use Change in Malaysia

In former times, natural forests were extensive in Malaysia. Contrary to events in other regions of the world, European colonization of Malaya, which began in 1511 with the capture of Malacca by the Portuguese, did not result in exploitation and removal of the forest. In those days, the foreign demand was for spices, gum Arabic, gutta percha and what were subsequently termed "minor forest products". Exploitation for timber began in earnest only towards the end of the 19th century. The logged timber was entirely used for development within Malaya, in construction work, the building of the railway lines and for tin mining and smelting. This period also saw an unprecedented demand for gutta percha, an exudate that resembles latex from gutta taban (*Palaquim gutta*). This substance was needed for the insulation of the sea cables used in pre-wireless days. This resulted in heavy exploitation of the taban trees from the forests. Another development of the time that affected forests was the introduction of rubber (*Hevea*) plantations.

Export of timber did not really take place until the Empire Trade Fair Exhibition of 1925. Samples of Malayan forest produce and timber samples were sent to London. This was when interest for Malayan timber was shown and a market for it began to be established. In those days sustainable forest management was never heard of and uncontrolled logging and heavy exploitation was the rule. In 1947, post-war examination from selective felling of forest was done and it showed that many areas contained adequate or even abundant regeneration of timber species (Walton, 1948) and that these areas on the whole would recover by themselves. This observation led to the development of the Malaysian Uniform System (MUS) for managing the lowland Dipterocarp forests in Malaya.

However, in 1960, the Malayanisation process began and by 1963, based on the Ford Foundation report, plans for agricultural diversification and rural development were initiated in P. Malaysia. Before the decade was over, sweeping changes to land-use policies were made and most of the timber-rich lowland forests were set aside for agriculture. Forestry was third priority after mining and agriculture for land-use. Forestry was forced up to the hills and those areas with soils too poor for agriculture, and where the forest composition and its merchantable value did not measure up to that in the lowland Dipterocarp rich forests. In Sabah and Sarawak, too, apart from uncontrolled logging, forest had been lost due to shifting cultivation using the slash and burn method by the natives.

Hence, beginning in the early 1960s, large tracts of lowland forest were cleared for the planting of paddy and rubber under the country's agricultural development program. Millions of hectares of rubber plantations have been established since then. Around the same time or earlier, tin mining became big business and large areas of lowland forest concessions were also given out for this purpose. After mining, these areas were laid bare with almost no vegetation. Around the early 1970s oil palm was also introduced into commercial planting and again vast tracts of lowland for-

est were taken up for this plantation crop. Today, it can be seen that we hardly have any lowland forest left in the country and most of our forests in Malaysia are confined to the hills.

Then again in and around the nineties, the country experienced the Industrialization and slump eradication era. Here again large tracts were cleared for building low cost housing for the mass and for other mixed developments. Land areas were also allocated for industrial buildings.

Today the status of the available forest is summarized in Table 1. In the category of Permanent Forest Estates (PFE) in Peninsular Malaysia, the very notable and recognized area worldwide is the Matang Mangrove Forest. It has been touted as the best sustainably managed mangrove estate in the world. Located in Perak (5°8'N; 100°35'E) it covers a total area of about 40,500 ha. A total of 19 forest reserves were gazetted beginning with the islands followed by the mainland beginning in 1902. In the category of the National and Wildlife Park, the notable reserve in Peninsular Malaysia is the Taman Negara. This is touted as the oldest rainforest in the world. It stretches over three states (namely Pahang, Trengganu and Kelantan) and covers a total area of about 500,000 hectares. It was established in 1939. In Sabah, the notable forest reserve is the Maliau Basin which covers an area of 39,000 hectares of pristine forest and was established in 1983.

Table 1. ***Existing forest types in Malaysia based on a usage classification***

Types	Peninsular Malaysia	Sabah	Sarawak	Total
PFE	4.73	3.59	6.00	14.32
• Productive	2.83	3.00	4.97	10.80
• Protective	1.90	0.59	1.03	3.52
National and wildlife parks	0.74	0.38	1.00	2.12
State land forest	0.46	0.49	2.89	3.84
Total	***5.93****	***4.46****	***9.89****	***20.28****
Total land area of Malaysia: 32.86 million hectares				

* In millions of hectares

2. Current Status of Forest (and Land) Degradation

2.1. Extent of Degraded Lands in Malaysia

Degradation is used here to refer to former forest land that has had the trees removed and is being farmed in a manner unlikely to be sustainable into the future or to forest land that has been disturbed and has been abandoned since. The degraded terrestrial ecosystems that are grouped according to the definition are abandoned agriculture land, ex-mining land, poorly stock logged over forests and ex-shifting cultivation areas. The extent of degraded lands in Malaysia is as shown in Table 2.

3. Causes and Impact of Forest (and Land) Degradation

In Malaysia, causes of degradation may be due to a consequence of a variety of processes or activities. Sometimes it is possible to identify a single cause but often it is a number of factors

that cause the degradation.The following are the leading factors behind deforestation (Panayotou & Ashton 1992).

Table 2. ***The extent of various degraded lands in Malaysia***

Type of degraded land	Acreage (ha)	Source
Poorly stock logged-over forests that had been converted to forest plantations in Peninsular Malaysia.	56,260	Thai *et al.* (1995)
Shifting cultivated areas	4,800,000	FAO/UNEP (1981)
Degraded secondary forests i. Peninsular Malaysia ii. Sabah iii. Sarawak	(4,604,000) 174,000 1,100,000 3,330,000	Ahmad ainal bin Mat Isa (1992)
Ex-mining land	114,000	Chan (1990)
Abandoned Agricultural land Rice field Others	(700,000) 260,000 440.000	Berita Harian (1989)

3.1 *Poorly Stock Logged-Over Forests and Shifting Cultivated Areas*

Degraded logged-over forests in Malaysia are only from the productive forests. The distribution of the productive forest is as shown in Table 1. The cause of degradation is mainly due to uncontrolled logging and followed by shifting cultivation. As the forests are opened out, the logging roads become highways for the illegal shifting cultivators and hunters to exploit the logged-over forests. The control of this illegal degradation of biodiversity is very difficult due to the lack of manpower in the forestry departments. The problem has made the effort on conservation of biodiversity in the productive forests a formidable task.

The Selective Management System employed to manage the productive forests is a fairly sound system. However, some uncontrolled loggings may result in poorly stock logged-over forests and in Peninsular Malaysia alone, it has been estimated to be about 56,200 ha (Table 2). These poorly stock logged-over forests have slow regeneration rates as a result of damages to their growth during logging activities. In addition, the removal of plus mother trees virtually stripes the genetic pool of commercially exploited species. Thus, the poorly stock logged-over forests need human intervention to improve the regeneration of the forests. In the past, enrichment planting was carried out after post-F inventory but it proved to be costly and ineffective.

The degraded secondary forests may come from productive forests, state land, natural greenbelts in the city which are normally characterized by secondary forests and shifting cultivated areas. The causes of the formation of secondary forests are shifting cultivation, abandoned plantation projects, and illegal clearing of the forests that are under state ownership. However, the secondary forests at undeveloped slopes in the city and river reserve are normally conserved as green belts and often act as environmental buffer zones.

Ex-mining land is a poor fertility site caused by tin mining activities and only a small number of plant species has successfully colonized the sites. The poor fertility of the ex-mining land is main-

ly due to its changing physical properties where water was used to separate the sand from the silt and clay particles, forming sand and slime tailings. This resulted in the large area of infertile sand, and slightly better fertility waterlogged slime (Ang, 1994). Thus, the colonization process is normally very slow which results in low diversity, especially on sites which are located far from the seed sources of natural forests. Table 3 shows the species diversity of the tin tailings. Slime tailing has the highest number of species probably due to its more fertile soils than sand. Hence, exmining land is usually very poor in diversity and needs enrichment of plant species. A classical successful story of the complete rehabilitation of a tin tailing site is located in Bidor, Perak. The area is about 130 hectares. Rehabilitation work started in 1997 and from the year 2000 onwards AKECOP provided funds to continue this work. The area currently is completely rehabilitated and stands out as a green belt against the vast area that continues to remain barren. The Perak State is now studying this model to extend this work to the other tin tailing areas in the State.

Table 3. ***Number of species at selected sites of tin tailings***

	Pond	Sand	Sandy slime	Slime
Shrub/small tree species	0	9	7	19
Creeper, grass, etc	24	38	54	56
Total	24	47	61	75

Source: adapted from Ang, 1994

Abandoned agricultural land derived mainly from the conversion of the state land forests or degazetted permanent forest estate (Table 2). The main cause of abandoned agricultural land lies mainly primarily the success of the industrialization process and the New Economic Policy, which has changed the social economic status of the villagers. Many of the villagers would prefer to work in air-conditioned factories with stable incomes, especially the new generations of villagers. This shift of economic balance in development prompts a new pattern of migration from village to the city or industrial zone and this has been taking place since the early 1990s. This migration pattern has caused a considerable setback in the rice production of the nation and resulted in an extensive area of abandoned rice fields (Table 2). The idle land is commonly covered with grasses and economically unimportant tree species.

3.2 *Conversion to Other Economic Uses*

Large tracts of easily accessible natural forests have been converted to other forms of land use such as agriculture, mining, timber plantations, pasture land, urban development, hydroelectric dams, etc. Conversion of natural forest to perennial tree-crop agriculture such as rubber, oil palm, cacao, fruit trees, spices, coffee, sugar cane, etc. have been important economic developments in the region. The pressure to convert more forested land for such development has not ceased, considering the apparently high profits from such activities. These activities result in definite loss of tree cover from the area.

The government sponsored settlement programs whereby people were relocated is another cause for forest degradation. The FELDA (Federal Land Development Authority) scheme in Malaysia was introduced to raise the economic standards of the settlers. Under the schemes, in the region in excess of 10 million ha of natural forests were converted to rubber and oil palm and other tree crops for the settlers to work on.

3.3 *Uncontrolled Exploitation*

Although statistics are not available, effects of over-harvesting, overgrazing and fire damage, all of which lead to forest degradation, has also to be taken into account. The incidences of fire are increasing in the region, with three major episodes of fires in the region in the last two decades. In each instance, about 1 million ha, mainly the peat swamps, were burned (e.g. Leighton & Wirawan 1986).

3.4 *Shifting Agriculture*

The problem of shifting agriculture has been highlighted extensively. Easily more than half of deforestation in the country can be attributed to unsustainable shifting agricultural practices (Spencer 1966). The rapid growth of the populations and shrinking of the existing forested areas are the main reasons behind the failure of this age-old system of agriculture. Besides shifting agriculture, encroachment by landless populations into newly logged forests is also taking its toll.

3.5 *Logging*

Prior to the introduction of Sustainable Forest Management guidelines, commercial extraction of timber in the country had been shown to be largely destructive. An ITTO study concluded that a very small percentage (less than 1%) of the natural forests in the country had been managed on a sustainable basis (Poore et al. 1989). In all cases, over-harvesting had been the usual practice. The growth figures obtained from studies rarely support the rate of harvesting, and the cutting cycles of 25-40 years are believed to be on the short side. The harvesting using heavy skidder-tractor machinery usually resulted in damage of over 60% to the residual vegetation (Appanah & Weinland 1990). The loss of potential tree crops as a result of logging damage had not been clearly recognized, but it has shown up to be considerable, and extensively depletes the stock left behind for the second cut (Appanah & Harun 1999). Logging is carried out with maximum speed, and rarely skidding tracks are pre-planned and controlled, very little road maintenance is carried out, directional felling is rarely employed, pre-felling climber cuttings are not conducted, and little silvicultural tending is done to improve the commercial regeneration. Besides damage to vegetation, the poor construction of roads, low maintenance, and the use of heavy machinery result in excessive soil erosion. If such conditions continue to prevail, many of the logged forests will be poorly stocked, and natural regeneration will be scarce.

PART B
IMPLEMENTATION OF FOREST RESTORATION AND REHABILITATION

1. History of Reforestation/Rehabilitation in Malaysia

Forest plantations are not a new concept and practice for Malaysia. However, interest in forest plantations lacked the required impetus in the distant past. It has vacillated quite a bit, influenced on the one side from fear of impending timber deficits in the future and poor results from planting trials on the other. Up until the 1970s, Malaysia was endowed with vast areas of natural forest. Under such superfluity, it was considered unnecessary and unnatural to convert natural forest into unstable monocultures.

A brief history of forest plantation trials can be found elsewhere (Appanah & Weinland, 1993; Wyatt-Smith, 1963). Here it will suffice to present the most notable events in the history of plantation forestry in the country, especially with Peninsular Malaysia (Table 4). The situation in Sabah and Sarawak is more straightforward, and less illustrative to the changing tides in forest management that Malaysia underwent. Therefore, in Table 4, the principal events in plantation development in Peninsular Malaysia, Sabah and Sarawak are highlighted.

Like with the management of natural forests, plantation trials were first begun in Peninsular Malaysia, and then subsequently in Sabah and Sarawak. Records of planting forest species date back as far as 1880, when concern for loss of desired species was expressed (Hill 1900). There was concern over the rapid destruction of the taban forests and it was also becoming increasingly difficult to obtain railway sleepers. This was the gutta percha era when the nyatoh taban (*Palaquium gutta*) trees were heavily felled for gutta percha, which fetched a very high price. Interest in plantations of gutta taban caught on. Wildings were collected and planted in regular plantations. At Ayer Kroh, Malacca, 500 gutta percha plants were planted (Hill 1900). A scheme for planting hardwood trees in Sungai Buloh Forest Reserve was also initiated. They removed all mature timber, and line planted the hardwood species. About this time, rubber production became the new excitement. In 1901, 180 acres of regular plantations of rambong (*Ficus elastica*) and para rubber (*Hevea brasiliensis*) were started in Pondok Tanjong, Perak.

Besides planting of heavy hardwoods, afforesting mining land and BRIS soils and reforesting forest lands were also of high priority. In 1898, the areas around Pekeliling (Circular Road), Kuala Lumpur, were planted with species such as *Casuarina equisetifolia*, *Eugenia grandis*, *Dryobalanops aromatica*, *Swietenia macrophylla*, *Hevea brasiliensis* and *Fagraea fragrans*. For example, the clumps of trees of *C. equisetifolia* and *Fagraea fragrans* found on the Selangor Golf Course in Kuala Lumpur are remnants of plantings done between 1896 and 1901. Forest planting was limited to trials of extremely valuable exotics such as *Eusideroxylon zwageri* and *Hevea brasiliensis*, and local timber species such as *Casuarina equisetifolia*, *Fagraea fragrans*, *Intsia palembanica* and *Palaquium gutta*.

After a while, all these planting fell out of favor. Plastics replaced gutta percha. Rubber planting was taken up increasingly by private planters. The reforestation work, experimental in nature, did not perform well and the results were considered not commensurate with the expenditure. Nevertheless, some planting trials persisted here and there. Plantings of *Intsia palembanica* and *Neobalonocarpus hemeii* were continued. Besides these, species trial with teak was also reported. They were first planted by rubber planter in Langkawi Island (1903 Annual Report).
These were the main developments, and by the end of 1912, there were 922 acres of regular plantations and 4,828 acres were line planted under shade. By that stage, results from improvement felling in natural forests were available. These suggested that it is still better to improve the crop in the natural forest than plantings in regular plantations (Annual Report 1912). As a result, no further increase in plantations occurred, and in the 1920 Annual Report, it was noted that the area of regular plantations stood at 869 acres.

The Forest Department did most of the plantings but the records were meager. Initially, exotics were tried, but subsequently local species were tested in the belief that they gave better growth. Foxworthy (1930) records that some 130 species were tested in all, but a high proportion of them yielded poor results. Overall, the plantings were haphazard, initiated by individuals, and scattered throughout the country. Many of the trials were lost when the officers got transferred. This was dubbed the "plant and forget" era (Oliphant 1932).

These disappointing results led to a major development in forestry in Malaya. It was decided that a central permanent experimental station should be set up, in Kepong. It was recommended that further planting should be initiated only after the species and methods would have been tested in Kepong. The experimental plantations were started in Kepong in 1927. While more species were added to the trials in Kepong, much of it remained experimental. The emphasis was mainly on high quality timber species that have a long rotation. These would yield definitive results only in the decades after 1970. In the early 1930s, the position on planting did not shift as the researchers were not in favor of planting.

Despite the reservation on planting, occasional experimental trials were conducted.In 1931, high elevation plantations were begun in Mentiga, Cameron Highlands, to test exotics (Annual Report 1933). In 1936, large-scale planting experiments were carried out in Rantau Panjang and Bukit Sungai Puteh Forest Reserves, Selangor. In 1937, trials were begun to establish commercial pole crops on denuded areas in Selangor and on the poor BRIS land in Kelantan. The latter were totally unsuccessful. During the Japanese Occupation, (1942-1945) many areas in Forest Reserves were cleared for farming due to food shortage and after the war, there were some efforts to line-plant these areas.

Taungya system was also tried. Progress was made, but the survival rate was very poor. In the early 1950s, extensive plantations were established in devastated areas in Malacca, Selangor and Perak. The experimental teak plantations in Northwest Malaysia were stepped up to test provenances from Java and Thailand (Wyatt-Smith 1961). This was also the period when many exotics were tried on an experimental plantation scale to gauge the costs. The species included some of the fast growing species like pines, yemane, and eucalypts. The pines and eucalypts were planted in the hills and lowlands. The pines were also tried on lalang (alang-alang) infested areas and tin tailings.

In the early 1960s, work still continued on trials of more pine species, especially the ones from Central America. Selection of elite trees of pines and their vegetative propagation were initiated. Another significant development then was a plan to set up a pulp and paper mill in Peninsular Malaysia. This lead to the “Pilot Plantation of Quick Growing Industrial Species” program, carried out with UNDP assistance. Several species of pines and other conifers were grown on a pilot scale for pulp production. Plantations were started in several states, including the setting up of seed orchards. The early results appeared promising with *Pinus caribaea* and *P. merkusii*, which had increments of above 21 m^3/ha. Their pulping properties were found to be suitable for paper manufacture. But before the viability of such plantations could be ascertained, the planned paper mill was scuttled. Thereafter, interest in raising plantations for pulp production diminished as well.

In the early 1960s, following sweeping changes to land-use policy, forestry became confined to poorer soils and to the hills. With these poorer forests, the old management systems were revised and planting was taken as an option to remedy logged sites that were poor in regeneration. The Forestry Departments embarked on Enrichment Planting under the Intensive Forest Management Scheme (Ismail 1964). Planting with potted seedlings and wildings of mainly indigenous species was carried out in several states, especially Selangor, Perak and Kedah. Such plantings dominated the Departments' activities for most of the 1970s. The results, however, were dismal, despite the high costs (Tang & Wadley 1976). Survival was moderate to low. Growth was good. Provided the canopy was kept open for a relatively long period. The species used were not necessarily the best for the purpose. Thereafter, enthusiasm for expensive enrichment planting faded, and is now employed to a minor degree only, to improve highly degraded sites.

Table 4. ***Summary of the most notable events in the history of plantation forestry in Peninsular Malaysia***

Year	Events
1877	Rubber (*Hevea brasiliensis*) planted in Kuala Kangsar
1884 - 1900	Small trials of exotics started
1900 - 1913	Regular plantations of gutta percha (*Palaquium gutta*) and rubber (*Hevea brasiliensis)*; Line planting of chengal (*Neobalanocarpus heimii*) in forest reserves; Experimental planting in abandoned mining land
1927 - 1941	Forest Research Institute set up in Kepong, and experimental plantations in lowlands were started; Plantation experiments in Cameron Highlands (ca. 1,500 masl); Teak planted in Langkawi Island
1945 - 1950	Experimental teak plantations in Northwest Malaya; Plantings in forest clearings resulting from disturbances during the war.
1952	FAO *Eucalyptus* study tour in Australia, and extensive species trials with *Eucalyptus* spp.
1954 - 1958	Species trials with *Pinus* spp. With potential pulp value were initiated; Experimental plantations were started on tin tailings; Taungya system tried using *Gmelina arborea* in tobacco farms; Line plantings of kapur (*Dryobalanops aromatica*) were established in Kanching.
1959 - 1962	Large scale experimental planting with *Pinus caribaea* and *P. insularis* in the lowlands. *Pinus* spp. From Central America and *Populus* spp. From Kenya were also tested; Experimental plantings in shifting cultivation areas; Line planting and small-scale plantings of secondary growth of *Dryobalanops aromatica, Eusideroxylon zwageri, Flindersia brayleyana, Fragraea fragrans, Khaya* spp., *Pentaspadon officinalis*, and *Shorea macrophylla.*
1963 - 1965	Bigger trials of *Pinus* spp. conducted in Selangor.
1966 - 1970	Under the UNDP assistance, pilot plantations of quick growing industrial tree species were initiated, mainly for production of pulp. Plantations of pine were expanded in Selangor, Johore, Pahang, Negeri Sembilan and Kedah; *Shorea* and *Dryobalanops* spp. planted under the Taungya system in Negeri Sembilan. Jelutong (*Dyera costulata*) plantations were expanded in Sungei Buloh F.R.
1971 - 1976	Mixed plantations of *Pinus* and *Araucaria* were tested on poor soils in Bahau; Enrichment planting using indigenous species became an important forestry practice.
1981 - 1992	The Compensatory Forestry Plantation Project through ADB loan was initiated. Quick growing tropical hardwoods like *Acacia mangiurn*, *Gmelina arborea* and *Paraserianthes falcataria* were chosen for producing general utility timber. The Compensatory plantations came under review and the planting for sawlog production has been put on hold. Planting for pulp production continues.
1992 - 1996	Planting of teak began earnestly event in wetter sites; Sentang (*Azadirachta excelsa*) is also given importance as a plantation species.

Source: Appanah & Weinland, 1993

As the 1980s approached, most of the State Lands Forests were converted, and forest resources were limited to the Permanent Reserves only. These are much poorer in stocking. But meanwhile, the industries have been developed for a much higher capacity than the natural forests would be able to sustain. This led to speculations that there will be a timber shortage in the future (Chong 1979). This led the Forestry Department to consider planting general utility timber under the 'Compensatory Plantation Project'. The compensatory plantation was to cover 188,200 ha by the year 1995, and was supported by an Asian Development Bank loan. The plantations were planned to produce general utility timber of small saw log dimensions for the domestic market in 15 year rotations. For the purpose, quick growing tropical hardwoods such as *Acacia mangium*, *Gmelina*

arborea, *Paraserianthes falcataria* and *Eucalyptus camaldulensis* were identified. However, due to difficulty in procuring planting material, the majority of the areas were planted with *Acacia mangium*, as seed was easily available. However, the species has not fulfilled the initial expectations, with relatively poor volume growth and trees have been susceptible to heart-rot damage in some sites (Hashim *et al*. 1991). Overall, its performance for sawlog production has remained dismal (Weinland and Zuhaidi 1990). As a consequence, additional planting of the species for sawlog production has been halted since 1992. But plans for planting the species for pulp production are being pursued on a big scale with development of one pulp and paper mill in Sabah and additional ones in Sarawak and Peninsular Malaysia.

At present, the Forest Department is looking for alternative species for forest plantations. Since the mid-1980s, rubber wood has become an important source of timber for furniture production. At present the source of rubber wood is mainly from replanting schemes. But the species has also been planted on a trial basis exclusively for timber production only.

Besides rubberwood, other promising candidates are also being tried out on a larger scale. This includes teak (*Tectona grandis*) and sentang (*Azadirachta excelsa*).Teak had been confined to the drier Northwest of Peninsular Malaysia before. But nowadays, it is being planted on a small scale in the wetter southern sites as well. The tree seems to grow just as well, the only drawback being the absence of close growth rings and therefore veneer quality may not be obtainable. The other species that has brought some excitement in the plantation scenery is sentang. This, too, has shown good growth rates in the early years, and is mostly free of pests. The plantings have to mature somewhat before their true value can be ascertained. A few other species that are also being considered for planting at the moment include *Khaya ivorensis* and *Khaya senegalensis*, and to a lesser extent *Swietenia macrophylla*. Some of the dipterocarp species also appear to be good and are being investigated as potential candidates. The reason for the new spate of interest in plan-ting timber species is partly because of the rising labor costs in the country. As a consequence many rubber and other cash crop plantation owners are looking for alternative and less labor-demanding crops. Timber trees fit that label neatly.

For Sabah and Sarawak, the gestation period between research to policy and implementation was usually shorter, taking off from experiences in Peninsular Malaysia. The path to implementation is therefore less convoluted and more or less direct. In Sabah, plantations were not considered important in its early forestry history, although there were some attempts to test out a few species on an experimental basis. In the 1970s the planners concluded that more should be done for forestry development. Unlike with Peninsular Malaysia, Sabah still lacks the momentum to develop its economy based on the industrial sector. Forestry remains in the forefront of its economic activity, and the planners realized something must be done if the State is to maintain its timber productivity. Moreover, forestry appealed to the State, as it provides the kind of rural development which is more appealing to the people, considering their lifestyle. The Sabah Forest Development Authority (SAFODA), a State statutory body, spearheaded the reforestation program. Thereafter, relatively rapid progress was made, and by 1995 almost a 100,000 ha of plantations had been developed, mostly through some of the statutory bodies responsible for rural development and reforestation (Anuar 1996). Both fast growing hardwoods and high quality timbers are being planted. Rattan has also been planted as an additional crop. Besides these developments, a paper mill was set up in the 1980s, and large areas are being planted up with fast growing pulp species.

In Sarawak, too, there never was an urgency to go into plantations, considering the large areas of natural productive forest in the State. Nonetheless, there was some concern regarding the large

areas of forest land that have become degraded as a result of shifting agriculture. In this regard, some experimental trials were started in the early part of the century, especially with species that had agroforestry potential (Fahlman 1975, Lee and Lai 1981). In the mid-1960s there were some attempts to test the potential of pines for reforestation purposes. In the 1970s, fast growing exotics were investigated. Also included were some long-rotation species which yield high quality timber. But all said, there have been relatively few plantations in Sarawak, although the position is likely to change very rapidly from now on.

2. Need for Rehabilitation of Degraded Lands

Rehabilitation is used here to refer to all those processes that help reverse the state or processes of degradation and return the land to a stable and more productive condition dominated by trees. Each type of degraded land has to be rehabilitated using different approaches and technologies. The aims of the reforestation efforts must be well defined. Generally, the selection of a suitable approach would encompass these objectives.

2.1 *Increasing Site Productivity*

Low productivity is one of the consequences of degradation. This will have to be considered along with cost-effectiveness of replanting and the acceptability of the social-economic component of the system.The purpose of increasing the productivity of a site is to ensure that the income for the illegal settlers is stable and that they are kept within the agroforestry sites. This will prevent further clearing of the forests. In Sarawak, shifting cultivators were invited to participate in the agroforestry projects initiated by the Forest Department. The shifting cultivators were issued permits for their cultivation practices but in return they have to assist the department in tree planting projects or the establishment of wood-lots (Leo & Lee, 1992).

2.2 *Increasing the Species Richness*

The rehabilitation processes to increase the species diversity of the site will only be applied in exmining land and patches of green belts in the city and river reserves. These degraded sites can be green with high diversity of plants and eventually turn into a conservation area for biodiversity and later can also be used as a green lung, park or botanical garden. These degraded sites will not be opened up for development anymore if they are gazetted as a green lung belt. The effort of enriching the species and thus increasing the biodiversity is necessary, as Malaysia would like to protect the endangered species despite the existence of the protected forests where no logging is allowed. Table 5 shows the species – mainly plant species – which are classified as endangered species requiring some kind of conservation or preservation measure. Any restoration or conservation activity must then include the planting of these endangered tree species (Table 5).

2.3 *Increasing Site Quality*

The planting of tree species will improve the site quality of the degraded lands including soil properties and microclimates. The general functions of the trees to improve the poor site such as tin tailings and other degraded sites in the productive forests are well established. In some decking sites and skid trails the soil properties are not conducive for the growth of plants. Rehabilitation of the degraded sites can only be successful if the right species is selected, followed by intensive site preparations with a high input of fertilizers.

Table 5. ***The status of some biodiversity in Malaysia***

Biodiversity	Total number of species	Number of endemic, and/or, vulnerable species	Number of endangered species	Number of extinct species
Mammals	675	126	60	0
Birds	1,200	118	16	1
Amphibians	147	134	127	0
Tree species	2,398	654	343	0

Adapted from Kiew, 1982; Kiew & Davison, 1982; Soepadmo 1983

While deforestation is required in order to develop sustained agriculture and viable cash crop plantations, beyond certain limits such forest openings would cease to be economically beneficial. Some of the countries are already beginning to reach such threshold levels. But agriculture on poor or ill-suited soils has proven to be disastrous and wasteful. The harvests have declined, and farmers have become impoverished as a consequence.

Deforestation, besides loss of valuable wood, which was often burned, has resulted in other serious problems. Heavy and unplanned encroachments have resulted in loss of major watersheds, which are facing severe de-vegetation and erosion (Hamilton & King 1983). This disrupts the water cycle, rivers and lakes become sedimented, and they finally affect agricultural development, hydroelectric dams, and silt-up ports. In many cases, the economic gains from logging are heavily offset by costs to society from the environmental damage ensuing. The cost of repairing flood damage has not been estimated in the region, but in the example of the Himalayas, it was estimated at USD 250 million per year (Spears 1982).

Logging often comes at the loss of environmental services whose values may even exceed the gains from timber (Repetto & Gillis 1988). Forests are the major source of potable water for large segments of the populations in the tropics. Many countries in recent times have experienced acute water shortages during unusual drought periods. The impact was most severe in areas which have lost their forests. In Malaysia such a situation has already been felt in some states like Malacca and Negeri Sembilan. It is indeed ironic that Southeast Asian countries, which are some of the wettest in the world, suffer from water shortages. A whole lot of other economic activities can be disrupted as a result of deforestation. They include river transport and ecotourism benefits. Climatic changes are also beginning to become apparent as a result of large-scale logging activeties (Sagan et al. 1979). Scientists speculate that large-scale clearing of tropical forests may affect the reflectivity of the surface of the earth, which could alter global climatic patterns and shift rainfall distribution. Another deep concern is the release of carbon into the atmosphere as a result of burning of tropical forests. This additional carbon dioxide in the atmosphere can cause global warming as a result of the green house effect.

The loss of forests has been considered to have affected the livelihood of the indigenous and forest-dependent population. Large-scale logging has resulted in loss of non-timber goods and environmental services, impoverishing the local people dependent on them. People who subsist on hunting, gathering fruits, nuts, cane, bamboo, medicinal plants, etc. have been affected (Caldecott 1987). Increasingly, non-governmental organizations have been vociferously campaigning against large-scale commercial loggings.

An additional facet to deforestation and forest degradation is the loss of biodiversity (Myers 1984). The rainforests of insular Southeast Asia fall among the richest zones for plant and animal biodiversity known in terrestrial ecosystems (Whitmore 1974). The loss has not been quantified, but considering some countries have already lost about 60% of the forest, the loss in biodiversity should have been substantial. Since not all the countries have done adequate surveys of the plants and animals, the losses may never be even recognized. The loss of biodiversity is not one of scientific curiosity. Biodiversity is necessary:

- To sustain and improve agriculture and animal husbandry;
- To provide opportunities for medical discoveries and industrial innovations; *and*
- To preserve the choices for future generations (OTA 1987).

The rare discovery of an important drug can revolutionize medicine, and that option should not be lost to future generations which may face new and unknown life-threatening diseases. Well-known drugs derived from tropical forests include the rosy periwinkle (*Cantharanthus roseus*), steroids from Mexican yams (*Dioscorea composita*), and antihypertensive drugs from serpentwood (*Rauwolfia serpentina*). One of the economic success stories of the pase was the discovery of rubber tree in the Amazon. Within the last century, the crop has grown into a USD 6 billion industry, and many countries are quite dependent on rubber exports for their foreign exchange. There still are economically important plants in tropical forests waiting to be discovered.

3. Current Government Policy Governing Land Use and Rehabilitation

Forest plantations have long been recognized as an essential part of the strategic development plan for the suitable management of forest resources in Malaysia. This strategy dates back to the beginning of the century, when efforts were made to test out both indigenous and exotic species in the country.
The Government is cognizant of the international debate on tropical rainforests, and the concerns over their rapid degradation and loss. Malaysia's rainforests are among the most biodiverse forests worldwide, and therefore their management is critical for the conservation of a vast number of plant and animal species. Hence, sustainable forest management has become the 'buzz' word for forest management. Under the Seventh Malaysia Plan, the Government has clearly expressed its commitment to protect the environment and ecological services by adhering to the principles of sustainable management. This would require that the annual felling rate be reduced by at least 12% over the five-year period.

3.1 *Forest Legislation*

Forest legislation in Peninsular Malaysia has been in practice since 1930 when the various forestry enactments and rules were formulated by the respective state authorities. These were found to be deficient and weak in areas of forest management planning and forest renewal operations which are vital to sustained yield management. In order to overcome these short-comings, the NFC agreed to review, up-date and uniformise the existing State Forest Enactments so as to streamline forest administration, management, conservation and forestry sector development in the country. Hence the National Forestry Act and the Wood-Based Industries Act were formulated. These were passed by an Act of Parliament in October 1984.

Apart from the National Forestry Policy and other forestry legislations, the federal government has enacted laws pertaining to timber trade, research and development, land conservation and environment quality.

Forest activities in Sabah are regulated by a Forest Enactment (1968). Forestry practices in Sarawak involve not only the regulation and management of the forest resources but also the protection and management of National Parks and Wildlife Sanctuaries. Thus, in Sarawak, the Forest Department has jurisdiction over all the permanent forests, national parks and wildlife sanctuaries. These activities are regulated by the following legislative documents:

- Forest Ordinance (Sarawak Chap. 126)
- National Parks Ordinance (Chap. 127)
- Wildlife Protection Ordinance (Chap. 128)

3.2 *The National Forestry Policy*

Malaysia has a National Forestry Policy (NFC), which was approved for implementation in 1978. The objectives of this policy are being strictly adhered to by the state authorities and the NFC is kept informed of all forestry development activities implemented in the various states. The National Forestry Policy ensures uniformity in the implementation of all forest management, conservation and development strategies towards achieving common objectives.

The objectives of the National Forestry Policy are as follows:

- To dedicate as Permanent Forest Estate sufficient areas of land strategically located throughout the country in accordance with the concept of rational land use in order to ensure:
    - Sound climatic and physical conditions of the country, the safeguarding of water supplies, soil fertility and environmental quality and the minimization of damage by flood sand erosion to river sand agricultural lands, such forest land being known as "*protective forests*";
    - The supply in perpetuity at reasonable rates of all forms of forest produce which can be economically produced within the country and are required for agricultural, domestic and industrial purposes, such lands being known as "*productive forests";*
    - The conservation of adequate forest areas for recreation, education, research and the protection of the country's unique flora and fauna, such forest lands being known as "*amenity forests"*.
- To manage the Permanent Forest Estate with the objective of maximizing social, economic and environmental benefits for the Nation and its people in accordance with the principles of sound forest management.
- To pursue a sound programme of forest development through regeneration and rehabilitation operations in accordance with approved silvicultural practices in order to achieve maximum productivity from the Permanent Forest Estate.

- To ensure thorough and efficient utilization of forest resources on land not included in the Permanent Forest Estate, prior to the alienation of such land, by means of proper coordinated planning by land development agencies in order to obtain maximum benefits for the people through complete harvesting and processing of such resources, adhering strictly to the optimum need of local processing industries.

- To promote efficient harvesting and utilization of all forms of forest produce and to stimulate the development of appropriate wood-based industries with determined capacities commensurate with the resource flow in order to achieve maximum resource utilization, create employment opportunities and earn foreign exchange.

- To ensure the sound development of trade and commerce in and to promote the exportation of forest products.

- To promote effective Bumiputera participation in the forest and wood-based industries consistent with government policy.

- To undertake and support an intensive research program in forest development aimed at achieving maximum yield from the Permanent Forest Estate, maximum direct and indirect benefits from harvesting and utilization and, above all, maximum financial return on investment in forest development activities.

- To undertake and support a comprehensive program of forestry training at all levels in the public sector in order to ensure an adequate supply of trained manpower to meet the requirements of forestry and wood-based industries.

- To encourage private sector involvement in forestry research and training at all levels with a view to accelerate industrial development and enhance the quality of professionalism in forestry and forest industrial practices.

- To foster, by education and publicity, a better understanding among the community of the multiple values of forests to them and their descendants.

- To foster close co-operation among all in order to achieve optimum utilization of the valuable natural resources of the country.

The Forest Policy of Sarawak, approved by the Governor-in-Council in 1954, remained the basis for forestry practices in that state. The main points of the Sarawak Forest Policy are:

- To reserve permanently for the benefit of the present and future inhabitants, forest land sufficient

    - for the assurance of the sound climatic and physical condition of the country; the safe-guarding of soil fertility, and of supplies of water for domestic and industrial use, irrigation and general agricultural purposes; and the prevention of damage of flooding and erosion to rivers and to agricultural land;

    - for the supply in perpetuity and at moderate prices, of all forms of forest produce that can be economically produced within the country, and that are required by the people for agricultural, domestic and industrial purposes under a fully developed national economy.

- To manage the productive forests of the Permanent Forest Estate with the objective of obtaining the highest possible revenue compatible with the principle of sustained yield and with the primary objectives set out above.

- To promote, as far as may be practical, the thorough and economical utilization of forest products on land not included in the Permanent Forest Estate, prior to the alienation of such land.

To foster, as far as may be compatible with the prior claims of local demands, a profitable export trade in forest produce.

3.3 *Salient Features of the National Forestry Policy, 1978 (Revised in 1992)*

- To dedicate as "permanent forest estate" sufficient areas strategically located throughout the country in accordance with the concept of rational land use, which will be managed and classified under four major functions, namely:

    - "Protection forest" for ensuring favorable climatic and physical conditions of the country, the safeguarding of water resources, soil fertility and environmental quality, the conservation of biological diversity and the minimization of damage by floods and erosion to rivers and agricultural lands;

    - "Production forest" for the supply in perpetuity, at reasonable costs of all forms of forest produce which can be economically produced within the country and are required for agricultural, domestic and industrial purposes, and for export;

    - "Amenity forest" for the conservation of adequate forest areas for recreation, ecotourism and in enhancing public awareness in forestry; *and*

    - "Research and education forest" for the conduct of research and education.

- To implement a planned program of forest development through forest regeneration and rehabilitation operations in accordance with prescribed silvicultural practices.
- To promote efficient harvesting and utilization within the production forest for maximum economic benefits from all forms of forest produce and to stimulate the development of appropriate forest industries commensurate with the resource flow, as well as to create employment opportunities.
- To increase the production of non-wood forest produces through scientific and sustainable management practices to meet local demands and related industries.
- To provide for the conservation of biological diversity and areas with unique species of flora and fauna.
- To encourage private sector investment in forest development through the establishment of forest plantation.
- To undertake and support intensive research programs in forestry and forest products aimed at enhancing maximum benefits from the forest.

- To undertake and support a comprehensive program of forestry training at all levels for the public and private sectors in order to ensure an adequate supply of trained manpower to meet the requirements of the forest sector and the forest-based Industries.
- To promote education in forestry and undertake publicity and extension services in order to generate a better understanding among the community of the multiple values of forest.
- To set aside specific areas for the purpose of forestry education and other scientific studies.
- To promote active local community participation in various forestry development projects and to enhance their involvement in an agroforestry program.
- To develop a comprehensive program in community forestry to cater for the needs of the rural and urban communities.

4. Formulation of Criteria, Indicators, Activities and Management Specifications for Sustainable Forest Management (SFM) in Malaysia

4.1 *Definition of SFM*

In accordance with the ITTO definition, sustainable forest management is defined as a process of managing permanently forest land to achieve one or more clearly specified objectives of management with regard to the production of a continuous flow of desired forest products and services without undue reduction of its inherent values and future productivity, and without undue undesirable effects on the physical and social environment.

In this regard, a criterion can be defined as a discrete and definable or distinguishable characteristic that must be considered in setting objectives and policy and by which a correct judgement may be made, while an indicator is a measurable variable, designed to provide quantitative evaluation of the progress in meeting policy objectives against specific criterion or criteria.

However, to ensure that the indicator is implemented, a set of activities or actions would have to be taken and hence, activities can be defined as tasks that have to be performed to realize the indicator or indicators, while management specifications provide further detailed quantification of the standards by providing exact information on measurement procedures, quantities, material, thresholds, etc., that is, something established for use as a rule or basis of comparison in quantifying the indicators or judging capacity, quantity, value and quality.

4.2 *National Level*

Malaysia as a producing member country of the International Tropical Timber Organization (ITTO) is fully committed to achieve sustainable forest management in the overall context of sustainable development. In this regard, Malaysia has taken action to elaborate and operationalize *the ITTO Guidelines for the Sustainable Management of Natural Tropical Forests* and its *Criteria for the Measurement of Sustainable Tropical Forest Management* in managing its natural forest and to ensure it is sustainably managed by the year 2000.

In this connection, a *National Committee on Sustainable Forest Management in Malaysia* comprising representatives from the then Ministry of Primary Industries, Malaysia, now comprising two ministries, namely the Ministry of Plantation and Commodities and the Ministry of Natural

Resources and Environment; the Forestry Department of Peninsular Malaysia, Sabah and Sarawak; the Forest Research Institute, Malaysia; the Malaysian Timber Industry Board; the Malaysian Timber Council and the Faculty of Forestry, University of Agriculture, elaborated ITTO's *Criteria for the Measurement of Sustainable Tropical Forest Management* in the Malaysian context. To further support the Committee's work, the ten State Forestry Department in Peninsular Malaysia had also formed a *Working Party on Sustainable Natural Forest Management, Peninsular Malaysia,* at the Forestry Department Headquarters, Peninsular Malaysia, also in February, 1994.

After a series of meetings the Committee had formulated a total of 92 activities to operationalize the ITTO's 5 criteria and 27 indicators on sustainable forest management at the national level. In the process, the Committee had added two additional indicators, while omitting two of the proposed ITTO's indicators. The two additional indicators were the indicator for Plantation Establishment of Non-wood Forest Produce and Annual Planting Targets under the ITTO's criterion on the Forest Resource Base and the indicator on Expenditure Budgets for Forest Administration under the ITTO's criterion on Socio-Economic Effects. The reason for omitting the ITTO's indicator on Availability of Environmental Assessment Procedures under the ITTO's criterion Socio-Economic Effects was that this indicator has already been included under the criterion on the Level of Environmental Control which the Committee deemed to be more appropriate, while the omission of the indicator on the Institutional Frameworks was that the National Forestry Policy of Malaysia had adequately met the objectives of the ITTO guidelines in terms of sustainable forest management.

4.3 *Forest Management Unit Level*

Currently, each individual state in Malaysia is defined as the forest management unit in view of the following legal and administrative requirements:

- Under Article 74 (2) of the Malaysian Constitution, forestry comes under the jurisdiction of the respective State Governments. As such, each state is empowered to enact laws on forestry and to formulate forestry policy independently. The executive authority of the Federal Government only extends to the provision of advice and technical assistance to the states, training, the conduct of research and maintenance of experimental and demonstration stations;
- The implementation of Criteria, Indicators and Activities, as well as Management Specifications are monitored and evaluated at the state level by the Federal agencies and bodies, such as the National Forestry Council;
- All the decisions made with regard to the implementation of forest management, conservation and development activities in the state are carried out at the state level by the respective State Authorities;
- The allocation of Annual Allowable Cuts (AACs) for the production forests of the PFE by the National Forestry Council is determined on a state by state basis; *and*
- Under section 4 of the National Forestry Act, 1984 (Amended 1993), each Director of the State Forestry Department is responsible to the State Authority for the preparation and implementation of the State forest management plan, reforestation plan and programs relating to amenity forests.

In this regard, the National Committee on Sustainable Forest Management in Malaysia had identified a total of 84 activities to be implemented at the forest management unit level under the 6

criteria of the ITTO and its 23 indicators. In its development, the Committee had added to the indicators at the forest management level 7 additional indicators from those identified at the national level, which are as follows:

- the length of cutting cycle,
- areas of Protection Forests and Production Forests within the PFE,
- establishment of forest plantations for wood production,
- establishment of forest plantations for non-wood production,
- availability of environmental assessment procedures,
- expenditure budgets for forest management; *and*
- expenditure budgets for forest administration.

Of the 84 activities that have been implemented on a State basis, a total of 70 activities, or 83%, are identical to those identified at the national level. This level of management will be continued to be refined when improved silvicultural management systems are further developed for application at a lower management level, perhaps at the forest district level, forest reserve level or even at the compartment level. In this connection, the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) Project on Sustainable Forest Management and Conservation in Peninsular Malaysia which was involved in the refinement of the existing forest management systems, the improvement of silvicultural practices and the development of a cost-effective forest planning system for application at the operational level have greatly enhanced this process.

4.4 *Management Specifications*

In Peninsular Malaysia, against each of the activities identified at the national and forest management unit levels, the respective Forestry Departments had also formulated management specifications (benchmarks) for their effective monitoring and evaluation. Currently, a total of 201 and 190 management specifications have been formulated at the national and forest management unit levels respectively. Of the 190 management specifications formulated at the forest management unit level, a total of 160, or 84%, of these specifications are identical to those formulated at the national level. In this context, management specifications have also been formulated by the respective Forestry Departments of Sabah and Sarawak which are now in place.

Furthermore, in formulating the 92 activities for implementation at the national level and the 84 activities for implementation at the forest management unit level, the National Committee on Sustainable Forest Management in Malaysia had reviewed the Principles and Criteria for Natural Forest Management of the Forest Stewardship Council and those of the Tropenwald Initiative, and had also taken into account the Principles and Recommendations as enshrined in the ITTO Guidelines on the Conservation of Biological Diversity in Tropical Production Forests.

Targets for the achievement of the 92 activities at the national and the 84 activities at the forest management unit levels respectively had also been set by the respective State Forestry Department in Malaysia, as well as the cost that would be incurred to fully implement them. As of 2000 in accordance with Malaysia's commitment to the ITTO's Year 2000 Objective, the preliminary

estimates indicated that a sum of RM 2911.5 million would be required to fully implement these activities, including the need for research.

4.5 *Formulation of Criteria, Indicators, Activities and Management Specifications for Forest Management Certification*

For the purpose of forest management certification, which is undertaken at the forest management unit level, Peninsular Malaysia had taken a sub-set of the activities and management specifications formulated for sustainable forest management at the forest management unit level on a state basis. It encompasses 71 activities under a total of 6 criteria and 28 indicators.

The rationale for this is that forest management certification only involves the sustainability of the PFE, especially its production forests. Hence, the activities that had been omitted from those formulated for measuring sustainable forest management at the forest management unit level are as follows:

- Identify areas for forest plantation of wood and non-wood forest produce outside the PFE;
- Determine the optimum concession length;
- Harvest and replant the forest plantation;
- Project the level of wood production from conversion forests, plantation forests and perennial agricultural tree crops (rubber wood);
- Establish forest plantation outside the PFE for wood and non-wood productions; *and*
- Report on the contributions in terms of forest revenue to the State Governments.

4.6 *Monitoring and Evaluation*

In order to ensure that the agreed activities are implemented in the field by the respective State Forestry Departments in Malaysia, a *Task Force* comprising representatives from the then Ministry of Primary Industries, Malaysia, now comprising two ministries, namely the Ministry of Plantation and Commodities and the Ministry of Natural Resources and Environment; the Forestry Departments of Peninsular Malaysia, Sabah and Sarawak; the Forest Research Institute, Malaysia; the Malaysian Timber Industry Board; the Malaysian Timber Council and the Faculty of Forestry, University of Agriculture, Malaysia was established in May, 1995. To complement this effort, Peninsular Malaysia had also formed a *Technical Monitoring Committee* at the Forestry Department Headquarters, Peninsular Malaysia in October, 1995 to monitor the implementation of all the activities undertaken by the respective State Forestry Departments in Peninsular Malaysia.

The Task Force has developed an effective mechanism and procedure for the periodic monitoring of the implementation of all the activities, and has submitted reports on their progress to the higher authorities in Malaysia for their information and further action. The implementation of the European Union project, at the Forestry Department Headquarters, on the *Development of Mapping and Geographic Information Systems for the Effective Planning, Management, Conservation and Sustainable Development of Forest Resources in Peninsular Malaysia* has further strengthened the

monitoring capacity of the implementation of the criteria, indicators, activities and management specifications in Peninsular Malaysia.

As of 1996, an internal assessment on the implementation of each of the activities at the forest management unit level was also conducted in Peninsular Malaysia and it was revealed that a total of 64 activities, or 76%, had been fully implemented, while 9 activities, or 11%, had only been partially implemented. These partially implemented activities together with the balance of the 11 activities, or 13%, which were yet to be implemented, were fully implemented as at the end of year 2000.

Malaysia and the Netherlands through its Foundation Keurhout had undertaken a Pilot Study to identify the requirements for timber labeling, developing an operational system for forest certification and in tracking timber/timber products through the chain of custody, as well as quantify the cost involved. This covered sawn timber, plywood and mouldings and had used a phased approach in accordance with the Malaysia's criteria, indicators, activities and management specifications, which had been elaborated from the ITTO guidelines. A third party, SGS (Societe Generale de Surveillance) Malaysia, Sdn. Bhd., was appointed to undertake this study and this was completed well before the year 2000.

5. Assessment of Existing Capacity of Stakeholders Involvement

5.1 *Anticipated Deficit in Timber Production*

Malaysia currently is producing about 27 million m^3 of sawlogs. With the implementation of sustainable practices, the sawlog production is expected to decline to about 23 million m^3 by the year 2010. This is much below the total installed processing capacity. As the timber industry is already having difficulty in sourcing timber, the decline in production would affect the down-stream timber industry considerably. New sources of wood like rubber plantations would assist marginally, but most of its wood would be used for furniture production, and the need for pulp, utility timber and high quality timber would always remain unfulfilled unless appropriate measures are taken.
To make up for the impending deficit in timber production, plantations are to be developed. Besides plantations, degraded forest land would be reforested, and under-stocked forests would be line planted. There is an estimated 153,900 ha of degraded forest land in the country. The Government's inspiration and desire are that such plantations should be private-sector driven.

5.2 *Recent Developments*

There is now a direct order from the Government to plant about 375, 000 ha as forest plantations in the next fifteen years. To kick-start the program, the Ministry of Finance has allocated a sum of RM 200 million to develop a pilot plot of 36,000 ha over a period of 3 years (2006-2008). A special purpose vehicle called Forest Plantation Development Sdn. Bhd under the aegis of Malaysian Timber Industry Board (MTIB) has been set up. This entity will undertake the program commercially. Under this program, landowners and plantation companies farming on state-leased forest land are expected to plant their land with valuable timber species in an effort to sustain the growth of the timber industry. It has been reported that to date a total of 36 applications have been received from the private and government linked companies to plant about 495,000 ha comprising Rubberwood, Acacia, Kelampayan and Teak (MTIB, 2006). The whole forest plantation program is estimated to cost about RM 2.2 billion (MTIB, 2006). The money allocated by the Government is in a

form of soft loan to MTIB at an interest rate of 2.5% per annum. The loan will be disbursed over a period of 3 years and is repayable after 15 years. To ensure the continuance of the program there are plans by the Plantation Ministry to issue 'green bonds' besides seeking additional funds from MOF when the RM 200 million fund has been fully utilized.

With this initiative by the Government, now put in place, there is currently a serious pressure to come out with good planting stock that can be made available to nurseries and companies that are carrying out the planting programs.

5.3 *Species Identified for the Forest Plantation Program in Malaysia*

For plantations, although indigenous species are available, a greater preference is given to the selection of exotic species. The reasons for this are:

- There is generally a lack of adequate knowledge in the propagation and silvicultural management of indigenous species;
- There is generally plentiful supply of seeds of the exotic species;
- The exotic species are easy for handling; *and*
- The exotics are fast-growing and high-yielding.

There is a great challenge ahead to carry out adequate studies on the indigenous species to see their viability for forest plantations.

Since the mid 1980s, rubber wood has become an important source of timber for the furniture industry. At present the main source of rubber wood for the industry is from replanting schemes and from large plantations. But the species has now been planted on a trial basis exclusively for timber production. While the demand for rubber wood is high, supply is decreasing, as fewer people are interested in planting it due to a low price.

Besides rubberwood, teak (*Tectona grandis*), Sentang (*Azadirachta excelsa*), *Khaya ivorensis*, *Dyera costulata* and to a lesser extent *Swietenia macrophylla*, some of the dipterocarp species such as *Shorea leprosula, S. parvifolia,* and *Hopea odorata* were also found to be good and are being investigated as potential candidates. In Sabah and Sarawak other species like *Octomeles sumatrana, Paraserianthes falcataria* and *Neolamarkia cadamba* have been grown and found to be suitable.

Early in 2006, after serious discussions and with the available data on growth and performance according to regions, tree species have been identified for the plantation forestry program. The species have been classified as main and additional species (Table 6). In all the regions the emphasis has been placed on *Hevea* and *Acacia.*

Table 6. ***List of species identified for the Plantation Program***

Region	Main Species	Additional Species
Peninsular Malaysia	*Acacia mangium*/hybrid *Hevea brasiliensis*	*Tectona grandis* *Khaya ivorensis* *Azadirachta excelsa*
Sabah	*Acacia mangium*/hybrid *Hevea brasiliensis*	*Tectona grandis* *Octomeles sumatrana* *Neolamarkia cadamba*
Sarawak	*Acacia mangium*/hybrid *Hevea brasiliensis*	*Neolamarkia cadamba* *Paraserianthes falcataria* *Octomeles sumatrana*

5.4 *Short Rotation Forest Tree Species in Malaysia*

In about the year 1900, rubber production became the new excitement. In 1901, the first 180 acres of regular plantations of Para rubber (*Hevea brasiliensis*) were planted in Peninsular Malaysia. For almost 100 years Hevea has been planted in Malaysia for latex and now over the last 20 years its timber has been highly sought after for the furniture industry. Extensive research on Hevea has been carried out by the Rubber Research Institute Malaysia, now known as the Malaysian Rubber Board, and they now have excellent clones both for latex and timber for their numerous breeding trials carried out over the years.

For the other selected timber species, tree improvement trials were started in the mid 19th century, mainly on an *ad-hoc* basis. Serious improvement programs (involving a sustained concerted effort to improve the genetic stock) started only in the last 10 years. Hence for many of these selected species we do not really have improved seeds or clones except for some clones of teak and Acacia hybrid that we had started evaluating in the early years.

5.5 *Strategies to Produce Improved Planting Material for the Immediate Needs*

In general, high levels of productivity are achieved, when genetic and physiological potential of the species are well matched with management practices which promote rapid growth. Valuable improvements can be made in important properties such as stem form and wood density through selection and breeding. One major constraint, that is currently perceived, is the shortage of good planting material for the various plantation programs. Quality seeds and plus trees that have been selected and reproduced vegetatively are inadequate to meet current and projected needs. While efforts are being stepped up to overcome this problem, middlemen and overnight nurseries are providing planting material whose genetic sources are unknown.

FRIM has now signed MOUs with four private nurseries to step up production of quality planting materials of the required species under license while the Forest Department of Peninsular Malaysia is in the process of setting up the National Seed and Planting Material Procurement Centre at Lentang, Pahang, to address this need also. In Sabah and Sarawak similar efforts are underway.

Work that has been done for *Hevea brasiliensis*, *Acacia* hybrid and *Tectona grandis,* for which planting materials have been evaluated, *albeit* not all the clones have been vigorously tested to ensure their versatility on a wide range of soil types particularly for *Acacia* hybrid and *Tectona* is elaborated below:

Hevea brasiliensis

For Hevea, extensive work had already been done by the Malaysian Rubber Board with regard to breeding. In the early past, the focus was only on latex yield, but in the last 15 years they started to breed for both latex and timber yield. Recently, they have released a list of 15 clones that could serve a dual purpose for both latex and timber yield. The proposed clones with details on yield are given in Table 7.

Large-scale production of these clones is carried out by bud grafting of the desired clones on compatible root stocks raised from seeds. This procedure is well established and planting material in large quantities is raised in this manner.

Table 7. ***Timber latex clones released for the Forest Plantation Program***

Clone	Latex yield (kg/ha/yr)	Clear bole volume (m^3/tree)	Canopy wood volume (m^3/tree)	Total wood volume (m^3/tree)
RRIM 929	3,148	0.60	0.60	1.20
RRIM 2001	2,850	0.41	0.82	1.23
RRIM 2002	2,348	0.44	0.66	1.10
RRIM 2008	2,686	0.33	0.99	1.32
RRIM 2009	2,277	0.34	0.34	0.68
RRIM 2015	2,760	0.43	0.87	1.30
RRIM 2016	2,582	0.43	0.85	1.28
RRIM 2020	2,232	0.36	0.64	1.00
RRIM 2023	2,822	0.35	0.46	0.81
RRIM 2024	2,685	0.52	0.74	1.26
RRIM 2025	2,700	0.63	1.24	1.87
RRIM 2026	2,204	0.66	0.45	1.11
RRIM 2027	3,036	0.60	0.70	1.30
PB 260	1,633	0.37	0.93	1.29
PB 355	1,397	0.53	1.06	1.59

Source: MRB, 2003

Acacia hybrid

Currently there are around 40 ortet selected from various locations all over the country, where the natural Acacia hybrid occur. This hybrid is a cross between *Acacia mangium* and *Acacia auriculiformis* and they have characteristics that are far superior than their parents in relation to susceptibility to heart rot and bole straightness. The selection criteria used is in relation to height,

stem diameter, volume, straightness, branch frequency and angle, branch diameter and health. Currently 5 of these clones (namely M2, M4, M5, F29 and F30) have been tested extensively and have been found to be suitable in multi location trials. Recent observations of these 5 Acacia hybrid clones provided to the Kosinar Plantations in Keningau, Sabah, for field trials have shown superior performance in terms of height growth and diameter increase on Sabah soils over clones procured from other sources. The other clones are currently being bulked up for trial. In addition, we have now initiated a control crossing program to develop clones with desirable wood density and fire length.

***Tectona grandis* (Teak)**

Teak is also not a native species but was introduced into the country a few hundred years ago. Today, this species has become a landrace and has adapted itself to some regions of the country. Particularly in the Northern region of the country, where the climate is somewhat pronounced monsoonal in nature, this species has adapted well. Close to 50 ortets based on phenotypic characteristics similar to the criteria used for selecting the teak ortets have been identified and selected. These parents have been used to initiate the cultures. Field data on about 10 of these clones are now available and out of these, one clone (Clone T16), initially for forest plantation establishment in the new program for the Northern Peninsular Malaysia, has been released.

5.6 *Selected Timbers Species and Their Proposed Uses*

- *Wood for Pulp and Paper Production*
  One pulp and paper mill is already in operation in Sabah (Sabah Forest Industries, SFI), but it hardly meets the local demand for paper, and none for newsprint. Additional mills are being planned. For pulp production, *Acacia mangium* has been identified as the principal species. Another species would be *Paraserianthes falcataria*. These would be planted in large-sized plantations, so that a sufficient amount of pulp would be produced in one site in short rotations of about 6-8 years. Such schemes would be developed in State lands.

- *General Utility Timber*
  There is a huge demand for general utility timber for industrial purposes. They go into cores of plywood, and make up the major constituent of fibreboard, particleboard, interior construction wood, and other low-grade use. Several species have been identified for this purpose, and include *Shorea* spp. (Light Red Meranti group), *Hopea* spp., *Dryobalanops* spp., *Ocotomeles sumatrana*, *Neolamarkia cadamba*, *Endospermum malaccense* and *Hevea brasiliensis*.
  Many of these species would be included in reforestation and enrichment planting schemes within the Permanent Forest Estate. The species would have rotations of about 15 to 20 years.

- *High Quality Timber*
  High quality timbers are in strong demand for veneers, paneling and furniture. The species identified for such needs include principally *Tectona grandis* (teak) and *Azadirachta excelsa* (sentang). Additional species include *Araucaria* spp., *Dyera costulata*, *Swietenia* spp., and *Khaya* spp. These would be grown both in small holdings and larger estates under full plantation conditions. Although some of the plantings would be located within the Permanent Forest Estate (PFE), most will

be in the State lands and in private holdings. This is to ensure the PFEs are not converted. The rotations, under full plantation conditions, would be kept short, at around 15 to 20 years.

5.7 Labor Situation in the Country

Since the country moved into rapid industrialization in the nineties, this has created a serious labor shortage which has resulted in some agricultural sectors like the runner plantations, becoming less viable. Many small holders have neglected these plantations not only due to labor shortage but also because of the low prices of latex. Under these circumstances, low-labor demanding forest plantations are being explored as a potential alternative to rubber tapping and other labor-demanding forms of agriculture. There are trials to plant timber-latex clones through replanting activities. These clones will be latex producers that will also maximize timber production.

In Sabah and Sarawak, timber plantations are being promoted for social development as well. Large tracts of forest lands have become degraded as a result of poor shifting cultivation practices. In these remote sites, traditional agricultural cash crops like oil palm and rubber are not attractive to the lifestyles of these people. In contrast timber plantations provide a more attractive option.

Besides the above, fuller utilization of timber products is being promoted, so there will be less pressure on the forests. Towards that, downstream processing of wood wastes into valuable products such as flakeboards, particle boards and charcoal briquettes are being developed. Reduced forestry wastage and increased efficiency during processing would help ameliorate timber shortage, and also be environmentally less damaging. R & D efforts are also being directed towards putting more efficiency into reducing wastage.

Overall, Malaysia aims to maintain a forest cover of at least 50% of the land area. In addition, it is committed to managing the permanent Forest Estate on a sustainable basis. For achieving sustainability, several policy options have been identified.They include Environmental Impact Assessments (EIAs) for forestry activities, subsidies for setting up forest plantations, rehabilitation of forests, and expanding the network of protected areas to include more ecosystems and thereby protecting the huge biodiversity of the Malaysian forests.

The plantation program initiated in the country, in a nutshell, then has the following objectives:

- To supplement the increasing timber requirement in Malaysia.
- To increase productivity of degraded forest lands.
- To alleviate rural poverty through implementation of social forest plantation programmes.
- To reduce excessive loss of foreign exchange by increasing production of raw material for the timber industry.
- With the increasing shortage of labour in the country, there is a need to diversify into low-labour demanding crops, and timber plantations offer an excellent opportunity *and*
- It would be appropriate and wise to introduce timber plantations, which, with their higher productivity, would reduce pressure on the PFE. The latter therefore can be managed in a sustainable way.

5.8 *Place of Forest Plantations in the Ecosystem*

Plantation development must take place within a holistic approach to land-use and ecosystem management. In the humid tropics, there is evidence that well-planned ecosystem-based plantation forestry can play a role in improving the environment. Under the Malaysian climatic conditions, tree plantations are ecologically more in harmony with the ecosystem compared to growing of annuals in agriculture. Tree plantations minimize soil erosion and do not disrupt the nutrient cycle.

5.9 *Potential of Forest Plantations*

Forest plantations are generally more efficient in producing commercial timber than natural forests. For example the increment from tropical plantations may be between 10-30 m^3 per hectare per year compared with less than 3 m^3 from managed natural forests. Furthermore, plantations are easier to manage due to the mono or double species mix only in contrast to very diverse natural forest stands. From the logistics point of view, the location of the plantations can be predetermined to reduce transportation costs. Currently available degraded and idle lands can be converted into productive forest plantations. Hence, plantation development will serve as a strategy for maintaining a sustainable supply of timber and at the same time relieve the natural forest for non-timber benefits such as water catchment areas, recreation, biodiversity and germplasm conservation.

5.10 *Agroforestry Approach*

The term ‘agroforestry’ commonly refers to a dynamic system involving the integration of agricultural crops and/or livestock with plantation tree crops for the purpose of increasing land productivity. It is a sustainable land use system and has the function of meeting the social and economic needs of both the forest and agriculture on the same piece of land. It can be introduced simultaneously or at different stages of the tree growth.

The benefits of agroforestry in forest plantation are many. Generally, for the investors it means extra income, early cash flow and better return on investment. Besides, it maximizes land use and optimizes labor use over longer periods from the onset of the establishment to the final harvest of the tree plantation. To the nation it will encourage private sector involvement in forest plantation and thereby improve utilization of idle land as well as damaged forest. The overall effect will be a sustainable or even increased timber and food production.

Agroforestry has important roles in the forest environment and social activities of the forest dwellers. It improves biodiversity; increases biomass production and provides a better microclimate where agroforestry is developed on damaged forests or land areas resulting from shifting cultivation, it will lead to the development of permanent resettlement centers. This among others will discourage collection of items such as bamboo, herbal plants and rattan over wide areas and hence leave the natural forest undisturbed. In essence agroforestry has the potential to transform ‘wasteland’ or disturbed forest into an integrated productive-protective system.

With these potential benefits mentioned above, the Government under its Third National Agricultural Policy (NAP3) has given great prominence to the development and practice of agroforestry in the country.

5.11 *Constraints of Forest Plantations*

Generally, while forest plantations are a lucrative option to supply the ever increasing demand for wood on a sustainable basis, the planting of timber trees on a plantation scale is constrained by a number of other factors that are critical. These are:

Ecology

The establishment of forest plantation involves extensive alteration of the ecosystem, particularly when heavy equipment is employed. The complex closed nutrient cycle in tropical rain forests is disrupted for a long time. This can lead to reduction of productivity unless ameliorative measures are undertaken. Furthermore, monocultures further destabilize the system, and require heavy use of fertilizers and pesticides. Next, with many slow-growing species, those grown under fast plantation conditions have poorer quality. Finally, there is the problem of species-site matching for the heterogeneous area of large plantations. The danger of fire may also increase in exotic species plantation.

Land

It is an established fact that land is the world's most valuable resource and public scrutiny of land is becoming more intense with each passing year. With the increase of the population, the competition on land for agriculture and development are ever increasing.

For a forest plantation investment to be commercially viable, a large area is required. The size of the land required will vary with the objective of the plantation. If the timber were for sawmilling and furniture manufacturing, then an area of around 15,000 to 20,000 hectares would suffice. On the other hand, if the objective is to establish a chip or pulp and paper mill, then economic-sized plantations should be in the range of 60,000 to 150,000 hectares. It would always be desirable to have a single contiguous piece of land area, or at least should the required land area just be in about two or three nearby parcels only. This is to ensure easy and efficient management of the activities. It is always preferable that the acquired land is close to basic amenities and near a relatively accessible road system and within an economic range to a processing mill or market. For example, to operate efficiently a pulp or a chip mill, the plantation should be located within a radius of 100 km. Otherwise, exorbitant cost for the transportation of logs would render the operations uneconomical.

In Malaysia, land is under the State's jurisdiction. This implies that in Peninsular Malaysia a large plantation project may stretch across state borders. Land being a state prerogative implies that commercial organizations may have to deal with different procedures adopted by individual State governments. Often, inquiries on information regarding land can become very difficult. Details for example on information regarding forest reserves are obtainable from the respective State Forest Departments while that on State land is obtainable from the Department of Land and Mines or the Department of Agriculture. The setting up of a coordinating agency is desirable to overcome this and thus encourage the easier establishment of plantation forests.

Besides sufficient land size, the location with suitable infrastructure and the premium rate for leasing are also crucial factors. Considering the long period necessary for forest plantations, many companies in Malaysia have requested that they be given the prerogative of allocating a fraction of the land leased for planting agricultural plantation crops, which can begin earning some revenue after three years of establishment. This is considered a necessary activity to

cushion the long waiting period before final harvests. However, according to the Forest Department such a request is not permissible unless the land allocated is State land and lies outside the forest reserves. Forest reserve land is strictly to be planted with forest trees. If forest reserves are ever to play a role in forest plantation establishment this issue needs to be reviewed.

The leasing period over land requested by commercial organizations varies. In order to attract their interest in forest plantations, land should be made available for leasing ranging from a period of at least four rotations to 99 years. The intention is to have tenureship long enough to assure that sufficient returns are obtained for the investments ploughed in.

Another concern that is slowing down the commercial sector's participation in forest plantation investments, either as joint venture partners or outright investments, is the issue of claims for customary rights by natives residing in affected logged-over forest lands where plantations are to be established. In Sabah for example, although these lands belong to the State and are untitled, under the provision of the Land Ordinance a native can claim customary rights on them as long as he or she has been living in it for at least 3 years. Such issues need to be resolved before if investors are to consider investing in forest plantations.

Labour and Mechanization

Labor supply is another issue of great concern. In Malaysia, the agricultural sector is experiencing a shortage of labor because of the rural to urban migration of youth to work in factories. Although the labor requirement in forest plantations is less then in agriculture, it still has to compete for labor in an expanding Malaysian economy, where the working conditions in other industries are usually more conducive.

A natural tendency in the plantation sectors is that foreign workers are engaged. The foreign labor recruitment process had never been efficient. The weaknesses have been attributed to inconsistent government policy on foreign workers' employment coupled with lack of dedication of the foreign workers resulting in extremely high turnover of manpower. One option to alleviate the labor shortage is increased mechanization. Machines developed in countries like Finland and Canada for example are environmentally friendly and highly flexible in their operation in forest plantations.

Finance and Private Involvement Issues

The planting of timbers on a plantation scale is constrained by a number of economic factors as well. These are:

- The high initial capital investment to establish the forest plantations,
- The long period between initial planting efforts and harvesting and thus the corresponding concern for the high capital cost or interest being carried until harvesting period,
- The high biological and economic risk involved in forest plantations *and*
- Unattractive and inappropriate investment incentives provided by the government for forest plantation investments in the past.

6. Government Tax Incentives and Regulations

6.1 *Incentives for Forest Plantations*

To hasten early development of forest plantations in Malaysia, incentive packages were introduced under the Promotion of Investment Act (PIA) 1986 and the Income Tax Act 1975 (Khaziah 1992). Under the PIA 1986, the two incentives offered were pioneer status and an investment tax allowance. Those planting timber, rattan, and bamboo, which were designated promoted activities under the PIA 1986, were granted pioneer status. The Income Tax Act 1975 provided an agriculture allowance to those who invested in forest plantations.

6.2 *The PIA 1986 (Malaysian Industrial Development Authority, 1986)*

Pioneer Status (PS)

Before 11 January 1991, PS provided full exemption from income and development taxes for a period of 5 years. However, since 1 November 1991, tax relief has been in the form of a 70% exemption from a company's statutory income. This means that a company-granted PS would have to pay income tax of 35% and development tax of 2% on 30% of its statutory income. Hence the company is taxed at a rate of 11% on its overall income. A company granted PS would be eligible for the 70% exemption for a period of 5 years from the date of its first sale.

Investment Tax Allowance (ITA)

The ITA is in the form of an allowance of 60% of the qualifying capital expenditure incurred within 5 years from the date of approval of the project. In the case of agriculture, the term "qualifying capital expenditure" has been expanded to include the following:

- The cleaning and preparation of land;
- The planting of crops;
- The provision of irrigation or drainage systems;
- The provision of plant and machinery used in Malaysia for the purpose of crop cultivation, animal farming, aquaculture, inland or deep-sea fishing, and other agricultural or pastoral pursuits;
- The construction of access roads, including bridges;
- The construction or purchase of buildings (including those provided for the people's welfare or as their living accommodations) and structural improvements on land or other structures that are used for the purposes of crop cultivation, animal farming, aquaculture, inland fishing, and other agricultural or pastoral pursuits; provided that the construction of roads, bridges, buildings, and structural improvements on land and other structures are on the part of the land used for the purpose of such crop cultivation, animal farming, aquaculture, inland fishing and other agricultural or pastoral pursuits.

The ITA is given as a deduction against statutory income (Khaziah, 1992). In any one year, the amount of deduction is limited to 70% of statutory income for that year. Although private investors were supported by these two incentives, the private sector's involvement in forest plantation development, especially in Peninsular Malaysia, has not been encouraging. Passive involvement by the private sector in forest plantation projects is still partially the situation today. Another option that has been proposed to attract investors was to introduce "group relief" under the ITA (Khaziah 1992). Group relief in this context refers to offsetting losses with income from other profitable ventures of a company's subsidiaries.

A revised version of the incentives has extended the PS for another 5 years for companies processing agricultural products, provided they fulfill certain criteria determined by the Ministry of Trade and Industry (Ministry of Trade and Industry 1988). Another important observation concerning the revised version of the incentives is the maximum rate of 100% for the ITA, compared to 60% when it was first introduced in 1986 (Ministry of Trade and Industry 1988). However, the 100% ITA can be granted only to companies that produce promoted products or are engaged in promoted activities.

There are three major types of risks involved in planting forest trees or commercial tree planting (CTP), namely:

a) Physical risk
b) Market risk
c) Financial risk

a) *Physical Risk*

Some of the major physical risks involved in CTP are the selection of the right species of tree to plant in certain types of soils, the growth rates of the tree, the physical properties of the timber required, the species' susceptibility to pests and diseases, the percentage of recovery from logs and the type of silvicultural regimes to follow. This list is not exhaustive and there are many more factors involved.

In general, tree plantation is exposed to a higher risk of pest and disease infections than trees in the natural forest. This risk can be associated with the homogeneity of tree plantation. Another reason could be the inadequate supply of quality seedlings during planting. As large-scale planting requires a large number of seedlings to be available within a relatively short period of time (within 2 to 3 months), quality seedlings may be hard to come by. The planting season is usually carried out just prior to the wet season to ensure higher survival rates. Up to a thousand seedlings are required for a hectare of land. At least a million seedlings would be required to plant an area of one thousand hectares. Given this scenario, it is not surprising that many CTP ended up with seedlings of poor quality and this may result in the trees being more susceptible to pests and diseases later on.

Fire is another major physical risk that is associated with CTP. Forest plantation fire outbreak is especially common during the dry season (the expected El Niño effect causing exceptionally dry weather).

b) *Market Risk*

Unlike other agricultural projects where the final products are realized within a short period of time (from a few months to one to two years), CTP can only be harvested from 15 years or more depending on the final objective of the forest plantation. For example, there is currently a high demand for rubberwood sawn timber but 15 years down the road, market preference may shift to

darker colored timber. It would be difficult for the investor to change the species mid-way through the rotation.

c) *Financial Risk*

The financial risk is perhaps the single major factor that has prevented the large-scale establishment of CTP. The high financial risk associated with CTP is due to the long gestation period and the payback period. The long gestation period means that investor has to set aside sufficient capital reserves for funding all the plantation activities from establishment to final harvest. This may span a period of 15 years or more depending on the species and the final objective. Many of those who have invested in CTP are currently facing cash flow problem.

The physical and market risks can be overcome through proper planning and implementation. However, the financial risks associated with the long gestation period and the uncertainty of the final outcome has discouraged new investments in CTP. The current sets of incentives available for CTP have not addressed the cash flow problem adequately and as a result very few CTP have been set up.

6.3 *Constraints of the Incentive Package*

The issue of incentives for the forest plantation program has been raised in many seminars and conferences. Almost everyone basically agrees that the existing incentives for forest plantation are not only unattractive but also, if applied, would place the company concerned in a difficult position to sustain its yearly cash flow.

For instance, Mohd Shahwahid and Saroni (1992) set out to find out the reasons why private investors showed no interest in becoming involved in commercial forest plantation projects. According to these researchers, there were four main reasons, inclusive of the incentives, why private investors were not interested in forest plantation projects. First was the issue of availability of land for the establishment of a forest plantation project. To make the project a profitable venture, most interested private entrepreneurs requested a sufficient land size, not to mention that the land must be suitable for planting at a low premium charge and in a suitable location in relation to infrastructure. Besides, the subject of land is a State prerogative; it is difficult to obtain information on the availability of land. Second was the issue of management of the land itself. Mohd Shahwahid and Saroni found out that the stipulations that the land is to be listed for 10 years or so and that the plantation together with the infrastructure must be established within 2 years of signing the contract might be difficult to achieve, considering other unforeseen problems that could arise. This was found to be not forthcoming. Third, the funds or loans at a subsidized interest rate must be made available for the development of the plantation. Fourth is the issue of the incentive package itself, which is focused more on crops with a shorter rotation period than on crops planted under the forest plantation program.

Norini (1994) stressed the importance of establishing forest plantations not only for timber production but also for recreational uses or as new breeding grounds for wildlife. Such multiple uses may not only help investors in forest plantations to achieve a positive cash flow but also make the project more financially viable. In other words, when issuing land, State governments must consider the multiple uses that can be derived from such man-made forests.

6.4 *Shortcomings of Current Incentives*

The current sets of incentives are not effective for CTP and do not benefit the investor as they do not address the long gestation period and cash flow problem associated with such a project.

6.5 *Weaknesses of the Pioneer Status (PS)*

The PS provides a 100% tax relief for an initial period of 5 years starting from the first harvest and an additional 5 years after expiry of the first period. In CTP the first harvest may be 15 years or more from the initial establishment stage. This means that a company will have to invest a substantial amount of money and wait for 15 years or more before it can make use of the tax relief, which is used to offset against the profits earned from tree harvesting. In many instances, CTP may involve longer rotation periods of 25 years or more. Under such circumstances, the investor would rather invest in other agricultural projects that have short payback periods and short gestation periods.

As an illustration, assuming the cost of plantation establishment is RM 2,000 per ha an investor will need to pump in RM 2 million annually if the annual target of 1,000 ha is to be reached. Over 15 years, a total investment of RM 30 million would be required and this is before taking into account the cost of maintenance and interest charges. Only then, from Year 16 onwards, income from the harvest of the first block of CTP will be realized. This is an enormous capital outlay and no company can afford to stay viable for 15 years without any returns on the capital invested. Furthermore, after discounting for time preference (say at 10% for 15 years – RM 1.00 in 15 years' time is only worth about 0.24 cents in net present value terms). This clearly illustrates the inappropriateness of the PS as an incentive for CTP.

6.6 *Weakness of the Investment Tax Allowance (ITA)*

Similarly, the existing ITA only allows qualifying expenditure to be given for the first 5 years only, whereas maintenance of planted areas goes beyond year 5 and in most cases up to year 15 or more depending on the species planted. Although the ITA allowance can be used to offset against statutory income and any unused portion can be carried forward indefinitely until all such balance is used up, it would take more than 15 years if the company does not have any other sources of income in the interim. In such a case, the ITA can only be used in the future when the company is making profits. The same reason is valid as in the case of Pioneer Status. Hence the ITA is also not useful to the investor during the establishment and tending phase of the plantation.

6.7 *Agricultural Allowance under Schedule 4A*

In the Income Tax (Approved Agricultural Projects) Order 2002 forest plantation has been included as an approved agricultural project thus qualifying for tax relief effective from the year of assessment 1999. However, this incentive is not available if a company has been granted PS or ITA (to be offset against statutory income). In such a case, PS, ITA and Schedule 4A are mutually exclusive. If the company elects for Schedule 4A then it is not entitled to PS or ITA.

Unused qualifying capital expenditure can be carried forward to the next assessment year and until all of it has been fully written off. This is especially useful if the company has other businesses that are generating an income stream.

The major drawback of Schedule 4A is that to qualify, a minimum area of 50 hectares of CTP needs to be established. This conditionality effectively excludes the thousands of individual planters (mainly one to two hectares) who are interested in CTP.

The costs of preparing the Forest Management Plan and the Annual Operating Plans cost of EIA study and all costs and fees related to the procurement of timber certification (MTCC, FSC and others) are currently not classified as qualifying capital expenditures.

6.8 *New Development Regarding the Incentive Package*

The new development regarding the incentive package is that there is a possibility of extending the incentive package based on the merits of individual companies. That is, the Ministry of Finance is willing to consider extra incentives on a case-by-case basis, according to the special incentives listed in the Budget 2000. This was stated in a letter forwarded to the Secretary of the then Ministry of Primary Industries from the Secretary, Department of Treasury. Currently this has come into effect and this now has created more interest from the private investors to venture into forest plantations.

PART C
FUTURE ACTIONS FOR ENHANCING RESTORATION/REHABILITATION

1. Improving/Revising Policies

While the Sustainable Forest Management guidelines in line with those of ITTO are in place in all the states, there is now the great need to ensure that these guidelines are adhered to. To this end enforcement is essential. If our timbers were certified we would be free to export to those countries that lay stress on such labels.

In the area of Biodiversity Conservation, Malaysia is a party to the Convention on Biological Diversity. To show its commitment, Malaysia has come out with its own policy on Biodiversity Conservation. Efforts are now on the way to completely document all the flora and fauna found in our forests and at the same time taking more efforts to gazette additional areas that have conservation value. More financial resources and manpower need to be committed to this mammoth task. In Sabah and Sarawak, in addition to conservation, the forest dwellers are being taught to settle down and to till the soil for their livelihood through the concept of agroforestry, then to continue with the destructive way of ‘slash and burn’ farming. More needs to be done in this area.

In relation to forest plantation, the government realizes the importance of timber farming to offset the expected shortage of timber in the future. To this end a special purpose vehicle has been set up along with a revolving fund to attract private sector participation in this activity. Many changes have been made to the incentive packages to attract investors. The process of planting trees needs to be expedited, so that such plantations are set up soon to meet the challenges of timber shortage that is evident to come in the near future.

2. Building Research and Educational Capacities and Facilities

Before the early nineties, there was only one institution of higher learning that was training forestry students at degree level. Forestry in the past was not thought of as a real science that needed skilled staff to manage them. All this has changed since the meeting in Rio in 1992, which created the awareness of the importance of forestry in relation to the environment. Since the nineties, two more universities have been set up, one each in Sabah and in Sarawak, where forestry and conservation have been given prominence as important areas of study. While the institutions are in place, there is now a need for these institutes to provide more emphasis in their syllabus on issues related to conservation, reforestation, rehabilitation, agroforestry, and in poverty eradication among the rural poor and forest dwellers There is also an urgent need to have graduates trained to handle and manage plantation forestry as a business entity similar to the other crops like rubber and oil palm being grown in the country. Research emphasis in the various disciplines of forestry also needs to be enhanced.

3. Reconciling Global and National Policies

The Malaysian Government is a party to many of the international initiatives that have come about, which are aimed at protecting forest by generating guidelines and protocols for sustainable forest management. Issues like forest certification, C&I for SFM, Forest Principles and Agenda 21 have all been addressed by the Malaysian Government. In line with the Convention of Biological Diversity, the Malaysian Government has formulated its own Policy, which came into effect in 1998. Malaysia continues to actively participate in the different processes like COP, LULUF etc. to make its stand on issues raised. The government is serious in its effort to retain its forest in its prime state and the present trend is to move away from logging and to protect the forest for conservation and other ecosystem benefits like water, carbon cycle etc.

4. Partnership and Collaboration with Private Sectors

The government policies are all aligned for the private sector to play a major role in the economy of the country. Private sector involvement has particularly been prominent in plantation crops management, in industrial processes and the down-stream timber industry. Much more is desired for the private sector to participate in the forest plantation industry. To facilitate this, the government is providing attractive incentives and soft loans for this sector to take off. Only now some momentum is being seen, where the private sectors are venturing into forest plantation industry. Much more needs to be done to attract private sector funding for forest rehabilitation programs.

5. Forest Fires

Forest fires are a rare phenomenon in the moist tropical rainforest. However, now with the advent of forest plantations on large tracts of degraded lands, the occurrence of forest fires are a probability. It is now necessary to set up plans to have a comprehensive forest fire prevention and fire fighting units in place. There is also a need to develop infrastructure for monitoring fire outbreaks in forest plantations. Criteria to determine zones that are fire prone also need to be established.

6. Pests and Diseases and Invasive Species

Strict guidelines for the introduction of alien species should be in place. Tests should be first made to ensure that an introduced species is not invasive in its new environment. Strict guidelines on health of imported forest materials and planting materials should also be in place to avoid accidental introduction of pests or diseases into the country that could affect the local flora.

With the increase in the area under monoculture forest plantations, it is essential that trained manpower to identify and control pest and disease outbreaks in plantations are in place. Due emphasis has to be given to the above issues, because if private sector involvement is desired, the investors should be assured of their returns during the harvest of these plantations.

7. Creating Public and Community Awareness and Support for Greening

Awareness campaign at the state and community level of the importance of trees and greening of the nation is an important tool to educate the public and to evoke a positive response for the love of trees in them. Currently in Malaysia there is a “plant a tree” campaign which is held annually where the public is encouraged to buy a tree and plant it in and around their homes and in open spaces. Such campaigns should be enhanced and carried out more frequently, so that trees are planted along the road sides, around housing estates and available open spaces. If this is continued, the urban areas, too, would be green within a few years.

8. Conclusion

The review above expounds on the Malaysian experience in moving towards a Green Nation. Currently 53% of the country is still covered by forest. The National interest and trend now is to move towards sustainable forest management and conservation of the forests. The need to hasten the forest plantation project is more evident than ever, especially with the decreasing trend in timber production from the natural forest. For instance, the timber production in Peninsular Malaysia has drastically declined from more than 12 million m^3 in the early 1990s to only 5 million m^3 from 1998 onward. A similar trend can also be observed for Sabah and Sarawak, where timber production dropped from 18 million m^3 and 8 million m^3 in the early 1990s to 14 million m^3 and 3 million m^3 in the year 2000, respectively (Anonymous 2001). It is well known that the forest-based industries employed more than 300,000 workers in the year 2000; a majority of these workers were from rural communities (Anonymous 2001). Hence the yearly declines in timber production will have a negative impact not only on the development of the existing forest based industries but also on the social well-being of the workforce engaged in such industries. Establishing forest plantations are therefore best seen as tree farms with multiple values designed to provide one or more very specific services to society. Whether managed by the private sector or the government with involvement of the rural communities, timber from these plantations will play an important role in relieving the pressure on natural forests by supplementing wood supply in the future and at the same time ensuring continued employment to the displaced workers from the rural communities.

The involvement of the public in greening the Nation will come a long way if the urban settings are also greened with trees and ornamentals. Educating the public on the importance of trees will evoke the culture of love for trees and a green environment.

It is critical that the correct policies and mechanisms must be put in place at a national level for the success of such programs. Forging partnership with the private sectors to invest into such venture

will speed up the greening process and also will complement the timber supply needed by the local timber industries.

LITERATURE CITED

Anonymous, 2001. Forestry Statistics in Peninsular Malaysia. Published by the Forest Department Peninsular Malaysia. 159pp.

Ahmad Zainal bin Mat Isa. 1992. Country report: Malaysia. MAB Regional Workshop on Rehabilitation of Degraded Secondary Forests, Kuala Lumpur. February, 1992.

Ang, L.H. 1994. Problems and prospects of afforestation on sandy tin tailings in Peninsular Malaysia. Journal of Tropical Forest Science 7(1): 113-128.

Annual Report. 1903. Report of Federal Forest Administration in the Federation of Malaya, 1903. Government Printer, Kuala Lumpur.

Annual Report. 1912. Report of Federal Forest Administration in the Federation of Malaya, 1912. Government Printer, Kuala Lumpur.

Annual Report. 1933. Report of Federal Forest Administration in the Federation of Malaya, 1933. Government Printer, Kuala Lumpur.

Anuar, H.M. 1996. Forest plantation development in the context of sustainable forest resources. Seminar on Forest Plantation Development and Sustainable Forest Management, Joint Working Committee on Forestry between Malaysia and Indonesia, 26-27 August 1996, Palembang, Indonesia.

Appanah, S. & Harun, I. 1999. Some thoughts on future management and silvicultural treatment of Malaysian forests. JIRCAS-FRIM-JFES Research Meeting, 11-13 October, 1999. Kuala Lumpur.

Appanah, S. & Weinland, G. 1990. Will the management systems for hill Dipterocarp forests, stand up? Journal of Tropical Forest Science 3:140-158.

Appanah, S. & Weinland, G. 1993. Planting Quality Timber Trees in Peninsular Malaysia. Malayan Forest Records No. 38. FRIM, Malaysia.

Berita Harian, 1989. Peluang Kerja di tanah terbiar. 26. Mei, 1989.

Caldecott, J. 1987. Hunting and wildlife management in Sarawak. World Wildlife Fund, Malaysia.

Chan, Y.K. 1990. The mining land - an overview of the current situation in Peninsular Malaysia. Paper presented at National Seminar on Ex-mining land and BRIS soils: Prospect & Profit. Kuala Lumpur. 17pp.

Chong, P.W. 1979. The growing domestic demand for timber and its influence on forest management. Malaysian Forester 42:378-389

Fahlman, R. 1975. Project S.4 - Species trials. Final Report. Research Report No. S.R.7. Forest Department, Sarawak.

FAO/UNEP. 1981. Topical Forest Resources Assessment Project (GEMS): Tropical Asia. Rome.

Foxworthy, F.W. 1930. Forest planting in Malay Peninsula. Staff Conference, Forest Research Institute, Federated Malay States, Kuala Lumpur.

Hamilton, L & King, P. 1983. Tropical Forested Watersheds: Hydrologic and Soils Response to Major Uses or Conversions. Westview Press, Boulder, CO.

Hashim, M.N., Maziah, Z. and Sheik Ali, A. 1991 The incident of heart-rot in Acacia mangium Willd. Plantations: a preliminary observation. In: Proceedings of the Conference on Forestry and Forest Products Research. Eds. Appanah, S. Ng, F.S. P. and Roslan I. Forest Research Institute of Malaysia, Kuala Lumpur. 54-60

Hill, H.C. 1900. Report on the Present System of Forest Administration in the Federated Malay States, with Suggestions for Future Management of the Forest of those States. Her Majesty's Indian Forest Service. Government Printers, Selangor.

Ismail, A. 1964. Enrichment planting in Selangor with particular reference to *Dryobalanops aromatica* (kapur). Malayan Forester 27:3-17

Khaziah, A.K. 1992 Investment incentives for forest plantation. In: Proceedings of the National Seminar on Economics of Forest Plantations. Forest Department Peninsular Malaysia. Pp.24-26.

Kiew, B.H. 1982. The conservation status of the Malaysian fauna, I. Mammalia. Malay Nat. 35(3)3-19.

Kiew, B. H. & Davison G. 1982. Conservation status of the Malaysian Fauna, II Birds. Malay. Nat. 26(2):2-25.

Lee, H.S. & Lai, K.K. 1981. Reforestation in Sarawak. Paper for the 1981 Forestry Departmental Conference, Sarawak, Malaysia.

Leighton, M. & Wirawan, N. 1986. Catastrophic drought and fire in Borneo tropical rainforests associated with the 1983 El Niño Southern Oscillation Event. Pp. 75-102 in G.T. Prance (ed.), "Tropical Forests and the World Atmosphere." American Association for the Advancement of Science Symposium, Washington, D.C.

Leo Chai & Lee, H.S. 1992. Rehabilitation of logged-over forests in Sarawak. In 1-6pp, Nik Muhamad M., Ismail Adnan AM, Mohd Zaki H. & Kamaruzaman J (Eds.), Proceedings of International Symposium on Rehabilitation of Tropical Rainforest Ecosystems: Research and Development Priorities. 2-4 September 1992. Kuching, Sarawak, Malaysia.

Malaysian Rubber Board 2003. Rubber Forest Plantation. Monograph No.5. Published by the Malaysian Rubber Board, Malaysia.

Ministry of Trade and Industry Malaysia 1986. Investment in the manufacturing sector – policies, incentives and procedures.

Ministry of Trade and Industry Malaysia 1988. Investment in the manufacturing sector – policies, incentives and procedures.

Mohd Shahwahid, O & Saroni Jodi. 1992. Forest Plantation Investment, viewpoints from the commercial sector. In: Proceedings of the National Seminar on Economics of Forest Plantations, 24-26th February 1992. Forestry Department Peninsular Malaysia and Forest Research Institute Malaysia. Pp 109-126.

MTIB, 2006. Malaysia's Forest Plantation Program. Maskayu Vol. 6:14-15.

Myers, N. 1984. The Primary Source: Tropical Forests and Our Future. W.W. Norton & Co., N.Y. & London.

Norini, H. 1994. Financial Assessment of Forest Plantation Project. Paper presented at the Malaysia-German Forestry Research Project Seminar, 13-15th February, 1994. Forest Research Institute Malaysia.

Oliphant, J.N. 1932. Artificial v. Natural regeneration. Malayan Forester 1:186-192.

OTA. 1987. Technologies to Maintain Biological Diversity. Office of Technology Assessment. U.S. Government Printing Office, Washington, D.C

.

Panayotou, T. & Ashton, P.S. 1992. Not by Timber Alone: Economics and Ecology for Sustaining Tropical Forests. Island Press, Washington, D.C.

Poore, D., Burgess, P., Palmer, J., Rietbergen & Synott, T. 1989. No Timber Without Trees: Sustainability in the Tropical Forest. Earthscan Publ., London.

Repetto, R. & Gillis, M. (eds.). 1988. Public Policies and the Misuse of Forest Resources. Cambridge Univ. Press, NY.

Sagan, C. Toon, O.B. & Pollack, J.B. 1979. Anthropogenic Albedo Changes and the Earth's Climate. Science 206:1363-68.

Soepadmo, E. 1983. Forest and man-An Ecological appraisal. An Inaugural lecture delivered at the University of Malaya on December 20, 1983. Kuala Lumpur, University Malaya.43p.

Spears, J. 1982. Preserving watershed environments. Unasylva 34:137.

Spencer, J.E. 1966. Shifting cultivation in Southeastern Asia. Univ. of California Press, Berkeley.

Thai, S.K. 1995. Status of Forest Plantation in Peninsular Malaysia. Paper presented at "Workshop Hutan Ladang", 21-22 August 1995, Tawau, Forestry Department, Sabah.

Thang, H.C. & Wadley, K. 1976. Report of the survival and development survey of areas reforested by line-planting in Selangor. Research Pamphlet No.67, Forest Research Institute, Kepong.

Walton, A.B. 1948. Some considerations for the future management and silviculture treatment of Malayan forests. Malayan Forester 11:68-74.

Weinland, G. & Zuhaidi, A. 1990. Management of *Acacia mangium* stands: Tending issues. In: Proceedings of the Conference on Forestry and Forest Products Research. Eds. Appanah, S. Ng, F.S. P. and Roslan I. Forest Research Institute of Malaysia, Kuala Lumpur. 41-53.

Whitmore, T.C. 1974. Tropical Rain Forests of the Far East (2nd Ed.). Clarendon Press, Oxford.

Wyatt-Smith, J. 1961. Provenance and Progeny trials of teak in Northwest Malaya. Malayan Forester 24:126-141.

Wyatt-Smith, J. 1963. Manual of Malayan Silviculture for Inland Forests. Malayan Forest Record No.23. Forest Research Institute, Kepong.