Transitions to Sustainable Forest Management and Rehabilitation in Malaysia

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TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

EXECUTIVE SUMMARY

The forestry sector is marked by various dimensions and diversity. It moves from a state of resource surplus to a state of resource deficit in most countries. At present rates of logging, countries such as Indonesia, Malaysia, Myanmar, Lao P.D.R., and Papua New Guinea will face a deficit, even in domestic timber supply from natural forests. The philosophy of traditional sustained yield forest management is to log forest area based on a short-term economic profitability as the bottom line, for example to contribute to its foreign exchange earnings and the country's economic development. This economic myth in the traditional forestry is now overtaken by the sustainable forest management concept. In many developed countries, the area of forest is now increasing after long periods of decline. The change from shrinking to expanding forests has been termed as the forest transitions. Similarly, China, India and Vietnam have recently experienced forest transitions from net deforestation to net reforestation. Between the years 2000 and 2010, Peninsular Malaysia experienced an annual declining rate in forest area of approximately -1.94%, with Sabah -11.64 % and Sarawak -3.49%.

The forested land in Malaysia was slowly giving way to agriculture especially oil palm and other forms of land use to support the growth in its population, foreign exchange earnings and gross domestic product (GDP) – all being the policies of the Government. The turning point for expanding agriculture and shrinking forest areas in Malaysia was the introduction of Land Capability Classification (LCC) system in the 1970, which was essentially an application of the economic concepts that assigned land uses to capability classes. According to the LCC, forestry did not belong in Classes I-III because it generated lower rents than competing uses, but it did belong in Classes IV-V, where it generated higher rents. This creates a conflict between agriculture production, forest management and the country's economic development. Hence, in the context of Malaysian deforestation, the implication is that agricultural expansion especially the oil palm, total GDP, population and also export of timber products could be the main factors that influence forest loss. Although Malaysia is categorized as a HFHD (High Forest Cover with High Rates of Deforestation) country, it is quite difficult to categorize it as experiencing forest transitions due to its officially fluctuating forest areas gazetted by the Government: for example, from 20.10 mil ha (61%) in 1988 to about 19.54 mil ha (59%) in 2003 and to about 18.48 mil ha in 2011. We think that the main question will be whether a transition from production forestry to forest conservation and protection can be efficiently managed by Malaysia, with or without international support, more so in the present era of REDD+ associated with the climate change. Although the GDP, area of oil palm planted, export of timber products and population have significant influences on the rate of deforestation in Peninsular Malaysia, the factor of rising population alone did not seem to increase deforestation in Peninsular Malaysia. An investigation on the possible presence of the EKC (Environmental Kuznets Curve) in Peninsular Malaysian deforestation rates did not support the long-run inverted-U relationship between economic growth and its deforestation rate. Sabah and Sarawak were not considered in the analysis due to difficulties in getting much information needed in the short duration of this study. However, if one broadens the perspectives of forest transitions to include, among others a change in emphasis from production to protection and conservation or a shift from unsustainable to sustainable forest management or even a societal transition or a cultural change for the better forest management, utilization and conservation, then Malaysia can be considered as transiting towards a sustainable forest management practices.

Keywords: Malaysia, drivers of deforestation, agriculture expansion, population growth, foreign exchange, forest transitions, EKC, HFHD, production forestry, forest conservation and protection.

1 BACKGROUND

Malaysia is a tropical country situated in South-eastern Asia, with the peninsula bordering Thailand and borders with Indonesia and Brunei on the island of Borneo, bound by the South China Sea. Malaysia occupies a total landmass of approximately 328 657 square km made up of Peninsular Malaysia (comprising 11 states), and Sabah and Sarawak (on the Island of Borneo) with a 4675 km long coastline (Peninsular Malaysia 2,068 km, East Malaysia 2607 km). Malaysia has a total population of 29 179 952 (estimated 2012) which translates to a high population density of nearly 89 people per square km. A map of Peninsular, Sabah and Sarawak is provided as Figure 1.

Malaysia is categorized as a HFHD (High Forest Cover with High Rates of Deforestation) country.[1] There are numerous threats to the tropical forest in Malaysia and some drivers for deforestation are discussed in the literature. A growing global population, rising incomes and changing diets will continue to increase demand for food, animal feed and fuel, which are some of the drivers for deforestation[2]. Malaysia's natural forests are under pressure in particular from the palm oil industry. However, it is difficult to quantify whether the establishment of oil palm plantations is a direct cause of deforestation, e.g. oil palm expansion could be replacing forests previously degraded by fire or logging or for economic enterprise as timber profits can be used to offset the costs of plantation establishment[3]. Land might be deforested for other reasons and subsequently planted with oil palm, as estimates do not typically consider oil palm expansion, forest lost, and the rate of forest conversion into unproductive land[4]. The new oil palm plantation is part of an area earmarked by the Malaysian Government for development, including plantations and urban development, and therefore new plantations in this protected area may not be counted in the estimated rate of deforestation directly from oil palm expansion. According to WWF (2012)[5], the area for the palm oil plantations is capped to 5 mil hectares. While in Peninsular Malaysia and Sabah most of the available space is already used for plantation, the land used for oil palm plantation in Sarawak is expected to increase by 400,000 ha. The control of oil palm expansion in Malaysia contributes to stable high prices that might further be affected by the commodity markets due to an expected demand shortage in the future.[7]

Based on estimations, the forest cover will shrink to 51.8% of the total land cover by 2020 (based on historical forest conversion figures) which is close to the target pledged at the Rio Earth Summit 1992 (WWF)[7.] The current supply of timber/plywood is exceeded by demand which leads to higher prices and in 2009 the Ministry of Plantations and Industrial Commodities, Malaysia estimated that the exports of timber products would double in 2020. In fact, currently, the largest producer of timber products is Sarawak with 8 mil m^3, followed by Sabah 4 mil m^3, and Peninsular Malaysia 2 mil m^3.[6]

Current environmental issues including global warming and climate change, deforestation and economic crisis call for the scientific community to concentrate efforts to address for new and better approaches that can help reduce deforestation, induce rehabilitation and foster sustainable forest management. Deforestation and forest transition studies of the last two decades have generally failed to provide workable models and tools that can be effectively used to achieve these objectives. The purpose of this country report is to identify factors that can help to reduce deforestation, induce rehabilitation and foster sustainable forest management. An innovative approach which incorporates a set of independent analyses of simultaneously occurring forest cover decline and increase, in a number of countries is proposed with the following objectives:

(i) To assess the underlying processes that explain forest cover changes;

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[1] *Meridian Institute (2009), Reducing Emissions from Deforestation and Forest Degradation (REDD): An Options Assessment.*

[2] *Eliasch Review (2008), Climate Change: Financing Global Forests, chapter 5, p. 103.*

[3] *Fitzherbert, E., et al, (2008), How will oil palm expansion affect biodiversity? Cell Press, Elsevier Ltd.*

[4] *Ibid. Fitzherbert, E. et al, 2008.*

[5] *WWF (2012), WWF-Malaysia Strategy 2012–2020, p. 5.*

[6] *Ibid. WWF (2012).*

(ii) To formulate categorization models characterizing the implications for environmental and economic benefits of forests; and

(iii) To enhance the capability and capacity of the forestry sector in reducing deforestation, raising rehabilitation and attaining sustainable forest management.

The hypotheses of this report are discussed from various perspectives as follows:
Property or tenure arrangement, State regulatory institutions, Effectiveness of government forest policies, Market institutions, Community institutions, Knowledge institutions and Multiple sector factors.

1.1 Brief Profile about Malaysia

Figure 1. Location of Peninsular Malaysia, Sabah and Sarawak.

1.1.1 Geography and Climate[7]

Location: Southeastern Asia, peninsula and northern one-third of the island of Borneo, bordering Indonesia and the South China Sea, south of Vietnam

Geographic coordinates: 2 30 N, 112 30 E

Area:
total: 329 750 sq km
land: 328 550 sq km
water: 1200 sq km

Area - comparative: slightly larger than New Mexico

Land boundaries:
total: 2669 km
border countries: Brunei 381 km, Indonesia 1782 km, Thailand 506 km

Climate: tropical; annual southwest (April to October) and northeast (October to February) monsoons

Terrain: coastal plains rising to hills and mountains

[7] *www.photius.com/wfb1999/malaysia/malaysia_geography.html. Accessed June 2013.*

Natural resources: petroleum, timber, copper, iron ore, natural gas, bauxite

Land use:
arable land: 3%
permanent crops: 12%
permanent pastures: 0%
forests and woodland: 68%
other: 17% (1993 est.)

Irrigated land: 2941 sq km (1998 est.)

*Natural hazards***:** flooding, landslides

*Environment—current issues***:** air pollution from industrial and vehicular emissions; water pollution from raw sewage; deforestation; smoke/haze from Indonesian forest fires

*Environment—international agreements***:**
party to: Biodiversity, Climate Change, Desertification, Endangered Species, Hazardous Wastes, Law of the Sea, Marine Life Conservation, Nuclear Test Ban, Ozone Layer Protection, Ship Pollution, and Tropical Timber
signed, but not ratified: none of the selected agreements

1.1.2 Flora and Fauna

*Forest Biodiversity Protection and Conservation***:** The strong environmental consciousness of recent years has also created certain buzzwords. Biodiversity and product certifications are two of them, which are currently debated upon. Malaysia is fully committed to the cause of protection and conservation of its biological resources.

Malaysia – one of the twelve "Mega Diversity" countries – is rich in biological diversity as reflected in the figures below (approximate in number):

⇒ 15 000 Angiosperms (flowering plants),

- 8500 species in Peninsular Malaysia,

⇒ 600 species of mosses,

⇒ 449 species of freshwater fish,

⇒ 1200 species of fern and fern allies,

⇒ 1200 species of butterflies, and

⇒ > 100 000 species of other invertebrates (insects, worms, etc).

⇒ 293 species of mammals,

⇒ 12 000 species of moths,

⇒ 1200 species of birds,

⇒ 294 species of reptiles,

⇒ 171 species of amphibians,

The twelve countries (China, Brazil, Australia, India, Congo, Mexico, Indonesia, Peru, Colombia, Madagascar, Malaysia, and Ecuador) together contain at least 60% of the world's known species.

1.1.3 Governance[8]

The *Government of Malaysia* comprises the federal, state and local governments. Malaysia is a federation of 13 states operating within a constitutional monarchy using the Westminster parliamentary system and is categorized as a representative democracy. The federal government adopts the principle of separation of powers and has three branches: executive, legislature and judiciary. The state governments in Malaysia also have their respective executive and legislative

[8] *http://en.wikipedia.org/wiki/Government_of_Malaysia. Accessed June 2013.*

bodies. The judicial system in Malaysia is a federalized body operating uniformly throughout the country. The federal government of Malaysia adheres to and is created by the Federal Constitution of Malaysia, the supreme law of the land.

*Legislature***:** The bicameral parliament consists of the lower house, the House of Representatives or *Dewan Rakyat* (literally the "Chamber of the People") and the upper house, the Senate or *Dewan Negara* (literally the "Chamber of the Nation"). All seventy Senate members sit for three-year terms (to a maximum of two terms); twenty-six are elected by the thirteen state assemblies, and forty-four are appointed by the king based on the advice of the Prime Minister. The 222 members of the *Dewan Rakyat* are elected from single-member districts by universal adult suffrage. The parliament follows a multi-party system and the governing body is elected through a first-past-the-post system. Parliament has a maximum mandate of five years by law. The king may dissolve parliament at any time and usually does so upon the advice of the Prime Minister.

*Executive***:** Executive power is vested in the cabinet led by the Prime Minister; the Malaysian constitution stipulates that the Prime Minister must be a member of the Lower House of Parliament who, in the opinion of *the Yang di-Pertuan Agong (YDPA)*, commands a majority in parliament. The cabinet is chosen from among members of both houses of Parliament and is responsible to that body. The executive branch of the government consists of the Prime Minister as the head of the government, followed by the various ministers of the Cabinet.

Judiciary: The highest court in the judicial system is the Federal Court, followed by the Court of Appeal, and two High Courts, one for Peninsular Malaysia, and one for East Malaysia. The subordinate courts in each of these jurisdictions include Sessions Courts, Magistrates' Courts, and Courts for Children. Malaysia also has a Special Court to hear cases brought by or against all Royalty.

State Governments: Each state government in Malaysia is created by the respective state constitutions. Each state has a unicameral state legislative chamber (Malay: *Dewan Undangan Negeri*) whose members are elected from single-member constituencies. State governments are led by Chief Ministers (*Menteri Besar* in Malay states or *Ketua Menteri* in states without hereditary rulers), who are state assembly members from the majority party in the *Dewan Undangan Negeri*. They advise their respective sultans or governors (Malay: *Yang di Pertua Negeri).* In each of the states with a hereditary ruler, the Chief Minister is required to be a Malay, appointed by the Sultan upon the recommendation of the Prime Minister**.**

Legal System: The law of Malaysia is mainly based on the common law legal system. This was a direct result of the colonization of Malaya, Sarawak, and North Borneo by Britain between the early 19th century and 1960s. The supreme law of the land - the Constitution of Malaysia - sets out the legal framework and rights of Malaysian citizens. Federal laws enacted by the Parliament of Malaysia apply throughout the country. There are also state laws enacted by the State Legislative Assemblies which applies in the particular state. The constitution of Malaysia also provides for a unique dual justice system—the secular laws (criminal and civil) and syariah laws.

Articles 73 to 79 of the Federal Constitution specify the subject in which the federal and state government may legislate. Parliament has the exclusive power to make laws over matters falling under the Federal List (such as citizenship, defence, internal security, civil and criminal law, finance, trade, commerce and industry, education, labour, and tourism) whereas each state, through its Legislative Assembly, has legislative power over matters under the State List (such as land, local government, Syariah law and Syariah courts, State holidays and State public works). Parliament and State legislatures share the power to make laws over matters under the Concurrent List (such as water supplies and housing) but Article 75 provides that in the event of conflict, Federal law will prevail over State law.

1.1.4 Economy

According to the World Bank, Malaysia has a 2011 Gross Domestic Product (GDP) of USD278.7 billion and a GDP per capita of USD9 656 making it an upper middle income country. With its New Economic Model (NEAC 2010)[9] the Malaysian Government attempts to achieve high-income status by 2020. GDP annual growth was steady over the last years; 5% to 7% between 2003 and 2008, with a decrease in 2009 of -2% but a positive growth in 2010 and 2011 with 7% and 5% increase respectively. The unemployment rate stayed almost constant around 3.2% between 2006 and 2011(World Bank 2012)[10]. The largest contributor to GDP is the services sector with a 54% share of total GDP in 2007; followed by the manufacturing sector with 28%. The third largest contributor to GDP is the mining and quarrying sector with 8%, followed by livestock, agriculture, forestry, and fishery with 7% and construction with 3%. Within the services sector, the largest contributor is the finance, insurance, real estate and business sub-sector with 16%, followed by the wholesale, retail trade, accommodation, and restaurants sub-sector 15%, the transport, storage, and communications sub-sector 8%. The smallest services sub-sectors are government services 7%, electricity, gas and water 3%, and other services 6% (NC2)[11]. Since 1980 Malaysia's major job-creating sector has been the services sector. Its employment share increased from 39% of total employment in 1980 to 53% in 2009. The employment share in the industry has also constantly grown from 24% in 1980 to 32% in 2009, while its importance relative to the services sector has shrunk. In contrast, the agriculture sector's employment largely decreased from 37% in 1980 to 15% in 2009 (World Bank 2012)[12]

Especially the role of tourism has constantly increased in Malaysia. In 2011, the direct contribution of tourism and travel to GDP was 6.7% of total GDP. When adding the indirect effects (e.g. tourism investment spending and domestic purchases of goods and services by the sectors involved in tourism) and induced effects (GDP support by the spending of those who are directly or indirectly employed in the tourism sector) then the total contribution of tourism and travel to GDP was even 14.8% of total GDP. In terms of employment, the tourism sector directly employed 753 500 people in 2010 (6.3% of total employment) while the total contribution to employment was 12.9% of total employment (World Travel & Tourism Council)[13].

The external debt stocks of Malaysia grew from USD55 billion in 2006 to USD66 billion in 2009 and sharply increased to USD81 billion in 2010 (World Bank 2012)[14] However, the Central Bank of Malaysia (*Portal Rasmi Bank Negara Malaysia*) maintains healthy foreign exchange reserves, which rose from USD106.5 billion in 2010 to USD 133.6 billion in 2011 (CIA 2012).[15] Malaysia's major export goods are electronic equipment, petroleum and liquefied natural gas, wood and wood products, palm oil, rubber, textiles, chemicals (CIA 2012)[16]. Exports are a key driver of the Malaysian economy. In fact, in 2010, the share of exports of goods and services as a share of GDP totalled 97% (World Bank 2012)[17]. Consequently, Malaysia is susceptible to slowdowns of the global economy as well as falls in world prices of its export commodities.

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[9] *National Economic Advisory Council (2010) New Economic Model for Malaysia - Part I: Strategic Policy Directions, 30 March 2010, www.neac.gov.my. The New Economic plan is an economic strategic plan to for transforming Malaysia from a middle income to an advanced nation by 2020,*

[10] *World Bank (2012), Data Bank, http://data.worldbank.org/, accessed November 2012.*

[11] *Malaysia's Second National Communication (NC2) submitted to the UNFCCC. Available at: nc2.nre.gov.my.*

[12] *Ibid. World Bank (2012)*

[13] *World Travel & Tourism Council (2012), Travel & Tourism, Economic Impact 2012, Malaysia*

[14] *Ibid. World Bank (2012)*

[15] *CIA. (2012). World Factbook, Malaysia Country Webpage, accessed November 2012.*

[16] *Ibid. CIA (2012)*

[17] *Ibid. World Bank (2012).*

However, being an oil and gas exporter, Malaysia profits also from rising global energy prices. The country was the 10th largest net exporter of natural gas in 2011 (IEA 2012)[18]. In fact, the oil and gas sector in Malaysia produces over 40% of Government revenues, although the Government is trying to reduce their dependence on state oil producer Petronas (CIA 2012)[19]. On the other hand, Malaysia is also highly dependent on fossil fuel imports. With net imports of 21 Mt, it was the 10th largest net importer of coal worldwide in 2011[20]. In the International Energy Agency's (IEA) Energy Development Index, comprising 80 countries and measuring the progress with respect to a transition to modern energy services and modern fuels, Malaysia is ranked fourth and belongs to the ten countries with the highest improvement between 2002 and 2010 (IEA 2012)[21].

Malaysia has a high achievable potential for renewable energy (RE) of 30,700 megawatt (MW) where hydro power is estimated to have the highest potential (22 000 MW), followed by solar power (6,500 MW), biomass (1,300 MW), mini-hydro (500 MW), and municipal solid waste (400 MW) (Oh et al. 2010)[22]. In order to increase the capacity of RE, the Malaysian Government launched the Small Renewable Energy Power Programme (SREP) in 2001. Within SREP a total capacity of 61.7MW of RE was connected to the national grid as of end of 2010. Further RE projects amounting to a capacity of 210.85 MW were under construction and approved - but not yet licensed or operational (Sovacool & Drupady 2011)[23].

1.1.5 Major Environmental Concerns

Current environmental issues including global warming and climate change, deforestation and loss of biodiversity, food security and social problems, increasing agricultural wastes especially from oil palm, unstabilized land utilization and agricultural activities, and inefficient energy consumption call for the scientific community to concentrate efforts to address these imminent and burgeoning issues. The major cause of the continued environmental and resource deterioration is the unsustainable patterns of production, consumption and socio-economic development. As the signatory of United Nation Framework Convention on Climate Change (UNFCCC), Kyoto Protocol, and Convention on Bio-Diversity (CBD), Malaysia is committed to take further mitigation measures against these environmental problems.

a) Environment, Climate change and Bio-diversity

The ratification of United Nation Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol (KP) signifies the commitment of Malaysia and the world in addressing the problems of climate change and sets the stage for further works on the issues. Malaysia's best practices approach to carbon conservation and sequestration, and carbon substitution has been able to curb the rate of increase in atmospheric CO_2. In Malaysia and elsewhere, a temperature increase of above 2^oC may induce: increase mean annual rainfall of up to 15%; increase evapo-transpiration of about 20–25%; increase demand of water for irrigation and domestic use by 15%; sea level rise of 40–100cm flooding the low lying coastal area of up to 2.5km further inland; reduce productivity of lowland crops, such as rice, rubber and oil palm by about 15–20%; and destroy mangrove and estuarine habitats. Malaysia emitted Green House Gases (GHG), the primary component of global warming: 3.0 tCO_2 in 1990, increased to 7.5 tCO_2 per capita in 2004; it captured 0.6% of the world total in 2004 (0.2% in 1990), and ranked 26th in the world overall.

The priority in the fight against climate change should be the reduction of emissions at source and that sinks should play only a transitional role and thus, be included as an activity for the short term.

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[18] *IEA (2012), Key World Energy Statistics 2012, accessed November 2012*

[19] *Ibid. CIA. (2012).*

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[20] *Ibid. IEA. (2012), Key World Energy Statistics 2012*

[21] *IEA. (2012), World Energy Outlook 2012 accessed November 2012.*

[22] *Oh, Tick Hui, Shen Yee Pang, and Shing Chyli Chua (2010), Energy Policy and Alternative Energy in Malaysia: Issues and Challenges for Sustainable Growth, Renewable and Sustainable Energy Reviews 14, pp. 1241–1252.*

[23] *Sovacool, B.K. and I. M. Drupady (2011), Untapped potential: The difficulties of the Small Renewable Energy Power (SREP) Programme in Malaysia, Energy Governance Case Study #9, Lee Kuan Yew School of Public Policy, National University of Singapore and Ministry of Energy, Green Technology and Water.*

Malaysia continues to emphasize the importance of sustainable management of existing sinks and reservoirs, in line with the commitments of the UNFCCC. On the other hand, Land Use, Land Use Change and Forestry (LULUCF) activities should promote the long-term sustainable development, including that of forests. As a result of Stern Report, which identified deforestation as the second major sources of GHG emissions driving climate change and global warming, a number of countries proposed a mechanism to compensate countries for reducing deforestation and degradation and conserving intact forest areas. Clean Development Mechanism (CDM) and Reduced Emissions from Deforestation and Degradation (REDD+) are mechanisms intended to reduce emissions: the CDM accomplishes this through afforestation and reforestation, but its existence is short lived until December 2012; and REDD – the successor to CDM - through reducing deforestation rates and managing forest degradation in ways that minimize GHG emissions. As a matter of principle, Malaysia supports global efforts to curb deforestation and to provide incentives for reducing deforestation and degradation, but such approach will be adopted with a clear and fair mechanism that will address the issues of leakage, permanence and additionality, and that recognizes the socio-economic impacts to Malaysia with relatively large areas of forests.

Malaysia is committed to sustainable forest management (SFM) practices in line with the resolution of United Nation Conference on Environment and Development (UNCED) as well as World Summit on Sustainable Development (WSSD). To further strengthen this effort Malaysia, Indonesia and Brunei have initiated the HEART OF BORNEO conservation project, which will protect biodiversity by preserving 220 000 sq km of rainforest on the island of Borneo. Similarly, the Malaysia government in 1999 initiated the project on “Conservation and Sustainable Use of Tropical Peat Swamp Forests and Associated Wetland Ecosystems” with UNDP/GEF, involving three sites – the Loagan Bunut National Park in Sarawak (10 736 ha), the Klias Peninsular in Sabah (6 130 ha core zones as project site), and South East Pahang Peat Swamp Forest (200 000 ha).

Among the key initiatives taken by the Malaysia government in the fight against global warming has been in the fields of renewable energy: exploring bio-fuels, providing tax incentives for energy conservation and energy saving initiatives, and minimizing carbon footage. Additionally, a series of strategic directions which may be policy oriented are worth the consideration by the appropriate authority, including business corporations. Strategic climate change directions related to Sustainable Development (SD) must be urgently identified at both the national level and international level with their impacts and effectiveness in terms of Emission Reduction Effectiveness (ERE).

b) Renewable Energy & Green Technology

Malaysia indirectly and unknowingly sets its commitment to climate change at the historic Langkawi Declaration on Environment at CHOGM 1989 - followed by the initiative “Greening the Earth” at Kuala Lumpur Declaration in April1992. It ensures that Malaysia commits to maintain a minimum of 50% of its land area with natural forest cover, and at UNCED Summit in Rio June 1992 urged the world governments to undertake similar initiatives.

In the late1980s to early 1990s (i.e. prior to UNCED (1992) Rio, UNFCCC and Kyoto Protocol) there were almost similar initiatives to save tropical forests from deforestation and degradation, but without cross referring to the issue of climate change at that time: *CONSERVATION BANKING; SWAPPING DEBT FOR NATURE*; and *TROPICAL (*subsequently became *NATIONAL) FOREST ACTION PLAN (TFAP/ NFAP*), but they were short lived for many reasons.

Among the other key initiatives taken by the Malaysia government in the fight against global warming has been in the fields of renewable energy:

1. The policy (many argue this as only a target set by the Malaysian government rather than policy!) of Renewable Energy (RE) as the fifth fuel has been formulated by the Malaysian government to diversify the traditional sources of fuel, including renewal energy such as solar, biomass, biogas, municipal waste and mini (small) hydro. The Government has also established Small Renewable Energy Programme (SREP) to promote the use of renewable energy for power production. The consequences of climate change together with the depletion of fossil fuels and escalating petroleum prices have made the Malaysia government initiate further push for an aggressive deployment of the above renewable energy, thus reduce dependency on carbon-intensive energy sources and mitigate global warming issues. The alternative energy sources have now been targeted to increase to 5% and 11% of the country’s energy mix in 2015 and 2020, respectively.

To this end, Sustainable Energy Development Authority Malaysia (SEDA Malaysia) has been established in 2011 to administer and implement the Feed-in Tariff (FiT) mechanism to increase the growth of RE and spur the industry and technology development in the country.

2. Companies that undertake renewal energy from biomass have been provided tax incentives. New sources of energy such as solar and wind will be developed, emphasizing on cost-effective technology and strengthening capacity building;

3. The development of bio-fuel using palm oil has been undertaken in line with the initiative to make Malaysia a world leader and hub for palm oil. Malaysia remains cognizant of the perception by some that increased production of palm oil bio-fuel will jeopardize the edible oil industry and act as yet another driver of deforestation and emissions, particularly from peat soils. Malaysia reassures the world that Life Cycle Assessment (LCA) of the various oil palm products is currently ongoing to determine the true impacts of producing renewable bio-fuel from oil palms;

4. In 2008, the Malaysian government proposed several improvements in tax incentives, including increasing Investment Tax Allowance on expenditures for energy conservation and energy saving initiatives, and

5. Malaysia suggested "*Personal Carbon Rationing*" in line with the equity principle of equal shares for everyone. As part of a global agreement, per capita rationing would ensure that people would only be able to pollute up to their equal rations and beyond that, they would have to buy credits from those who have not utilized their rations fully. The whole idea of personal carbon rationing is to ensure that people adjust their life styles to less carbon intensive ways.

1.2 Current Land Use and Land Tenure Arrangement

Malaysia is rich in natural resources and commodities. It produces petroleum and is a net exporter. Malaysia also produces liquefied natural gas as well as various other related products, most of which are found off the coasts of Terengganu, Sabah, and Sarawak. Other commodities explored and extracted are tin, petroleum, timber, copper, iron, ore, natural gas, bauxite. Malaysia was the largest exporter of tin until the industry wide collapse in 1980s. Tin deposits are still found in Selangor, Kinta valley in Perak, Pahang and Johor. There are significant deposit of gold in Pahang towns of Raub and Kuala Lipis and also Kelantan's district of Gua Musang. Coal is mostly concentrated in Sarawak town of Kapit, Mukah and Silantek. Malaysia is one of the largest exporters of palm oil and rubber and their products in the world. Malaysian continued to be an important exporter for timber and other timber products.

Table 1 shows that, at the end of 2005, an estimated 18.31 mil ha (55.8 % of total land area) was forest. Land under perennial tree crops such as rubber, oil palm, cocoa and coconut totaled 5.55 mil ha (16.9 %), and land used for other purposes such as settlements and infrastructural development amounted to 8.97 mil ha (27.3 %). If the 5.55 mil ha of tree crops - which are similar to reforested land and are increasingly looked upon as alternative sources of wood supply, especially rubberwood - were counted as part of the area under tree cover, it would increase to 23.86 mil ha or 72.7 % of Malaysia's total land area.

Table 1. Land Use Patterns by Region in 2005 (mil ha)[24].

Region	Land Area	Natural Forest	Forest Plantation	Agricultural Tree Crops	Other Land Uses	Total Forest Area	Percentage Total of Forest Area
Peninsular Malaysia	13.16	5.81	0.07	3.32	3.96	5.88	44.7
Sabah	7.37	4.16	0.20	1.50	1.51	4.36	59.2
Sarawak	12.30	7.94	0.13	0.73	3.50	8.07	65.6
Malaysia	32.83	17.91	0.40	5.55	8.97	18.31	55.8

1.3 Land Use Change and Its Driver

1.3.1 Land Use Change After 1970

The Land Capability Classification (LCC) used soil fertility as the criterion of land-use in the country. This implied that a large portion of the present productive lowland forests have to be surrendered to agriculture, and productive forestry will be confined largely to land unsuited to permanent agriculture - land unlikely to be carrying highly productive natural forest. The LCC established five classes of land and recommended economically best uses for each. Mining (mainly for tin) and agriculture were deemed more valuable in Classes I-III, which comprised the better-quality land in the lowlands and on gentle slopes, while forestry was assigned to the poorest land, in Classes IV and V. These two classes covered about 40 percent of the Peninsula, but they were largely restricted to inland freshwater swamps and upland areas. Swamps were later reassigned to Class III, leaving forestry with only the uplands (Salleh 1972)[25]. In short, the LCC provided some assurance of a permanent forest base, but it did not include the fertile lowland forests.

The LCC was essentially an application of the economic concepts that assigned land uses to capability classes; it focused on the "added value due to the use of the land and did not consider secondary processing industries" (Salleh 1972)[26]. According to the Classification, forestry did not belong in Classes I-III because it generated lower rents than competing uses, but it did belong in Classes IV-V, where it generated higher rents. Numerous studies have determined that rubber and oil palm plantations established during the 1960s and 1970s by the Federal Land Development Authority (FELDA) and private plantation companies did indeed earn high rates of return (Vincent and Yusuf 1993)[27]. Agricultural area expanded and forest area shrank. Agriculture received another policy ally in the form of the National Economic Policy (NEP) established after 1969 with its emphasis upon alleviating rural poverty. In fact, land development showed no sign of slowing down at the start of the 1970s. Land use change in the 1970s and 1980s continued to be guided by the LCC. Even with the passing of National Forest Policy in 1978 where a permanent forest estate was established. Deforestation in the 1980s continued to be driven by perceived returns to agricultural expansion, with the Forestry Department's efforts to prevent conversion providing only minor resistance. If there was a reasonable request to alienate forests for some form of development, the

[24] *Samsu Anuar, N. (2010). Malaysia Country Report on Forest land Tenure System. Country Reports on Forest Tenure in Asia and the Pacific. Proceedings of APFNet Workshop on Forest Tenure, July 2010, China.*

[25] *Salleh M.N. 1972. Proposals for a permanent forest estate for West Malaysia. Malayan Forester 35(4):269 284.*

[26] *Ibid. Salleh M.N. (1972)*

[27] *Vincent J R. and Yusuf H. 1993.Malaysia. In Sustainable Agriculture and the Environment in the Humid Tropics, ed. Committee on Sustainable Agriculture and the Environment in the Humid Tropics, National Research Council. National Academy Press, Washington D.C.*

states generally granted it. But despite that by the late 1980s the rate of conversion was slowing, as industrialization and urbanization caused the rural labor market to tighten and agricultural returns to fall. Most striking was a statement in the *Sixth Malaysia Plan* 1991–1995 (p. 117) that, except for projects in-progress, FELDA would develop no additional land during the period covered by the *Plan.*

1.3.2 Major Drivers to Land Use Change

Peninsular Malaysia, historically known as Malaya before 1963, is the largest of the three main regions that make up the country. Large-scale rice cultivation, rubber, oil palm, and tin are all found here. The vegetation varies from swamp in the lowlands to plush evergreen forests. Industrialization and a growing economy significantly influence land use, with agriculture, logging, and resettlement all contributing to the deforestation of Malaysia. Although shifting cultivation is expanding as well, it only accounts for a small percentage of the land use in Peninsular Malaysia. Timber was a leading export for Malaysia, although agriculture production was also destined to foreign markets. Agriculture expansion boomed from 1904 to 1932, slowed down for a time, then increased again from 1966 into the 1980s. Because of the rapid development of land in the 1960s and the clearing of forests, suitable land for habitation decreased. The Federal Land Development Authority (FELDA), established in 1956 by the British, opened new area for cultivation and was a major factor in the clearing of forests. Because of the changes in land use and weak government policies to control it, forest cover has been declining since the 1960s.

Sabah: Sabah's forests, which once covered about 56.7% of land area, mainly consist of tropical evergreen and tropical rain forests. Although deforestation is a problem, it has received less attention than in the peninsula or in Sarawak. Many of the contributing factors are similar - agricultural expansion, land development, and logging. Poverty, often overlooked as a reason for forest degradation, also plays a role. For example, government agencies will authorize forests to be cleared to create affordable living space. The building of roads and increased logging provide access to new land as well - activities which, in turn, cause forests to become degraded. Population pressure, combined with the shortage of suitable land for agriculture, was responsible for deforestation as well. Extensive planting of crop-yielding trees also affects forest area over the long term. Sabah's policy to open new land for development drew the attention of FELDA, which began to pay more attention to forest degradation in this region in the 1980s.

Timber became Sabah's most important export in 1958 and, by the time it became a state in Malaysia, constituted a high proportion of government revenue and a subject of state politics in which forest conservation was of little concern. From 1966 to 1991, it lost approximately1.85 mil ha of forest due to logging.

*Sarawak***:** Although oil, gas and timber drive economic growth in Sarawak, forestry and agriculture remain the key sources of state revenue and are the largest employers in Sarawak. Forests for timber production - a major export - take up much of the land but the replanting of harvested areas depends on extraction methods used. In addition, agriculture and tree-crop plantations are increasing, both of which involve forest clearing. Resettlement also can lead to forest loss. Logging, particularly in the rainforest, replaced shifting cultivation as the main cause of deforestation. Other causes, in order of importance, are agricultural development and aquaculture in coastal wetlands; plantation development; shifting cultivation; dams and resettlement - none of which are regulated to any great extent. Accelerated plantation agriculture and land development, in turn, are gradually overtaking logging as the driver behind forest removal. The revenue that such activities generate makes it difficult for Sarawak to stop the loss and degradation of these resources.

2 FORESTS AND FORESTRY IN MALAYSIA

2.1 Extent and Scarcity of Forests

2.1.1 Malaysia is fortunate to be endowed with vast stretches of evergreen tropical rainforests – a natural heritage rich in plant and animal life (Figure 2). The Malaysian tropical rainforest is one of the most complex and species – rich ecosystems on planet earth. With more than half the country clad in forests, home to an astonishing diversity and abundance of living plants, animals, insects, fish and reptiles, Malaysia recognizes the need to manage its forests for sustainable yield of economicallyvaluable timber that will not put at risk environmental stability and ecological balance.

Malaysia reports its forests according to three major forest categories: Permanent Reserve Forest – PFR (or Permanent Forest Estate - PFE), State/ Alienated forest and National Park & Wildlife/ Bird sanctuary. In 2011, Malaysia has about 14.61 mil ha of PFR (Peninsular Malaysia = 4.92 mil ha; Sarawak = 6.09 mil ha; Sabah = 3.60 mil ha), 2.04 mil ha of State/Alienated forest, and about 1.83 mil hectares of National Park & Wildlife/ Bird sanctuary. From the log production viewpoint, Malaysia has about 13.42 mil ha (11.38 mil ha from PFR and 2.04 mil ha from State/ Alienated forest). Malaysia has about 5.06 mil ha of totally protected forests (3.23 mil ha from PFR and 1.83 from National Park & Wildlife/ Bird sanctuary). This is summarized in Figure 3 below.

Figure 2. Malaysia geographic position.

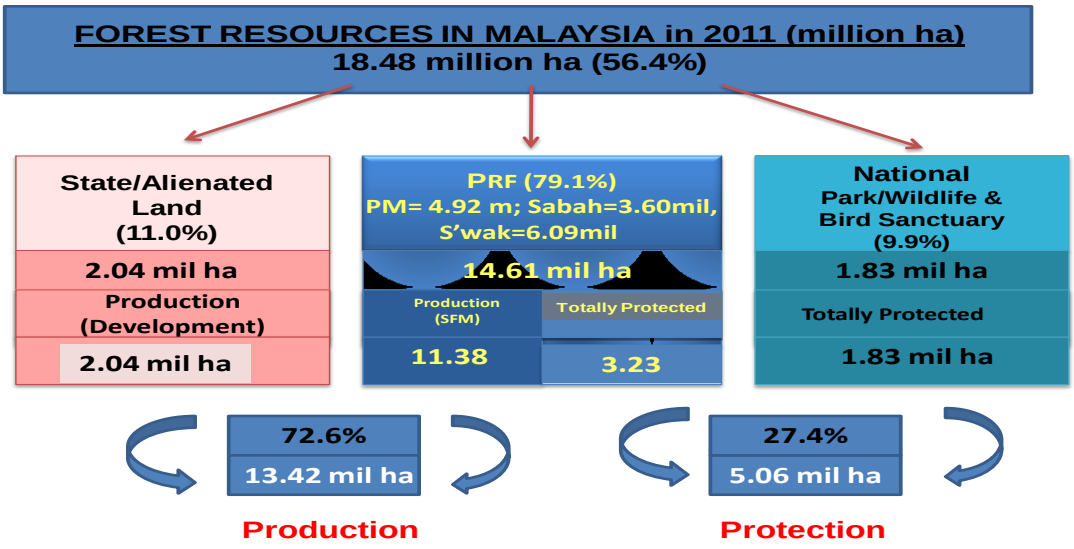


Figure 3. Forest resources in Malaysia in 2011.
(Source: Abd. Rahman Abd. Rahim. 2012)[28]

2.1.2 Forest Sustainability Between Peninsular Malaysia, Sabah and Sarawak

Peninsular Malaysia: There is no doubt that the long-term productivity, renewability and sustainability of the forest in Peninsular Malaysia depend mainly on the productive portion of the PFE. As of January 1988, the total standing merchantable volume of all trees with diameter greater than 45 cm dbh was estimated at 525 mil cu m in the Dipterocarp forest and 22 mil cu m in the swamp forest (Forest Dept. 1989)[29]. It was observed that forests in the east coast states of Peninsular Malaysia were lightly and selectively logged compared to forests in the west coast states. The forests in the east coast states possessed a greater number of residual trees for the next cut, and formed likely areas to be managed on the 30-year cutting cycle. On the other hand, the west coast forests were logged more intensively leaving behind less trees for the next cut, and became more likely areas to be managed on 55-year cutting cycle.

The general trend in Malaysia is a declining forest area for timber production, i.e. the PFR or PFE. Despite the reduction of forested areas, our policy analyses have indicated a favourable scenario in ensuring the continuous supply of timber from sustainably managed forests. In Peninsular Malaysia, forest management had been practiced to sustain:

1. A minimum commercial logs production of:

   - 3.2 million m^3 per year from 1991 to 1995, and
   - 2.7 million m^3 per year from 1996 until the year 2011

   from undisturbed (virgin) natural forests in accordance with the set annual allowable cut (AAC) - (Figure 4);

[28] *Abd. Rahman Abd. Rahim. 2012. The state of our forest in Peninsular Malaysia. The public awareness campaign on forest conservation in Malaysia, 1 February 2012, Sunway Pyramid Shopping Centre, Selangor, Malaysia.*

[29] *Forest Dept (1989). Sustained yield management in Malaysia. Unpubl. Paper. Forestry Dept. HQ, Kuala Lumpur, Malaysia. 18pp.*

2. A continuous production of commercial logs from second cycle natural forest managed under MUS/ SMS, about

   - 12 million m^3 in 2012 to about 6 mil cu m in 2020 (Figure 5);

3. A further production of commercial logs from second cycle natural forest managed under MUS until the year 2045 (Figure 6); and

4. A complementary supply of commercial logs from both plantations of Acacia and rubber, about:

   - 1 to 3 million m^3/year from the year 2000 onwards (Acacia).
   - 1.5 to 2 million m^3/year from 1994 onwards (Rubberwood).

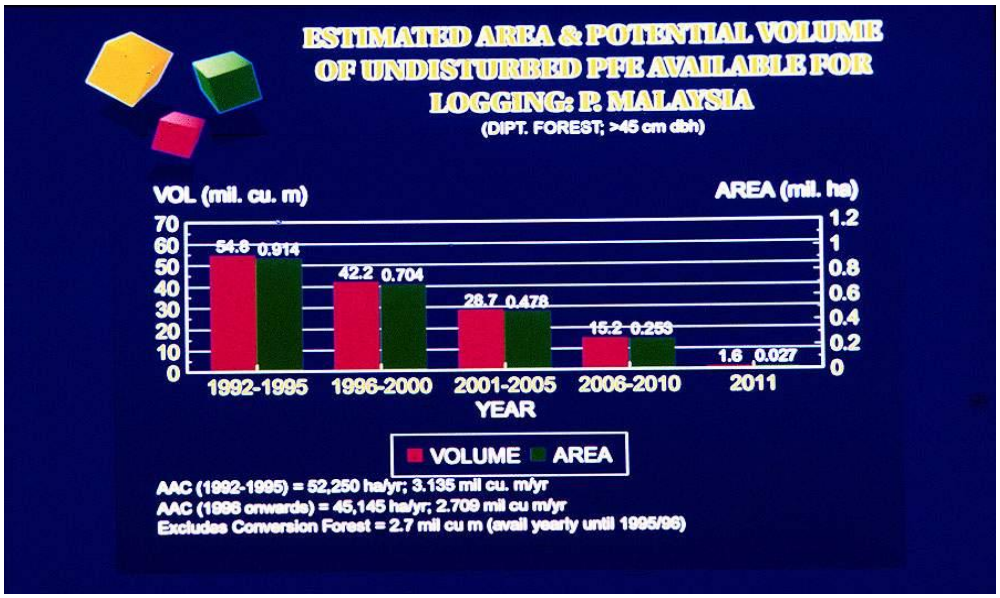


Figure 4. Estimated area and potential volume of undisturbed PFE available for logging in Peninsular Malaysia.

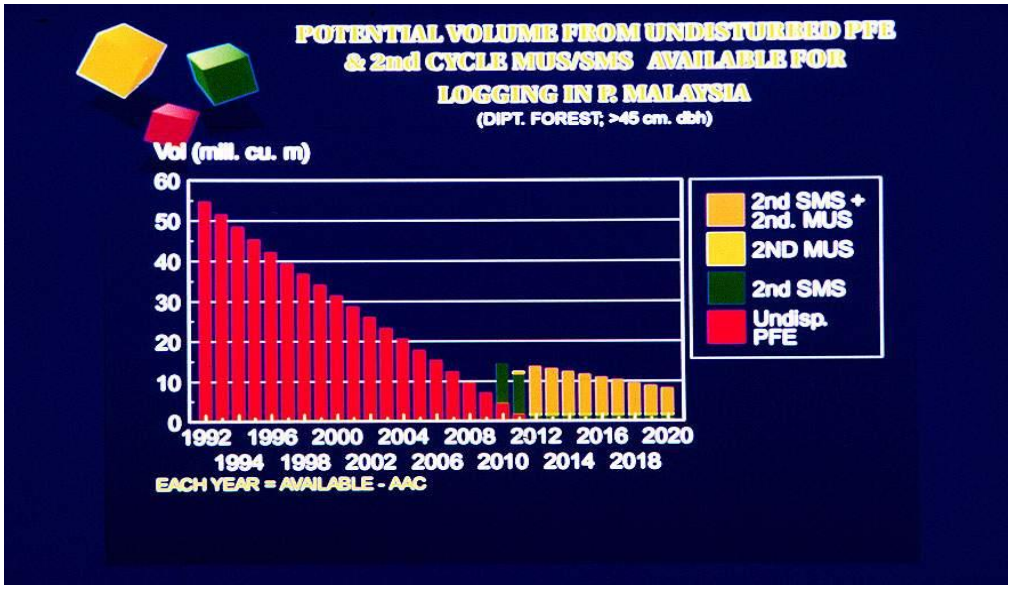


Figure 5. Potential volume of undisturbed PFE and second cycle MUS / SMS available for logging in Peninsular Malaysia.

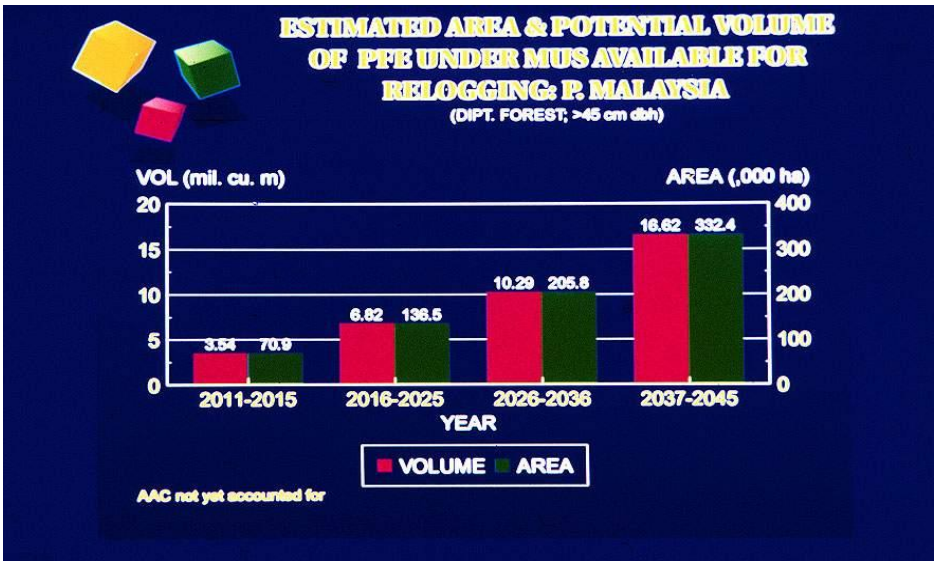


Figure 6. Estimated area and potential volume of PFE under MUS available for relogging in Peninsular Malaysia.

From Table 2, the current timber production from the natural forest had more than sustain the domestic consumption until the year 2000. The availability of rubberwood logs and plantation logs is an added bonus to Peninsular Malaysia. However, in the year 2015, the timber production from natural forests alone would not be enough to sustain the domestic consumption, but with the availability of logs from plantation forests and rubber plantations domestic consumption can be created for easily.

Table 2. Projected sustainable log production and domestic consumption and export demand up to the year 2015 compared with 1987 (mil cu m – roundwood equivalent).

Region	Year	Sustainable log supply			Domestic consump-tion[4]	Export demand[5]		Supply avai. minus domestic consump.	Supply avai. minus domestic consumption & export Demand
		Natural Forest	Plantation Forest	Rubber Plantation		Logs	Processed Products	Surplus (+) Deficit (-)	Surplus (+) Deficit (-)
Peninsular Malaysia	1987	8.06	-	1.16	3.69	0.054	5.78	+ 5.97	+ 0.14
	1995	4.80	-	2.4[1]	4.29	0.020	6.98	+ 2.91	- 4.08
	2000	4.80	1.13	2.6[1]	4.66	0.020	6.98	+ 3.87	- 3.12
	2015	4.80	3.00	2.0	5.76	0.020	6.98	+ 4.04	-2.95
	Perpetuity	5.70	2.30[2]	2.0	-	-	-	-	
Sabah	1987	11.50	-	-	0.35	7.50	1.98	+ 11.15	+ 1.67
	1995	1.67	3.00	-	0.41	8.50	2.85	+ 4.26	- 7.09
	2000	1.24	4.00	-	0.44	8.50	2.85	+ 4.80	- 6.55
	2015	2.80	8.10	-	0.55	8.50	2.85	+ 10.35	- 1.00
	Perpetuity	4.50	4.68[3]	-	-	-	-	-	
Sarawak	1987	13.66	-	-	0.41	12.64	0.18	+ 13.25	+ 0.43
	1995	10.15	-	-	0.49	10.00	0.70	+ 9.66	- 1.04
	2000	10.15	-	-	0.53	10.00	0.70	+ 9.62	- 1.08
	2015	7.00	-	-	0.65	10.00	0.70	+ 6.35	- 4.35
	Perpetuity	7.54	-	-	-	-	-	-	
MALAYSIA (Total)	1995	16.62	3.00	2.4	5.19	18.52	10.53	+ 16.83	- 12.22
	2000	16.19	5.13	2.6	5.63	18.52	10.53	+ 18.29	- 10.76
	2015	14.60	11.10	2.0	6.96	18.52	10.53	+ 20.74	- 8.31
	Perpetuity	17.74	6.98	2.0	-	-	-	-	-

[1]*[See: FRIM Reports No.49 (1988) – pg. 29: Columns 3 & 5, allowing 10% harvesting loss]*
[2]*Based on 188,000 ha and rotation period of 15-years for sawlog production with a net volume of 180cu m /ha*
[3]*Based on 390,000 ha and rotation period of 15-years for sawlog production with a net volume of 180cu m /ha*
[4]*Domestic consumption based on average per capita wood consumption of 0.27cu m and 2% population increase per year (base year 1987)*
= 13.684 million people – Peninsular Malaysia
= 1.305 million people – Sabah
= 1.555 million people – Sarawak
[5]*Export demand assumed constant. Processed products include timber, plywood, veneer, and moulding*

The timber processing activities for export demand will have to get logs from elsewhere to keep mills in production. By the year 2015 about 3 mil cu m of logs are expected from the plantation forests. This is important as the log supply from natural forest will no longer meet even the domestic consumption.

By the year 2020 at least 0.47 mil ha (out of a total of 1.87 mil ha) of logged-over forests within the PFE will be available for re-logging as they were managed under Malayan Uniform System under a 55-year cutting cycle and were harvested well before 1966. The only question that remains is whether the forest at the end of the cutting cycle will yield the expected volume.

Therefore, with the above arguments and that the areas logged in 1960s and early 1970s (under MUS) are best managed on a 55-year cutting cycle and that the areas logged in late 1970's and 1980's (under SMS) are best managed on 30-year cutting cycle, then Peninsular Malaysia will have three sources of log supply from its natural forests by the year 2020, from the:

(i) existing remaining natural forests within the PFE;

(ii) regenerated forests, logged and managed under the SMS with 30-year cutting cycle [note that the forests logged and managed under SMS with 30-year cutting cycle will be re-loggable as early as the year 2010]; and

(iii) regenerated forests logged and managed under MUS (about 470,000 ha available by the year 2020).

The natural forests of Peninsular Malaysia are capable of sustained and increased productivity is not seriously in doubt at least from a technical point of view. The 2.85 mil ha of forests, out of which 1.30 mil ha are to be managed on a 30-year cutting cycle and 1.55 mil ha on a 55-year cutting cycle, will be able to sustain production in perpetuity of not less than 3.84 mil cu m/year of log, i.e. 2.60 mil cu m from the 1.30 mil ha and 1.24 mil cu m from 1.55 mil ha respectively. Meanwhile, the production of plantation logs will play a much significant role to support the existing and future domestic consumption and export oriented wood-based industries. The above management scenario, supplemented by the plantation forests and rubberwood will no doubt give Peninsular Malaysia an advantage or an edge in sustaining its resources, thus ensuring the supply of timber in perpetuity.

Sabah: Under the Sabah Constitution, forestry is a state matter and forestry development plans are formulated as the state level. These plans are prepared within the overall perspective of national development objectives and strategies.

The continuous "*mining*" of the state's primary forest resources may present a bleak prospect on the future of the state if left unchecked. In 1975 the total forest areas was 5.54 mil ha or about 74.9% of the total land in Sabah. In 1987 the areas have been reduced to about 4.44 mil ha or 60.3% of the total land area. In 2010, the area is further reduced to 3.60 mil ha of PRF. However, of significant importance is the gazettment of 3,348,641 ha (about 45.4% of the total land area) as Permanent Forest Reserves (PRF) in consonance with the National Forest Policy of Malaysia. These state land forests would ultimately be logged for non-forestry uses.

The long term productivity, renewability and sustainability of Sabah's natural forests depend on the PRF's productive portion [Commercial Forest Reserve (CFR)] which is about 2.67 mil ha or 36.3% of the total land area. Additionally, the state land forests are also available for commercial logging but its production will not be sustained as they have been allocated for other purposes. The timber industry of Sabah is traditionally oriented the export of round logs. The typical "*exploit and export*" phase of forest development is characterized by a harvest rate in excess of the productive capacity of the forest, a rate which depends initially on the standing timber in unlogged primary forests. This is evident from the fact that the long-term sustained yield level prescribed for the forests in Sabah is only 2.5 mil cu m/year (although the long term sustainable timber supply is about 4.5 mil cu m/year – Table 2) whereas the timber requirements by the existing industry is about 3 mil cu m/year. However, the actual production has been steadily on the increase, averaging about 10 mil cu m in the last two decades.

It is evident from the above total log production figures and from Table 2 that beyond 1991 the timber from natural forest will still be sufficient to meet the domestic consumption. As Sabah continues its policy to export about 8 mil cu m of logs and about 3 mil cu m of processed products (Table 2), then Sabah already faced a critical supply problem around year 1995. This deficit cannot be even supplemented by the supply from forest plantation.

Forest Plantations - Future Resource of Sabah: The log production from forest plantations of fast-growing exotic was able to supplement the shortfall in the supply of logs from natural forests by 2015. By the year 2015, Sabah is expected to produce about 8 mil cu m of plantation log and may fulfil the export quota to about 7.5 mil cu m/year (Table 2). Two questions that remain are whether the market will accept these plantation logs and, if so, at what price. The sustainability of forest resources from Sabah in the year 2015 looks bleak provided that the:

(i) current level of activities within the timber industry is maintained,

(ii) timber from plantations are suitable for the current timber industry, and

(iii) log export target can be reduced in consonance with the sustainable log supply.

Any increase in the present level of industrial activity will result in increased rate of depletion of natural forests, unless the market is able to accept more intensive use of species that are currently not so "marketable". However, the present forest plantations in Sabah will not be sufficient in view of the anticipated increase in the level of wood-base industry, especially beyond the year 2000.

The natural forests of Sabah are capable of increased and sustained productivity, at least from a technical point of view. The long-term sustainable timber production of the CFR, estimated at about 4.5 mil cu m will be available by the year 2018 (30-year cycle) when the present CFR would have regenerated and ready for harvest (Table 2). Meanwhile, the production from plantation forests will play a much more significant role to support the wood-based industries. Beyond the year 2010, the sustainable management of both of natural forests and plantation forests will definitely be important as to supply the resources in perpetuity of the state of Sabah.

Sarawak: Sarawak is about 69% larger than neighbouring Sabah in terms of its land area. It is to be noted that different sources provide conflicting estimates of the total forested areas, often differing by as much as 1 mil hectare. Recent figure (for the year 2011) from Forestry Department, Sarawak[30]

[30] *Wan Razali W.M. (2013). Preparation of the guidelines and procedural documents on planning of forest resource inventory in Sarawak with the application of hyperspectral technology.FD Sarawak, Kuching.*

indicates that about 8.53 mil of its 12.38 mil ha land area are forested, although an area of about 6.1 mil ha forests is still being quoted[31].

Sustained Yield Natural Forest Management: An Achievable Goal for Sarawak? As of 31 December 2011, 4.15 mil ha has been designated as Permanent Forest Estate (PFE) for sustainable forest management practices, with the aim of increasing it to 6 mil ha; 0.49 mil ha for Totally Protected Area (TPA), with the aim of increasing it to 1 mil ha; and the remaining areas (3.89 mil ha) fall under the category of state land forest. There are, however, a number of important factors which may affect the implementation of sustainable forest management, and hence sustained timber yield, in Sarawak. One of the most important factors is shifting cultivation which is regarded an impediment to such efforts. As logging roads penetrate further into the forests, shifting cultivation spreads beyond the navigable river valleys where it has been traditionally practiced. Areas which have been converted to shifting cultivation will no longer contribute to sustainable management of forest in Sarawak. Short term licenses of 5–10 years duration do not promote sustainable forestry practices either. Furthermore, difficulties in enforcement of rules and regulation due to a lack of infrastructure and accessibility problem in the state, are further constrains to sustainable forest management.

Future Timber Harvest: Present and future harvests in both swamp and hill forest come from two sources: (1) virgin or old growth forests and (2) logged-over forests. Since the 1970s, the current production rate of logs from Sarawak forests is about 8 mil m³ per year[32]. Selective harvesting in the hill forests removes between 6-10 trees/ha. The hill forests produce an average gross volume of 44cu m/ha and the swamp forests produce an average gross volume of 62cu m/ha. Re-logging operations of the regenerated forests would continue to supply timber on a sustained basis. However, this timber still will not be enough to sustain the planned export production of 10 mil cu m per year after 1990.

Sarawak will face a critical supply shortage scenario by the year 2015 by about 4.4 mil cu m if the annual log export target of 10 mil cu m is to be achieved. Although Sarawak can still sustain its local and domestic processing consumptions, by then the planned export production of 10 mil cu m per year will have to be revised in accordance with the sustainable timber production of the forest of about 7.5 mil cu m/year. In Sarawak, a priority is given to the management of the natural forests for ecological and economic reasons. Plantation forests are only established on areas inside the PFE which have been disturbed by shifting cultivators. A planned target to plant about 2,000 ha/year is unlikely to be achieved and even if achieved, it is too small and too late to have any impact.

The long term annual harvestable increment of Sarawak natural forests is about 2cu m/ha/year. With only 4.15 mil ha in PFE, of which only 3.77 mil ha are productive, the long term average sustainable timber production would be around 7.5 mil cu m per year. This considerably less than the present level of log production that has averaged 8 -10 mil cu m annually. From the year 2000 to 2015 the productive forests of Sarawak will be able to produce only about 7 mil cu m of log per year, gradually increasing to about 7.5 mil cu m in perpetuity. This critical stage needs a second look or evaluation by the Sarawak Government, perhaps having to change it export target to that of what the forests can sustain annually (Table 2).

2.2 Forestry Regulation and Administration

2.2.1 Forestry Administration and Forest Ownership

Malaysia will "*ensure that her invaluable resources are not wasted. The land must remain productive and fertile, the atmosphere clear and clean, the water unpolluted, the forest resources capable of regeneration – able to yield to the needs of the nation's development. The beauty of the land must not be desecrated: for its own sake and for economic advancement*." So it is stated in the *Malaysia's Vision 2020*.

These forests are gazetted in accordance with the National Forestry Act (1984) in Peninsular Malaysia and the relevant state forest ordinance/ enactment in Sabah and Sarawak. A significant proportion of the total PFR (i.e. natural forests and planted forests combined) has been demarcated on the ground. Licensed land surveyors mark the boundaries of the PFR by the placement of permanent boundary

[31] *Ibid. Abd. Rahman Abd. Rahim. 2012*

[32] *WWF (2012), WWF-Malaysia Strategy 2012–2020, p. 5.*

stones; the painting of trees with three rings of red paint at 10-metre intervals; and the construction of notice boards at 800m intervals and at all entrances to the forest. In Peninsular Malaysia, an estimated 65% of the production PFR has been demarcated in this way, 6% in Sabah and 72% in Sarawak. About 25% of the protection PFR has been demarcated in Peninsular Malaysia, 41% in Sabah and 80% in Sarawak (FAO 2011)[33].

Detailed information about the ownership arrangement of forestlands in Malaysia is rarely published in the public arena – though it need to be noted, currently, all gazetted forestlands in Malaysia are owned and managed by the Government, while small patches of forestlands in Sabah and Sarawak are claimed as indigenous customary right lands and some forest plantations are privately managed. Although the management of all natural forests is under the purview of the respective state departments of forestry, state governments do lease forestlands out to integrated timber companies, at various lengths; giving long-term concessions tenure for 30-60 years. The management of leased forestland has to be guided by their forest management plans approved by the State Department of Forestry. Additionally, the private management is continuously scrutinised by oversight bodies to ensure the sustainable management of the forestland.

As mentioned above the management of the forests is considered a state matter and forests come under the jurisdiction of state governments, while Federal Government agencies provide technical assistance, advice and development aid. When the state of Sabah decided to lease the forestland to private companies it created forest management units (FMU). Each FMU is required to have a management plan. The plan has to describe in detail what actions will be performed within the concession and how this would affect the forest resource overall. The state of Sabah provides FMUs with a size of about 100,000 ha and tenures of 99 years[34]. Mainly large timber companies lease concessions from the state with a trend of conversion of FMUs to plantations in Sabah. Another popular option for timber companies is to buy the patches of land that are marked to be converted into rubber or oil palm plantations. For example, forest areas in Sarawak are allowed to be earmarked for plantation development, and in Sabah, there are degraded areas that are also earmarked for plantation development.

2.2.2 Administration of Forest Use

Following comprehensive land use in Malaysia, about 56% of land area, exclude rubber and oil palm plantations, is today still covered with indigenous forests. Legally, various forest land classifications were gazetted in accordance with the following legislations:

(1) National Forestry Act, 1984;
(2) Sabah's Forest Enactment, 1968;
(3) Sarawak's Forest Ordinance, 1954;
(4) National Parks Act, 1980;
(5) Protection of Wildlife Act, 1972 (Rev: 1976);
(6) Sabah's Parks Enactment, 1984;
(7) Sabah's Fauna Conservation Ordinance, 1963;
(8) Sarawak's National Parks Ordinance, 1956; and
(9) Sarawak's Wildlife Protection Ordinance, 1958.

Other legislations have strengthened the implementation of forest land classifications. These include: Water Enactment, 1935; Land Conservation Act, 1960; National Land Code, 1965; and Environmental Quality Act, 1974 (Environmental Impact Assessment Order 1987).

Over the period 1970 to 2000, natural forest - the storehouse of biodiversity - was reduced by about 20% in the whole of Malaysia, mainly in conversion to the cash crops, oil palm and rubber. There is no need to be apologetic about this as the agro-based industries were the backbone of our industrial development in the recent past and continue to be a substantial contributor to the economy of the country. Nevertheless we have reached a time in our development path where we could be more

[33] *FAO (2011). State of the world's forests 2011. Food and Agriculture Organization of the United Nations Rome, 2011*

[34] *Gregersen, Contreras-Hermosilla, White and Phillips 2004, Forest Governance in Federal Systems: An Overview of Experiences and Implications for Decentralisation, Interlaken Switzerland, p.43-45.*

sensitive to the needs of nature and ensure that any further reduction in the extent of our forested land should only be after the most careful of considerations.

In accordance with the Malaysian Constitution, forestry comes under the jurisdiction of state governments which are empowered to enact laws and formulate policy independently. The authority of the federal government only extends to the provision of advice and technical assistance, training, and research. In order to coordinate approaches and harmonize policies of other sectors that interface with forestry, the National Land Council (NLC) established the National Forestry Council (NFC) in December 1971. The NLC is empowered under the Malaysian Constitution to formulate a national land use policy for mining, agriculture and forestry. The Deputy Prime Minister chairs the NFC which comprised the Chief Ministers of the 13 Malaysian states, the Minister of Natural Resources and Environment Malaysia and other federal ministers whose portfolios have impacts on the forestry sector: finance; trade; agriculture commodities; science, technology and the environment. The heads of the forestry services of Peninsular Malaysia, Sabah and Sarawak are also members. In addition to enhancing collaboration, the NFC serves as a forum for federal and state governments to discuss and resolve issues relating to forest policy, administration and management. The NLC endorses all decisions of the NFC but the responsibility for implementing them largely lies with state governments.

In 1992, the National Forestry Policy 1978 (NFP) was revised to include the conservation of biological diversity, the sustainable utilization of forest genetic resources, and the role of local communities in forest development. To ensure effective forest management and implementation of the National Forestry Policy in Malaysia, state authorities have been formulating and enforcing various acts and ordinances since the early 1900s. Forest management planning and operations were further streamlined and strengthened with the adoption of the National Forestry Act and the Wood-based industries. Similar to the NFP, the National Forestry Act 1984 was amended in 1993 to incorporate additional provisions related to sustainable forest management, by way of more stringent penalties for violations, including the illegal felling of trees, and to provide for mandatory imprisonment of convicted offenders. The police and armed forces were given new powers of surveillance in the forestry sector, with the aim of curbing illegal logging, encroachment, and timber theft.

In December 2007, Parliament approved Malaysia's International Trade in Endangered Species Act 2008 to legislate the administration and management of international trade in wild fauna and flora so that it does not threaten the survival of any species of wild fauna and flora in the country. Other pieces of legislation of major importance to the forestry sector are:

- National Land Code 1965
- Penal Code (FMS Cap. 45), 1948 (Amendment 1993)
- Criminal Procedure Code (FMS Cap.6) 1903 (Amendment 1995)
- Evidence Act 1950 (Amendment 1993)
- Financial Procedure Act 1967 (Amendment 1993)
- Water Enactment 1935
- Land Conservation Act 1960
- Protection of Wildlife Act 1972 (Amendment 1976 & 1988)
- Malaysian Timber Industry Board Act 1973
- Environmental Quality Act 1974 (Amendment 1995)
- National Park Act 1980 (Amendment 1983)
- Malaysian Forestry Research and Development Board Act 1985
- Mining Enactment 1926
- Local Government Act 1976
- Biosafety Act 2007.

2.2.3 Forest Utilisation and Management

Malaysia's Tropical Forests: Silviculture and Management Systems[35]

> *"Nature designed a forest with interrelated processes. We are trying to design a forest based on isolated products....." (Chris Maser 1988, The Redesigned Forest)*

Tropical forests have been a source of commercial timber for the last two centuries and have been managed under several management and silvicultural systems for the last five decades. These systems were applied with the aim of optimizing timber yield and quality from the forests and of improving the regenerating capacity of stands of commercially valuable species. The systems introduced rules concerning felling, pre-and post-felling inventory, and timber stand improvements. Silviculture, which may be defined as the art and science of growing trees, forms an important component of forest management. The concept of sustainable forest management is an integral part of forestry and has been in place for a long time.

Tropical forest in Malaysia has, for nearly a century focused solely on the production of timber, but of late non-timber resources especially rattans, bamboos and medicinal plants have been considered and integrated into the management of the forests. The forests have been managed under several management (including its silvicultural practices) systems:

- The Gutta Percha: (1900 – 1911)
- Regeneration Improvement Felling: RIF (1911-1942),
- The Malayan Uniform System: MUS (Since 1948), and
- The Selection Management System: SMS (Since 1978).

These systems aimed to increase the amount and quality of timber produced by manipulating stand density and composition; Often they relied on rules concerning:

- felling (e.g. number, type and diameter of trees to be felled and retained, felling techniques),
- pre-and post-harvest inventory, and
- timber stand improvement (e.g. climber cutting, girdling of undesirable trees, regeneration improvement and enrichment planting)

The choice of management regime may depend on the type of forest, the timber market and the forest policy of a country or forest owner. However, until today only two forest management systems predominate.

Malayan Uniform System – A Monocyclic System: Under this system all commercial trees, usually not less than 45cm dbh, are removed in a single felling. This felling operation is usually followed by a silvicultural treatment such as climber cutting and poison-girdling of defective relics and of non-commercial trees as small as 5cm dbh to enhance growth of natural regeneration. Alternatively, the area is left to regenerate naturally without any silvicultural treatment. In either case the residual trees and regeneration is left to grow for 60-80 years before the next harvest from the same forest area. Damage to regeneration from repeated harvest is avoided. The success of this system depends on the abundance, distribution and survival of seedlings and saplings of economic species. The Malayan Uniform System (MUS) practiced in Peninsular Malaysia and its modification in Sabah (Modified MUS) and in Nigeria (Tropical Shelterwood System [TSS]) are the best known examples of this type of management system.

The objective of producing second and subsequent rotation dipterocarp forests, mainly from seedling regeneration, either natural or artificial, must be reviewed from the cost-benefit viewpoint. Species considered commercial within the MUS were those species that were known to reach timber size (about 40cm dbh) irrespective of timber quality but excluding a relative small number of species listed as "weed trees". However, the continuing rapid depletion of tropical forests has strengthened the

[35] *Wan Razali W.M, Salleh M.N., and N. Manokaran. ((1995). Forestry in Malaysia: Yesterday, Today and Tomorrow. Paper prepared for 150th Anniversary of The New Straits Times [Note: subsequently published by The New Straits Times in 1996 entitled "An Abiding Asset"].*

arguments for adopting a more "conservational approach" to the management of tropical forests. For example, under the MUS and TSS the traditional poison-girdling of "unwanted" tree species to make way for the more valuable "marketable" seedlings and saplings has come under increasing criticism in recent years. This was due to the fact that very little reliable evidence is available to show that species of trees being poison-girdled today may not become marketable before regeneration attains harvestable size. Market demands may dictate changes in species and size limits. These concerns led to polycyclic systems which offer greater flexibility.

Selective Management System - A Polycyclic System: The above factors have resulted in the use of selective management system in Peninsular Malaysia and Sarawak. The use of trees of intermediate size classes to form the next rotation presupposes that these trees will be able to respond vigorously to the opening of the canopy through logging and, therefore, would yield higher growth increment.

In theory, such a system would offer several advantages, principally, a reduced cutting cycle and reduced total silvicultural costs. Such a system can be effectively applied only if the residual stand contains an adequate number of undamaged trees of "regeneration" species which are capable of responding vigorously to the "release" created by the logging operations.

Consequently, the Selective Management System (SMS) was introduced in Peninsular Malaysia in 1978 to allow for more flexible cutting limits but nevertheless requires a residual stand at least 32 trees per hectare (currently commercial and undamaged tree of good form) of 30-45cm dbh or its equivalent be left behind after harvesting (Thang 1988)[36]. The system also discourages the girdling of trees and, hence, is very much environmentally and biologically preferred. Minimum cutting limits of 45 cm dbh for non-dipterocarps and 50 cm dbh for dipterocarps species have been fixed under this system. The cutting limits selected enable the management to expect a possible growing stock of at least 30-40cu m /ha net in a 30-year cutting cycle. This approach to forest management, not only helps to conserve the resource but sustain the yield in perpetuity. The SMS was acclaimed to be also practiced in Sarawak but with a 25-year cutting cycle. In Sabah the MUS is still being practiced with a cutting cycle of 60 to 80 years, but with modification to include a series of treatment applied to the forest before and after logging.

Many countries have adopted this system. Typical examples include the Selection Logging System in Philippines, the Indonesian Selective Cutting System, Liberation Thinning in Sarawak, and the Selection Management System (SMS) in Peninsular Malaysia. The Queensland Selection System (QSS) was also a good example of this type of management system, although it is no longer used since the Queensland forests were included into the World Heritage List.

2.3 Economic, Social and Environmental Contribution of Forests

2.3.1 Timber Extraction

Information on forest areas logged and the volume of timber harvested annually are published respectively by the Forestry Departments of Peninsular Malaysia, Sabah and Sarawak, e.g. *Forestry Statistics Peninsular Malaysia*. The Ministry of Natural Resources and Environment Malaysia also publishes annually such statistics for the entire country. Harvesting of timber in Malaysia is based on the principles of Selective Management System (SMS). The SMS was evolved to optimize (i) an economical cut, (ii) the sustainability of forests, and (iii) minimum costs for forest development. Elements of SMS include a quota for each state, which is approved by the National Forestry Council (now merged into National Land Council), and adopted by the respective states. In the course of implementing the SMS, Malaysia pays attention to related environmental management practices such as RIL (reduced Impact Logging), in addition to establishing forest checking stations, forest land premium, log royalty assessment and issuance of removal passes. A forest certification process (see section 4.2.3) is also in place to certify that logs harvested come from areas that has been managed sustainably, meeting the social, environmental and economic requirements under MC&I (Natural Forests) and MC&I (Plantation Forests).

[36] *Thang, H.C. (1988). Selective Management System: Concept and Practice. Forestry Dept. HQ, Kuala Lumpur, Malaysia. 19pp.*

2.3.2 Protecting Forest Biological and Environmental Benefits

At the heart of forest conservation in Malaysia are its protected areas that have been legally gazetted by law. In Malaysia, protected areas cover both terrestrial and marine environments. Almost half of the total land area in Malaysia is protected under Permanent Reserve Forests (PRFs - as of 2011: 14.61 mil ha) of which about 11.38 mil ha and 3.23 mil ha are set aside respectively for sustainable timber production and as totally protected areas for their economic, social, and conservation values.

In addition, the protected area network has been further extended by the designation of national and state parks, wildlife reserves, bird and game sanctuaries, such as Taman Negara, Cameron Highland Wildlife Sanctuary, Tioman Wildlife Reserve, Royal Belum State Park, Tasek Bera (RAMSAR wetland) and Tanjung Piai (RAMSAR mangrove) in Peninsular Malaysia; Gunung Mulu National Park, Lanjak-Entimau Transboundary Conservation Area and Lambir Hills National Park in Sarawak; and Kinabalu Park, Danum Valley and Maliau Conservation Areas in Sabah.

Apart from the above legal mechanisms to gazette Protection Forests within the PRFs as defined by the National Forestry Policy (1978: Revised 1992), the National Forestry Act (1984: Amended 1993) Section 10(1) stipulates 11 functional classes for various functions, including biological and environmental benefits as follows[37]:

(1) Timber Production Forest under sustained yield;
(2) Soil Protection Forest;
(3) Soil Reclamation Forest;
(4) Flood Control Forest;
(5) Water Catchment Forest;
(6) Forest Sanctuary for Wildlife;
(7) Virgin Jungle Reserve;
(8) Amenity Forest;
(9) Education Forest;
(10) Research Forest; and
(11) Forest for Federal Purposes

At the species level, biological protection comes in the form of 32 timber species not allowed to be harvested within the PRFs in Peninsular Malaysia (MTC 2006).[38], 48 protected plant species in Sarawak under Section 31 of Sarawak Wildlife Protection Ordinance (MTC 2006)[39], and 20 genera/ species of trees listed as “prohibited species” under Sabah’s various enactments (MTC 2006)[40].

2.3.3 Forest product marketing and processing

Wood based industries were among the earliest processing industries established in Malaysia. The number of timber processing mills expanded rapidly in 1980s and 1990s due to increasing demand for Malaysian timber and timber products in the overseas markets. Some snap shots statistics for wood-based industries in the year 2011 are shown below[41]:

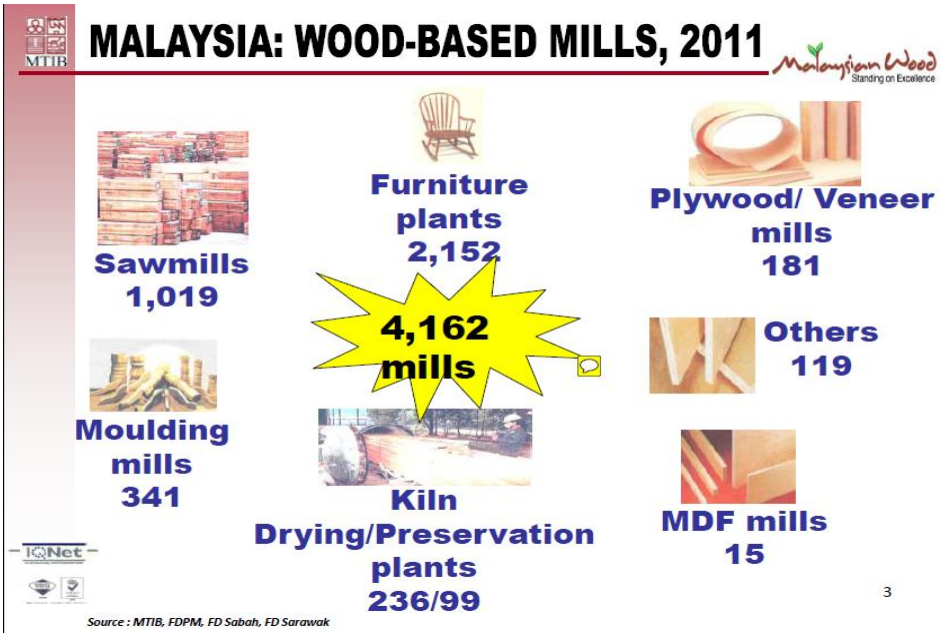
[37] *See Shamsudin Ibrahim et al. (2003). Management prescriptions for non-production functional classes of forest. Malayan Forest Record No. 46. FRIM, for detailed criteria and condition of these forests.*

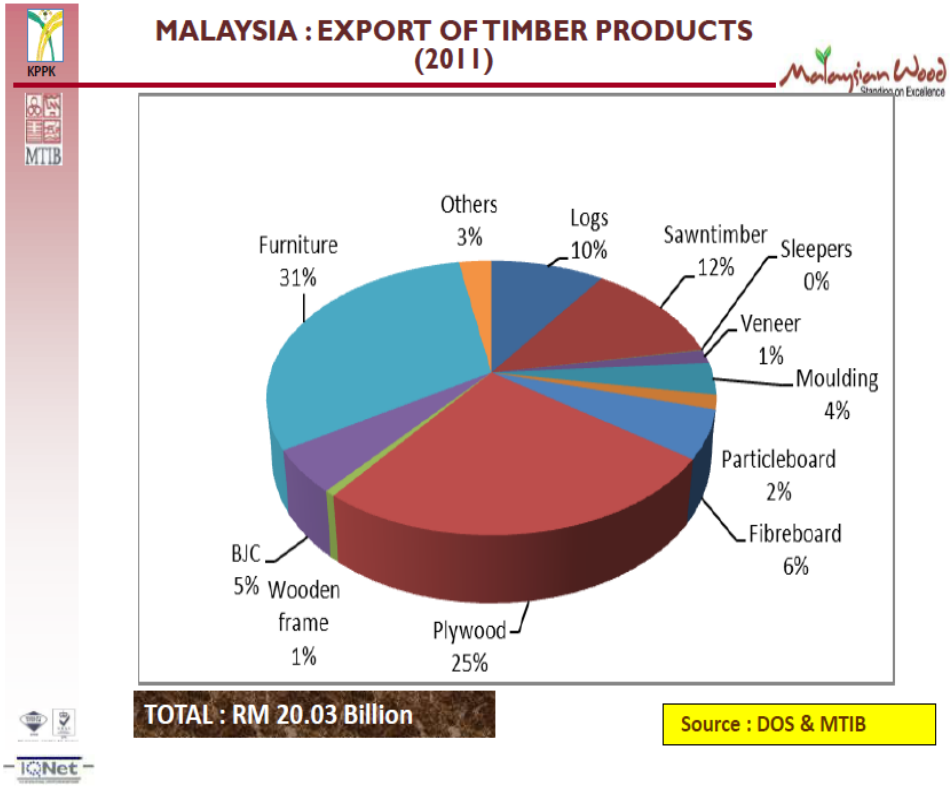
[38] *MTC. (2006) FAQs on Malaysia’s forestry & timber trade. Malaysia Timber Council.*

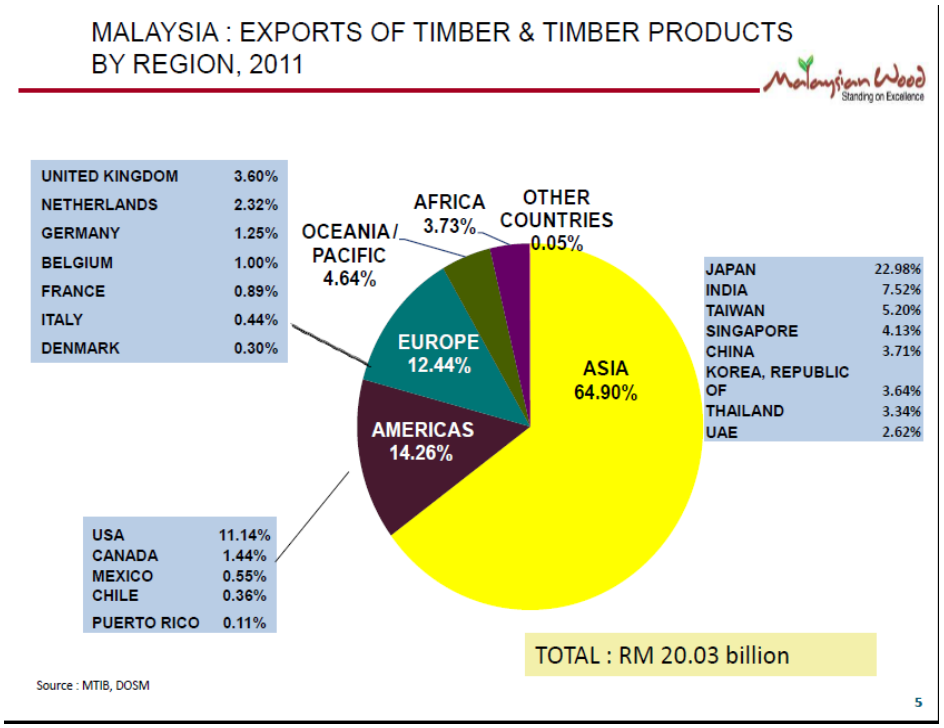
[39] *Ibid. MTC (2006).*

[40] *Ibid. MTC (2006).*

[41] *http://www.mtib.gov.my. Accessed June 2013*


MALAYSIA: WOOD-BASED MILLS, 2011
Sawmills 1,019
Furniture plants 2,152
4,162 mills
Plywood/ Veneer mills 181
Others 119
Moulding mills 341
Kiln Drying/Preservation plants 236/99
MDF mills 15
Source : MTIB, FDPM, FD Sabah, FD Sarawak


MALAYSIA : EXPORT OF TIMBER PRODUCTS (2011)
Others 3%
Logs 10%
Sawntimber 12%
Sleepers 0%
Veneer 1%
Moulding 4%
Particleboard 2%
Fibreboard 6%
Plywood 25%
Wooden frame 1%
BJC 5%
Furniture 31%
TOTAL : RM 20.03 Billion
Source : DOS & MTIB


MALAYSIA : EXPORTS OF TIMBER & TIMBER PRODUCTS BY REGION, 2011
Malaysian Wood
Standing on Excellence
UNITED KINGDOM 3.60%
NETHERLANDS 2.32%
GERMANY 1.25%
BELGIUM 1.00%
FRANCE 0.89%
ITALY 0.44%
DENMARK 0.30%
AFRICA 3.73%
OTHER COUNTRIES 0.05%
OCEANIA / PACIFIC 4.64%
EUROPE 12.44%
ASIA 64.90%
AMERICAS 14.26%
JAPAN 22.98%
INDIA 7.52%
TAIWAN 5.20%
SINGAPORE 4.13%
CHINA 3.71%
KOREA, REPUBLIC OF 3.64%
THAILAND 3.34%
UAE 2.62%
USA 11.14%
CANADA 1.44%
MEXICO 0.55%
CHILE 0.36%
PUERTO RICO 0.11%
TOTAL : RM 20.03 billion
Source : MTIB, DOSM
5

3 HISTORIC REVIEW OF FOREST COVER CHANGE

3.1 Definition of Forest

Malaysia uses the current FAO definitions of various land cover classes, i.e. total area, forest, other wooded land and other land as defined below:[42]

Land cover class	**Definition**
Total area[1]	Total area (of country), including area under inland water bodies, but excluding offshore territorial waters.
Forest	Land with tree crown cover (or equivalent stocking level) of more than 10 % and area of more than 0.5 ha (ha). The trees should be able to reach a minimum height of 5 meters (m) at maturity *in situ*. May consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground; or open forest formations with a continuous vegetation cover in which tree crown cover exceeds 10 %. Young natural stands and all plantations established for forestry purposes which have yet to reach a crown density of 10 % or tree height of 5 m are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention or natural causes but which are expected to revert to forest. **Includes**: forest nurseries and seed orchards that constitute an integral part of the forest; forest roads, cleared tracts, firebreaks and other small open areas; forest in national parks, nature reserves and other protected areas such as those of specific scientific, historical, cultural or spiritual interest; windbreaks and shelterbelts of trees with an area of more than 0.5 ha and width of more than 20 m; plantations primarily used for forestry purposes, including rubberwood plantations and cork oak stands. **Excludes**: Land predominantly used for agricultural practices
Other wooded land	Land either with a crown cover (or equivalent stocking level) of 5-10 % of trees able to reach a height of 5 m at maturity in situ; or a crown cover (or equivalent stocking level) of more than 10 % of trees not able to reach a height of 5 m at maturity in situ (e.g. dwarf or stunted trees); or with shrub or bush cover of more than 10 %.
Other land	Land not classified as forest or other wooded land as defined above. Includes agricultural land, meadows and pastures, built-on areas, barren land, etc.
Inland water	Area occupied by major rivers, lakes and reservoirs.

[1)] The Total land area is defined as the Total area, but excluding Inland water.

[42] *http://www.fao.org/docrep/006/ad665e/ad665e06.htm. Accessed June 2013.*

3.2 Forest Cover Change

As much as the Government of Malaysia pledged to ensure that at least 50% of its land remains permanently under forest cover[43], forest area of Malaysia had been in a state of flux: from 20.10 mil ha in 1988 to 20.46 mil ha in 2101, then fluctuated in hectarage between the years 1989 to 2011 as shown in Table 3 below.

In many developed countries, the area of forest is now increasing after long periods of decline. The change from shrinking to expanding forests has been termed as the forest transition (Grainger 1995)[44]. It is quite difficult to categorise Malaysia as having forest transition or otherwise due to its fluctuating forest areas as presented above. However, if one broadens the perspectives of forest transitions to include, among other *a change in emphasis from production to protection and conservation*, *a shift from unsustainable to sustainable forest management* and even *a societal transition or a cultural change for the better forest management, utilization and conservation,* then Malaysia can be considered as transiting towards a sustainable forest management.

[43] *Greening of the world to a better living-siri ucapan penting: Jabatan Perkhidmatan Penerangan Malaysia, Kementerian Penerangan Malaysia, May 1992, p.16*

[44] *Grainger, A. (1995). The forest transistion: an alternative approach. Area 27: 242-251.*

4 MAJOR FORCES TO DRIVE FOREST TRANSITION

4.1 Drivers to Deforestation and Forest Degradation

According to Abdul Rahim and Mohd Shahwahid (2009)[45], the forested land in Malaysia is slowly giving way to agriculture especially oil palm and other forms of land use to support the growth in its population, foreign exchange earnings and gross domestic product (GDP). This creates a conflict between agriculture production, forest management and the country's economic development. Hence, in the context of Malaysian deforestation, the implication is that agricultural expansion especially the oil palm, total GDP, population and also export of timber products could be the main factors that influence forest loss.

Table 3. Changes in forest area: Malaysia.

Year **Hectare** (%)**	**Year** **Hectare** (%)**
1988 ~ 20.10 mil ha (61%) 1989 ~ 19.47 mil ha (59%) 1992 ~ 19.15 mil ha (58%) 1994 ~ 19.00 mil ha (58%) 1996 ~ 18.87 mil ha (57%) *Approval and adoption of National Forestry Policy 1978 (Revised 1992).*	2003 ~ 19.54 mil ha (59%) 2005 ~ 18.31 mil ha (56%) 2007 ~ 18.23 mil ha (56%) 2010 ~ 20.46 mil ha (62%) 2011 ~ 18.48 mil ha (56%) *Enactment of National Forestry Act 1984 (Amended 1993)* ***(of total land area: about 33 mil ha)*

4.1.1 Commercial Logging

Commercial logging is one of the proximate causes of deforestation (Geist & Lambin, 2001)[46]. This process of creaming or removing selected trees amidst dense vegetation on rather delicate soil causes much more damage than actual number of trees or the volume of timber taken out would suggest. It was found that the logging operations in Indonesia destroyed about 40% of the trees left behind (Debjani 2012)[47]. In East Kalimantan, the seat of Indonesia's lucrative timber trade logging firms are required to leave behind 25 select crop trees per hectare. However, in practice there is no logger who would leave the required number of younger trees, and the notion that the woodland shall be ready for another valuable timber harvest in forty years appears to be the best wishful thinking (Debjani 2012)[48].

The above picture on commercial logging has failed to acknowledge that timber harvestings are being undertaken from two types of forest. The first are from natural forests, mainly located in the low areas whose land and soil are suitable for agricultural, settlement and urban lands. The second are from

[45] *Abdul Rahim A.S. and Mohd Shahwahid H.O. 2009. Determinants of Deforestation in Peninsular Malaysia: An Ardl Approach. The Malaysian Forester 72 (2): 19-28*

[46] *Geist, H.J. and Lambin, E.F. 2001. What Drives Tropical Deforestation? A Meta Analysis of Proximate and Underlying Causes of Deforestation Based on Subnational Case Study Evidence. Louvain-la-Neuve (Belgium): LUCC International Project Office, LUCC Report Series no. 4.*

[47] *Debjani B. 2012. What are the Major Causes of Deforestation? Preserve articles.com. Retrieved from www.preservearticles.com/2012021623379 [downloaded 7th June 2013]*

[48] *Ibid. Debjani. 2012.*

productive forest reserves where selective harvesting is employed. The large destructions reported in many studies refer to harvesting on forest intended for conversion to other land uses. It can be argued that conceptually selective harvesting of timber in productive forest reserves, in itself is not to be blamed. It is the implementation in various tropical regions that is in question. The practice of cutting down larger trees based on selected species and leaving behind younger ones which can grow into fresh stock to be harvested later may appear rational. In theory, such patch should become ready for harvest back within thirty to forty years. This has been the case in Peninsular Malaysian productive forest reserve, where previous cycles of harvesting have allowed subsequent cycles of harvesting (Wan Razali 1990)[49].

4.1.2 Land Use Change and Logging Prior to Agriculture Development

Kummer and Turner (1994)[50] focused on the deforestation in the Philippines which permits a quantitative assessment between human forces and land-use change. The authors postulated two most immediate (proximate) causes of deforestation, specifically logging and agricultural expansion. The Philippines has 73 provinces that range in size from 209 to 14,896 km^2; average size is approximately 4100 km^2. A panel analysis of province level data from 1970 and 1980 was used to explore the model. Panel analysis is similar to standard regression except observations are taken at relatively few points in time. The dependent variable was absolute amount of deforestation in each province from 1970 to 1980, and independent variables were the change in agricultural area, change in population, distance from Manila (a surrogate for the degree of control of logging activity by the national government), and amount of lumber (annual allowable cut) in cubic meters that the Bureau of Forestry determines (based on the area to be cut and stand density) is an appropriate, sustainable yield for each province. The result indicated that the rates of deforestation have been high in the Philippines.

A similar pattern for Indonesia was observed such as the expansion of large-scale commercial logging in the late 1960s (Daroesman 1979)[51] followed by subsistence and plantation agriculture (Collins et al. 1991)[52]. In Sarawak, logging has been identified as the primary agent of deforestation followed by shifting cultivation (Repetto 1988)[53]. However, the shifting agriculture was the primary agent which caused 50% of deforestation, with logging and small- holder cultivation playing lesser roles (Brookfield et al. 1990[54]; Collins et al. 1991[55];Repetto 1988[56]). Much of the deforestation in Peninsular Malaysia and Sarawak was deliberately planned to be followed by plantation agriculture. These studies indicated a broad recurrent pattern. Hence, it can be concluded that heavy logging can cause major forest disturbance. Much damage from logging results from the small clearings in the forest and others.

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[49] *Wan Razali Wan Mohd. 1990. Sustainable forest management in ASEAN with reference to sustainable timber production in Malaysia. International Development Research Center, Canada. Internship Report. FRIM / IDRC. 101pp.*

[50] *Ibid Kummer and Turner.1994.*

[51] *Daroesman, R. (1979). An economic survey of East Kalimantan. Bulletin of Indonesian Economic Studies 15(3): 43-82.*

[52] *Collins, M., J. Sayer, and T. Whitmore, eds. (1991). The Conservation Atlas of Tropical Forests: Asia and the Pacific. Simon & Schuster, New York*.

[53] *Repetto, R. (1988). The Forest for the Trees? Government Policies and the Misuse of Forest Resources. World Resources Institute, Washington, DC*

[54] *Brookfield, H., F. J. Lian, L. Kwai-Sim, and L. Potter. (1990). Borneo and the Malay Peninsular. Pages 496-512 in B. L. Turner II, W. C. Clark, R. W. Kates, J. T. Richards, J. T. Burgess, 1993. "Timber Production, Timber Trade, and Tropical Deforestation." Ambio 22(2–3):136–43*

[55] Ibid. *Collins, M., J. Sayer, and T. Whitmore, eds. (1991).*

[56] *Ibid. Repetto. (1988).*

4.1.3 Agricultural Expansion

In many developing countries rural poverty, skewed land ownership, and population growth were major influences of deforestation. Unlike the case of the Philippines, in both Indonesia and Malaysia forest-competing crops are cash crops directed mainly for the export market. Also, unlike Brazil and the Philippines, the timber extraction for foreign markets in combination with agricultural expansion has also played a significant role in deforestation. In Peninsular Malaysia, the development of export-oriented crops plantation such as rubber, that started early in the twentieth century, and latter oil palm were directly related to the reduction in forest cover. Sabah followed suit with the same pattern of agricultural expansion and deforestation in the latter part of the twentieth century. Logging was considered the main cause of deforestation in Sarawak.

It is anticipated that rapid and widespread agricultural expansion will cause a serious threat to natural ecosystems around the world (Tilman et al. 2001)[57]. Oil palm has become one of the most rapidly grown crops in the world. The global extent of oil palm cultivation increased from 3.6 mil ha in 1961 to 13.2 mil ha in 2006 (FAO 2007)[58]. In 2007, oil palm was grown in 43 countries with a total cultivated area accounting for almost one-tenth of the world's permanent croplands (FAO 2007)[59]. The two largest oil palm producing countries, Indonesia (4.1 mil ha) and Malaysia (3.6 mil ha), are located in Southeast Asia, together contributing 58.3% of global cultivated areas. Coincidentally, this region also consists 11% of the world's remaining tropical forests (Iremonger et al. 1997)[60], and harbours numerous endemic or rare species, many of which are restricted to forest habitats (Sodhi et al. 2004[61]; Koh and Wilcove 2007[62]). Therefore, the potential impacts of further oil palm expansion on tropical forests and biodiversity in the region are a major conservation concern (Koh & Wilcove 2007 [63]).

Using national land-use data compiled by the Food and Agriculture Organization of the United Nations (FAO), Koh & Wilcove (2008)[64] analysed data relationships to determine the types of land that have been converted to oil palm lands in Malaysia and Indonesia. They have presented a framework for assessing the impact of oil palm agriculture on biodiversity by determining the relative impacts to biodiversity of converting different land uses to oil palm. Although, it has generally been acknowledged that oil palm plantations in Malaysia and Indonesia have been created from existing agricultural lands (example, rubber) and forests, the relative contributions of these two land uses to oil palm expansion have to be investigated.

As seen from the above citations, it was perceived by many writers that governments in Malaysia and Indonesia were reactive rather than pre-emptive. It was as though, that these governments have often regarded logged forest as degraded habitats and subsequently, they were allowed to be cleared for agriculture. This has presumably encouraged the conversion of secondary (logged) forests to oil palm

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[57] *Tilman, D., Fargione J. and Wolff B. 2001. Forecasting agriculturally driven global environmental change. Science 292, 281–284.*

[58] *FAO (2007) FAOSTAT Online Statistical Service. Available from: http://faostat.fao.org (accessed June 2013).United Nations Food and Agriculture Organization (FAO), Rome.*

[59] *Ibid. (FAO 2007)*

[60] *Iremonger, S., Ravilious C., Quiton T. (1997) A global overview of forest conservation CD-ROM. Center for International Forestry Research and World Conservation Monitoring Centre (CIFOR-WCMC),Cambridge*

[61] *Sodhi, N.S., Koh L.P., Brook B.W., Ng P.K.L. (2004) Southeast Asian biodiversity: an impending disaster. Trends Ecol Evol 19, 654–660.*

[62] *Koh, L.P. and Wilcove D.S. (2007) Cashing in palm oil for conservation. Nature 448, 993–994.*

[63] *Ibid. Koh & Wilcove .(2007).*

[64] *Koh, L.P., Wilcove, D. S. (2008). Is oil palm agriculture really destroying tropical biodiversity? Conservation Letters 1(2) March 5:60-64.*

plantations in Malaysia and Indonesia (McMorrow & Talip 2001[65]). Many of these writers were not aware that these governments have formulated national land use plans that have earmarked forests with certain characteristics suitable for agriculture to be converted into plantation agriculture for the benefit of the economy. At the same time, other forest lands have remained as forest reserves, for both productive and protective purposes. For instance, Malaysia has its Land Capability Classification (LCC) as far back as in 1970 and followed by it National Forest Policy (NFP) in 1978. The earlier are land use plans to convert lowland forests to development, including agriculture. The latter, was further classification of mainly hill forests into permanent forest reserves, either for protection and production. The production forest reserves permit selective harvesting of trees under the selective management system. The rests of forest areas are left as stateland forests earmarked for conversion into development purposes.

There is no denying for every natural forest converted, there will be a degradation of biodiversity but a balance has to be striken between protective and productive forests with development of the nation. Therefore, from both the policy and scientific perspectives, the relative biodiversity values of primary forests, secondary forests, existing cropland, and oil palm plantations must be evaluated to access the impact of changes in land use. Further, independent remote sensing survey have to be carried out regularly to validate data whether a country is under-reporting forest losses to the FAO which then would tend to underestimate the extent to which forests are being cleared to grow oil palm. A recent study has shown that FAO statistics for Malaysia and Indonesia correspond well to the estimates of cropland and forest areas generated from a remote-sensing analysis using the Landsat TM satellite imagery (Stibig et al. 2007)[66]

Over the period of 1990 to 2005, the Malaysian oil palm grew by a total of 1 874 000 ha (FAO 2007)[67]. In order to estimate the minimum and maximum areas of pre-existing agricultural land and forests that were converted to oil palm plantations, two scenarios were considered. In the first scenario, the aggregate reduction in the areas of all commercial crops that declined in cultivated areas between 1990 and 2005 was taken to be the maximum cropland area converted to oil palm plantations (834000 ha; FAO 2007)[68]; this accounted for only 45% of oil palm expansion during this period. However, the remaining unaccounted increase in oil palm-cultivated area (1 040 000 ha; 55%) was taken to be the minimum forest area converted to oil palm plantations.

In the second scenario, the total decline in forest areas (including primary, secondary, and plantation forests; but excluding rubber plantations) in Malaysia during the period 1990–2005 was taken to be the maximum forest area converted to oil palm plantations (1 109 000 ha; FAO 2006)[69], which accounted for 59% of oil palm expansion. The remaining unaccounted increase in oil palm-cultivated areas (765 000 ha; 41%) is taken to be the minimum cropland area converted to oil palm agriculture.

As such, the analysis by Koh & Wilcove (2008)[70] shows that during the period of 1990–2005, between 55% and 59% of oil palm expansion in Malaysia was due to forest conversion, and between 41% and 45% of oil palm expansion was likely due to the conversion from pre-existing agricultural lands (including rubber plantations). Although Malaysia reported no loss of primary forests during that period (FAO 2006)[71], a large area of secondary or plantation forests were likely to have been converted to oil

[65] *McMorrow, J., Talip M.A. (2001) Decline of forest area in Sabah, Malaysia: relationship to state policies, land code and land capability. Global Environ Chang 11, 217–230.*

[66] *Stibig, H. J., Belward A.S., Roy P.S. et al. (2007) A land-cover map for South and Southeast Asia derived from SPOT-VEGETATION data. J Biogeogr 34, 625–637.*

[67] *Ibid. FAO (2007).*

[68] *Ibid. FAO (2007).*

[69] *FAO (2006) Global forest resources assessment 2005: progress towards sustainable forest management. Forestry Paper 147. Available from: http://www.fao.org (accessed June 2013).United Nations Food and Agriculture Organization (FAO), Rome.*

[70] *Ibid. Koh & Wilcove. (2008).*

[71] *Ibid. FAO. (2006).*

palm plantations.

This finding has strongly proven that oil palm plantation establishments have led to the conversion of either the primary forests or secondary forests. The above estimates of forest areas converted to agriculture are influenced by many factors including structural and government policy. Land expansion occurring in tropical regions shows its relation to the structural features of the agricultural sectors of developing economies, such as low agricultural productivity and input use (Barbier 2004)[72]. Poor agricultural intensification and development in turn exert more pressure to convert forests and other marginal lands to crop production. Various other studies suggest that the above structural conditions are influenced, both directly and indirectly, by economic policies (Barbier & Burgess 2001[73]). Although improvements in cropping intensity and yields are expected to reduce the developing world's dependency on agricultural land expansion over the period of 1990-2010, about 19% of the contributions to total crop production increase in poorer economies were likely to be still derived from the expansion of cultivated land (FAO 1995)[74]. Throughout the developing world, the cultivated land area is expected to increase over 47% by 2050, with about 66% of the new land coming from deforestation and wetland conversion (Fischer & Heilig 1997)[75].

4.1.4 Growth in Gross Domestic Product (GDP)

Deforestation is also linked to economy-wide factors, especially on trade openness and economic growth. Of significance are access to roads and other infrastructure that encouraged the opening up of forest land for eradication of poverty, agricultural expansion and trade. Growth in GDP per capita affects forest cover in two ways. Road access and crop expansion have negative effects on forests while poverty-reducing programmes have positive impacts on forest. In four tropical countries namely Brazil, Indonesia, Malaysia and Philippines, the negative effects dominate, and thus economic growth causes a reduction on the forest area, with an elasticity of -0.76 in the Asian countries and -0.06 in Brazil (Lopez & Galinato 2004)[76].

4.1.5 Deforestation and Export of Timber Products

There is a positive relationship between the export of forest products and forest area in the countries of Asia, South America and North and Central America which have more forest areas exporting resources or forest products in large quantities. Most of the developing countries like Malaysia are relatively dependent on forests directly or indirectly, in terms of timber and other forest products. Earning foreign exchange by way of exporting forest products (natural resources) is the easier way for these countries to reduce debts (Hyde & Seve 1993[77]). Hence, the implication is that deforestation is related to the export of forest product for developing countries as compared to developed countries.

Evidence of the relationships of export of forest products with deforestation in developing countries could be seen also in the case of Ghana. Yiridoe and Nanang (2001)[78] use the econometric analysis

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[72] *Barbier, E.B. 2004. Panel Data Evidence on Economic Development and the Environment in Developing Countries. American Agricultural Economics Association annual meeting . Washington D.C.*

[73] *Barbier, E.B. and J.C. Burgess. 2001. The economics of tropical deforestation. Journal of Economic Survey 15 (3), 413-433.*

[74] *FAO.(1995). Forest Resources Assessment 1990. Global Synthesis. FAO Forestry Paper No. 124, FAO, Rome, Italy.*

[75] *Fischer, G. and G.K. Heilig. 1997. Population Momentum and the Demand on Land and Water Resources. Philosophical Transactions of the Royal Society Series B 352: 869-889.*

[76] *Lopez, G. and Galinato, G.I. (2004). Trade Policies, Economic Growth and the Direct Causes of Deforestation*.

[77] *Hyde,W., and J.Seve 1993. "The economic role of wood products in tropical deforestation : the severe experience of Malawi." Forest Ecology and Management 57(2):283-300.*

[78] *Yirodoe,E.K & Nanang, D.M. (2001). An Econometric Analysis of the Causes of Tropical Deforestation:Ghana. American Agricultural Economic Association Conference, (pp. 1-27). Chicago*

to examine the causes of deforestation in Ghana, and in their study deforestation is modeled in order to analyse key sectors such as forest product exports, fuelwood energy consumption, cocoa production and food crop production which compete for forest land use or forest products in the Ghanaian Economy. According to their investigation, the export of forest products is the third leading source of foreign exchange in Ghana and it plays an important role in deforestation. Although the volume of the traditional forest products exported had dropped ever since the 1960s, the actual value of products from forests has been increasing largely due to to the value added activities from non-traditonal timber and non-timber forest product export. Although commercial timber harvesting by itsely may not necessarily cause deforestation, however by opening up forest, farmers and other encroaching individuals find it easy to further exploit forest resources. Thus, the volume of forest products export is hypothesized to be the first level of factor that aggravates deforestation. Although forest product export is a causal factor but its elasticity of deforestation with respect to forest products export is estimated only as 0.059 implying that a 1% increase in forest export products will lead to only 0.059% increase in deforestation (Yiridoe & Nanang 2001)[79]. This phenomenon could be explained by economic theory that suggests there is a positive correlation between forest export products and export price of wood products received by exporters.

4.1.6 Deforestation and Population Growth

Population dynamics have been widely considered as elements in land cover change dynamics. Many studies have singled out population growth as one of the most important causes of deforestation (Vanclay 1993[80]; World Bank 1992[81]; and Zhao *et al*. 2006[82]). In fact some studies have argued that population growth explains more than half of the loss in forest area worldwide (Mather & Needle 1998[83]; Myers 1991[84]). Hence, the role of population growth in contributing to deforestation in Malaysia would have to be verified in our case study investigation.

4.2 Key Points Leading to Afforestation and Forest Rehabilitation - Legal and Policy Milestones

4.2.1 Afforestation/ Reforestation

Deforestation and forest degradation. Apart from its monetary value, forest also play important role in maintaining environmental stability, in minimizing damage to riverine ecosystem by erosion and agricultural lands by floods, in storing the germplasm of wood and non-woody resources (rattan, bamboo, etc.) and plant species of potential pharmaceutical significance, and lastly, in providing important sources of food, fuel, and other materials to satisfy the basic need of rural population. Therefore, Malaysian forests have always been regarded as great importance to the nation and prudent measures have been instituted to ensure their conservation and effective management and viability as a renewable and sustainable resource.

According to FAO (2010a)[85], Malaysia's total forest area decreased by 434 000 ha between 2005 and 2010 (an annual decline of 0.42%) and by 1.92 mil ha between 1990 and 2010. The Malaysian

[79] *Ibid.Yirodoe,E.K & Nanang, D.M. (2001).*

[80] *Vanclay, J. (1993). Saving the tropical forest: Needs and Prognosis. Ambio, 22(4), 225-231.*

[81] *World Rainforest Movement. 1992. Rainforest Destruction: Causes, Effects and False Solutions, World Rainforest Movement, Penang.*

[82] *Zhao, S., Peng, C., Jiang, D.T., Lei, X., & Zhou, X. (2006). Land use change in Asia and ecological consequences. Eco Res, doi:10.1007/s11284-006-0048-2, http://dx.doi.org/10.1007/s11284-006-0048-2*

[83] *Mather AS, and Needle CL 1998. The human drivers of global land cover change: the case of forests. Hydrological Processes. 12(13–14):1983–1994*

[84] *Myers N. Tropical forests: Present status and future outlook. Climatic Change. 1991;19(1–2): 3–32.*

[85] *FAO. 2010a. Global forest resources assessment 2010 country report: Malaysia (available at http://www.fao.org/forestry/ fra/67090/en/).*

government reported that a total of 12,359 ha of forest were formally converted to agriculture in the period 2004–07 (all in Peninsular Malaysia because data were unavailable for Sabah and Sarawak), while just over 53,000 ha were formally added to the forest estate in the same period. An estimated 20,000 ha were converted illegally in Sabah FAO (2010b)[86]. Human-induced forest fire was reported to be negligible, as was illegal harvesting. FAO (2011)[87] estimated a total area of primary forest of 3.82 mil ha and Peninsular Malaysia reported 191,000 ha of degraded primary forest in the PFE (Table 4). There were an estimated 2.70 mil ha of secondary forest in Sabah's PFE, the only region for which data on that parameter were available.

Countries can be categorised regarding their forest cover (>50% = high forest cover) and deforestation rate (>22% p.a. = high deforestation)[88]. Malaysia is categorised as a HFLD (high forest cover with low rates of deforestation) country.[89] Malaysia has a negative but decreasing annual change rate of the total forest area of -0.42% from 2005 to 2010 (in comparison to -0.66% in 2000 to 2005). The area of planted forest was 1.81 mil ha and increased with an annual growth rate of 2.81% from 2005 to 2010[90].

Rehabilitating Logged-over Forests – A Much Needed Commitment. The period of 1970s coincided with the rapid increase of the world's demand for tropical hardwoods, which further stimulated logging activities in Malaysia (Wan Razali[91] - see Table 4.4). Silvicultural treatments failed to keep pace, thereby leading to the accumulation of large areas of untreated forests. At the end of 1988, there were

Table 4. Forest area and area change in some forested countries in ASEAN.

Country / area	**Extent of forest 2010**			**Annual change rate**			
	Forest area	**% of land area**	**Area per 1 000 people**	**1990–2000**		**2000–2010**	
	(1 000 ha)	**(%)**	**(ha)**	**(1 000 ha)**	**(%)**	**1 000 ha**	**(%)**
Brunei Darussalam	380	72	969	-2	-0.4	-2	-0.4
Cambodia	10 094	57	693	-140	-1.1	-145	-1.3
Indonesia	94 432	52	415	-1 914	-1.7	-498	-0.5
Lao People's Democratic Republic	15 751	68	2 538	-78	-0.5	-78	-0.5
Malaysia	**20 456**	**62**	**757**	**-79**	**-0.4**	**-114**	**-0.5**
Myanmar	31 773	48	641	-435	-1.2	-310	-0.9
Philippines	7 665	26	85	55	0.8	55	0.7
Thailand	18 972	37	282	-55	-0.3	-3	0

(Source: FAO 2011. State of the world's forests 2011. Food and Agriculture Organization of the United Nations Rome, 2011)

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[86] *FAO. 2010b. Forests and Climate Change in the Asia-Pacific Region. Forests and Climate Change Working Paper 7. FAO, Rome, Italy.*

[87] *Ibid. FAO. 2011.*

[88] *GCP, 2008, The little REDD Book*

[89] *Meridian Institute (2009), Reducing Emissions from Deforestation and Forest Degradation (REDD): An Options Assessment*

[90] *UN Global Forest Resources Assessment 2010 available online: http://www.fao.org/forestry/fra/fra2010/en/, accessed November 2012.*

[91] *Ibid. Wan Razali Wan Mohd . 1990.*

approximately 2.29 mil ha of logged-over forests in Peninsular Malaysia, 1.92 mil ha in Sarawak, and about 2.25 mil ha in Sabah (Wan Razali[92] - see Table 4.4). These logged-over forests are within the permanent forest estates which form part of forest area for sustained yield.

Where needed, appropriate and timely silvicultural treatments, such as climber cutting and poison-girdling of bad form trees, have been carried out - and will have to continue – in order to improve logged-over forests and to enhance their future yield, consistent with the concept of sustained yield. At the end of 1988, about 0.99 mil ha of the logged-over forests in Peninsular Malaysia have been silviculturally treated. Sabah and Sarawak silviculturally treated about 0.40 mil ha and 0.26 mil ha respectively. Therefore, while much efforts have been directed to developing silvicultural and management systems, larger areas of logged-over forests are awaiting to be silviculturally treated, which constitute an enormous effort and commitment needed by the Government in order to ensure that these forests are to remain productive in perpetuity.

4.2.2 Wood based industries

Timber production and trade. Forests have contributed significantly toward the socio-economic development of Malaysia. For example, in 1988 alone, the total export of timber and timber products amounted to RM$7.12 billion (US$2.64 billion) or about 13% of the total gross export earnings of the country. At the same time, it provided direct employment to 146,000 people. Similarly in 1989 and 1990, the total export of timber and timber products increased to about M$8.98 billion (US$3.33 billion) and RM$8.94 billion (US$3.31 billion) respectively; contributed about 13.2% for 1989 and 11.2% for 1990 of the country's total export earnings, and provided direct employment to 176,666 people in 1989 and 177,317 people in 1990. In 2009, total Malaysian industrial log production was 18.0 mil cu m (mostly from natural forests), down from 24.7 mil cu m in 2004 (ITTO 2011)[93]; in 1990 the estimated total industrial log production was 39.1 mil cu m (FAO 2011)[94]. The main wood-based industries are sawmilling, wood-based panel products, wood moulding and furniture manufacture. The contribution of wood-based products to export earnings is significant: in 2008, for example, the export of wooden furniture from Malaysia was valued at more than US$2 billion and the value of plywood exports was nearly US$1.9 billion. The total value of all wood-based product exports in 2008 was US$6.6 billion (FAO 2011)[95].

4.2.3 Forest Certification

Forest certification is a method for addressing concerns related to deforestation and degradation of forests, and for promoting the development and maintenance of biological diversity. Certification programs are basically processes that attempt (1) to identify and promote forest land that is well-managed, and (2) to recognize the products that are produced from these forests as having been sustainably managed. Certification also is a method for verifying a landowner's commitment to sustainable forestry objectives, and has been used as a method for obtaining publicity for voluntary conservation efforts. The underlying idea of forest certification is that consumers of wood products will choose to purchase products derived from sustainably managed forests, and pay more for these products (offer a price premium) than for products derived from poorly managed forests. Forest certification is aimed at improving the quality of forest management, as well as providing better market access for its wood products. The concept was originally designed for improving tropical forest management, where most forest losses currently take place. Forest products originating from sustainably managed forests can be certified by reliable, independent, third-party auditors. Certified products can then be labeled so that consumers can clearly recognize them and make informed choices at the time of purchase (Bettinger *et al*. 2008)[96]

[92] *Ibid. Wan Razali Wan Mohd (1990).*

[93] *ITTO (2011), Annual Review statistics database (available at http://www.itto.int/annual review output /?mode = searchdata). Accessed March 2013).*

[94] *Ibid. FAO (2011).*

[95] *Ibid. FAO (2011).*

[96] *Bettinger, P., Boston, K., Siry, J. & Grebner D.L. (2008). Forest Management and Planning. Amsterdam: Academic Press*

Many non-governmental organizations (NGOs) and governmental organizations participating in the Earth Summit (1992) strongly supported binding international agreements and legislation to address deforestation and degradation throughout the world. Despite their efforts, no legally binding commitments were developed, and as a result many NGOs considered the Summit a failure. In an attempt to better protect global forests, NGOs since have devised several forest certification processes that use market-based approaches to address international wood products trade. Today two types of certificates are awarded: (1) Forest Management Certification (FMC): certificates that verify forests are sustainably managed, and (2) Chain-of-Custody Certification (CoC): certificates that verify forest products were made with wood harvested from sustainably managed forests. As a result, forest certification is a market and consumer-oriented approach that has developed a high level of acceptance among many private and public forest managers.

In Malaysia, FMC and CoC are administrated via the Malaysian Timber Certification Scheme (MTCS) operated by Malaysian Timber Certification Council (MTCC). The MTCS was endorsed and recognized in May 2009 by the Programme for the Endorsement of Forest Certification scheme (PEFC), which is presently the largest forest certification organization in the world. Timber certification in Malaysia was implemented based on the following rationale (MTCC 2013).[97]

(1) Market-driven: Timber industry is export-oriented and is important source of foreign exchange;
(2) Concern in key timber markets whether timber products from Malaysia are manufactured from materials sourced from sustainably managed forests;
(3) Procurement policies in key importing countries – public and private;
(4) Green building schemes in key importing countries and Green Building Index in Malaysia under its sustainable timber criteria;
(5) Increasing demand for certified timber products; and
(6) Demand in domestic market is increasing with higher income levels and greater awareness of environmental issues.

Figure 7 shows to date the MTCS-PEFC certified Forest Management Units (FMUs) in Malaysia (MTCC 2013)[98]. Currently also, 169 timber companies in Malaysia have been issued with PEFC - CoC certificates covering the various timber products as shown in Figure 8 (MTCC 2013)[99].

4.3 Reforestation Programmes Since 1980s

4.3.1 Compensatory Forest Plantation Programme (CFPP)

The CFPP envisaged to establish about 188,000 ha of forest plantations in Peninsular Malaysia within 15 years starting from 1981 to 1995 (Johari 1988)[100]. The CFPP was expected to cost about USD207 million. The Asian Development Bank (ADB) has financed US24.5million (to finance 50% of the cost) to establish about 40,000 ha of forest plantations in Peninsular Malaysia for the period from 1985 to 1989 (Phase I). By the end of 1989, only 35 152 ha had been planted (JPSM 1992).[101] Similarly, the World Bank had financed the establishment of about 150 000 ha of forest plantations in Sabah by the year 2000 and by the end of 1988 about 40 000 were planted.

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[97] *MTCC. (2013) Certification workshop 2013 – Responsible Procurement & Purchasing in Asia: Implementation of MTCS by Malaysian Timber Certification Council (MTCC), 25 Jan 2013, Kuala Lumpur.*

[98] *Ibid. MTCC (2013).*

[99] *Ibid. MTCC (2013).*

[100] *Johari Baharudin. (1988). An appraisal of the compensatory plantation programme in Peninsular Malaysia. Pp. 117-133 in Tang, H.T., Pinso, C. & Marsh, C. (eds)Future Role of Forest Plantations in the National Economy and Incentives Required to Encourage Investments into Forest Plantation Development. Proceedings of a seminar, Kota Kinabalu, Sabah. 30 Nov. – 4 Dec. 1987.*

[101] *JPSM. (1992). Project Ladang Hutan Fasa II: Kertas 3: Status Kajian Reput Teras.*

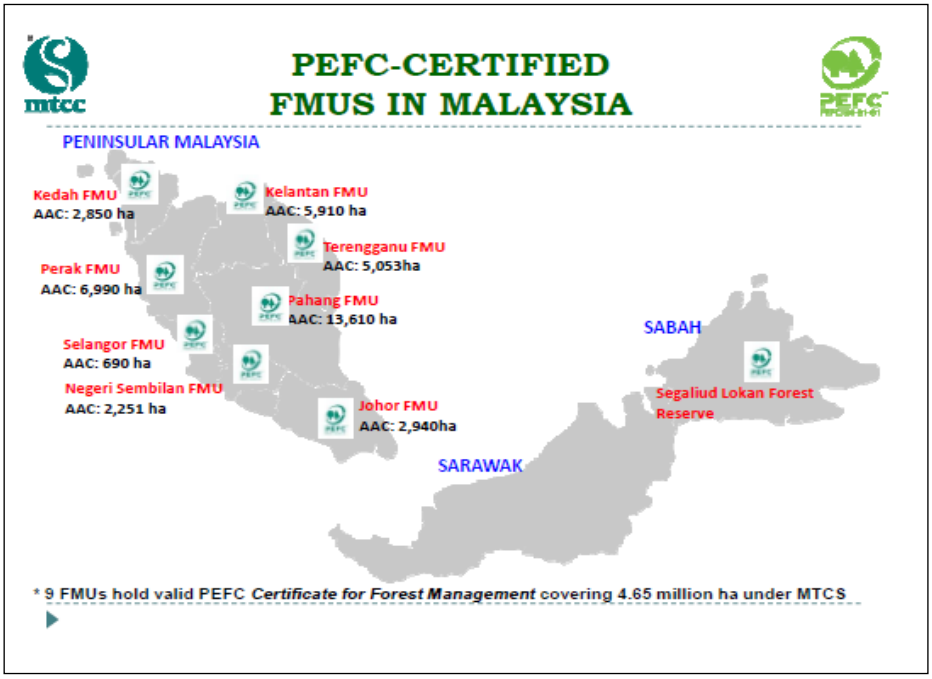


Figure 7. MTCS-PEFC Certified Forest Management Units (FMUs) in Malaysia.

The main species planted under the ADB project was *Acacia mangium,* as much as*Gmelina arborea* and *Paraserianthes falcataria* were also recommended. During Phase II (1989–1993) of the program, another 42 000 ha were planned to be planted with *Acacia mangium* at an estimated cost of USD69 million and the Federal Government financed USD39.5 million and the remaining USD29.5 million came from ADB loan.

The FMC and CoC in Malaysia are carried out by independent third party auditors using the various standards or guidelines developed by MTCS-PEFC as shown in Figures 9 and 10 (MTCC 2013).[102]

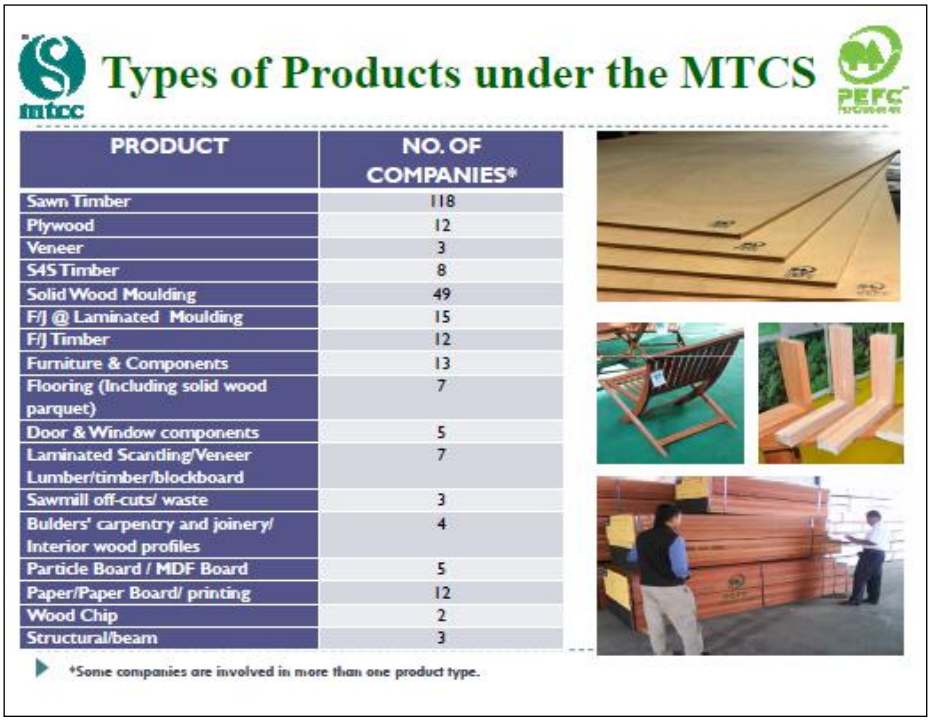


Figure 8. Types of timber products certified under MTCS-PEFC in Malaysia.

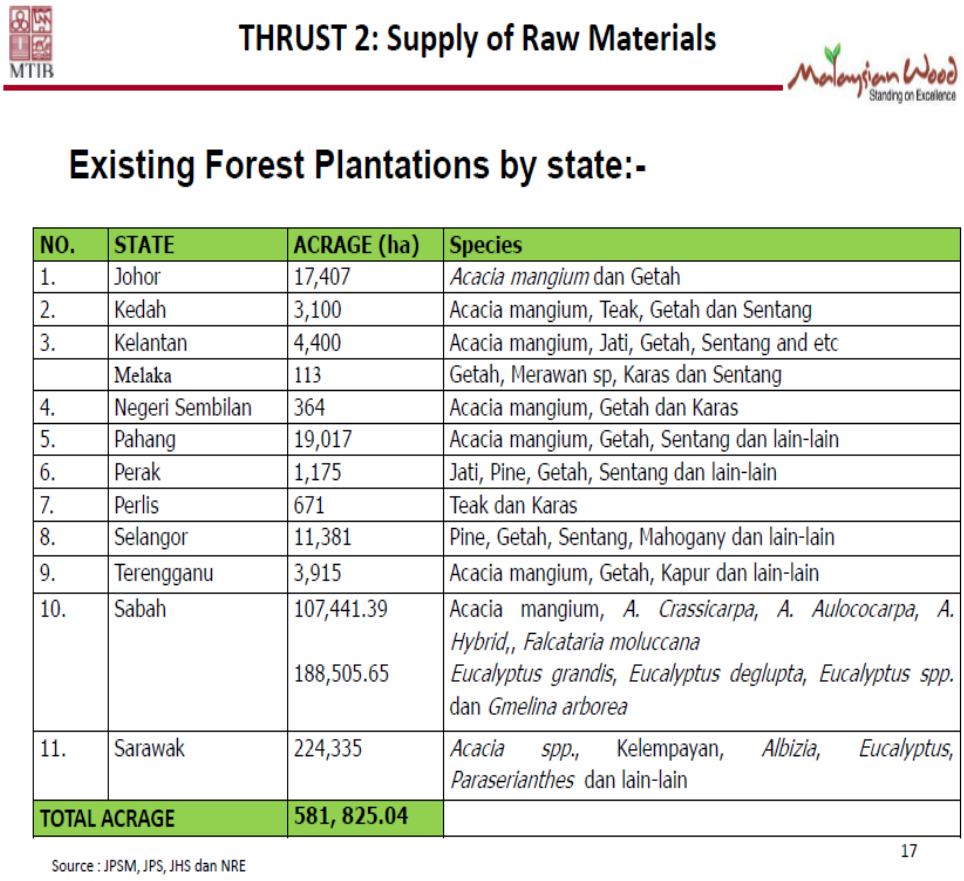
[102] *Ibid. MTCC (2013).*

Figure 9. Standards used in FMC of natural forests and forest plantations in Malaysia.

Figure 10. Standard used in CoC in Malaysia.

However, the shift to plantation forestry in Peninsular Malaysia was rather quick and many fundamental forest management issues were not given serious attention right from the beginning. The CFPP came to a complete moratorium in February 1992 due to heart rot problem in *Acacia mangium* already planted. By then about 47,066 ha had been established with a cost of about USD29.15million (JPSM 1992)[103]. Subsequently, the Government decided that the forest plantation program would continue but more species are to be allowed, including the indigenous forest species. Up to date, the following forest plantations had been established, including those established under the MTIB's Special Purpose Vehicle (SPV) – see below (Existing forest plantations by state):

[103] *Ibid. JPSM (1992).*



NO.	STATE	ACRAGE (ha)	Species
1.	Johor	17,407	*Acacia mangium* dan Getah
2.	Kedah	3,100	Acacia mangium, Teak, Getah dan Sentang
3.	Kelantan	4,400	Acacia mangium, Jati, Getah, Sentang and etc
	Melaka	113	Getah, Merawan sp, Karas dan Sentang
4.	Negeri Sembilan	364	Acacia mangium, Getah dan Karas
5.	Pahang	19,017	Acacia mangium, Getah, Sentang dan lain-lain
6.	Perak	1,175	Jati, Pine, Getah, Sentang dan lain-lain
7.	Perlis	671	Teak dan Karas
8.	Selangor	11,381	Pine, Getah, Sentang, Mahogany dan lain-lain
9.	Terengganu	3,915	Acacia mangium, Getah, Kapur dan lain-lain
10.	Sabah	107,441.39 188,505.65	Acacia mangium, *A. Crassicarpa, A. Aulococarpa, A. Hybrid,, Falcataria moluccana* *Eucalyptus grandis, Eucalyptus deglupta, Eucalyptus spp.* dan *Gmelina arborea*
11.	Sarawak	224,335	*Acacia spp.*, Kelempayan, *Albizia, Eucalyptus, Paraserianthes* dan lain-lain
TOTAL ACRAGE		**581, 825.04**	

4.3.2 Special Purpose Vehicle (SPV) in Reforestation

In March 2005, the Government pursued an aggressive programme to develop forest plantations in Malaysia. Under this National Timber Industry Policy – NATIP, the Government planned to develop 375,000 ha of forest plantation at an annual planting rate of 25 000 ha per year for the next 15 years. Once successfully implemented, every 25 000 ha of land planted is expected to produce 5 mil cu m of timber every year based on the wood production of 200 cu m per hectare per year[104]. A *Special Purpose Vehicle* (SPV) was established to manage the disbursement of *soft loans* (total RM1.045 billion), to carry out auditing process of the plantation as well as to provide technical support and training for the programme. To attract and encourage the private sector (local and foreign companies) to participate in the forest plantation programme, the Government is providing them with *fiscal incentives* such as an investment tax allowance. Besides of tax exemptions the Government extends also soft loans to eligible companies[105]. At the same time various states in Peninsular Malaysia, Sabah and Sarawak offer additional incentives. Eight species are given preference in this program, namely: *Hevea brasiliences, Acacia hybrid, Khaya ivorensis/ senegalensis, Tectona grandis, Azadirachta excelas, Noelamarckia cadamba, Paraserianthes falcataria,* and *Octomeles sumatrana.* Some features of this SPV are as follows[106]:

- The SPV is not revolving and as the purpose of the setting up of Forest Plantation Development Sdn Bhd (FPDSB) was to promote the establishment of forest plantations for the future timber supply through the soft loan it manages, it can be said that FPDSB will continue to play its role for as long as the forest plantation program exist or is in operation;

[104] *Ministry of Plantation Industries and Commodities, (2005), Conference of Forestry and Forest Products Research (CFFPR)*

[105] *MTIB.(2012., Official Portal, http://www.mtib.gov.my/, Accessed 16th November 2012.*

[106] *Personal communication with MTIB in March 2013*

- The first borrower will only start to pay in the year 2022 i.e. the 16th year of his loan period from 2007. Therefore, there is no record of no payment loan (NPL) yet. In the case of NPL, the FPDSB has the right terminate the agreement and exercise such rights as provided under the Agreement such as the right to enter and take possession of the plantable area or any part or parts thereof for the purpose of enforcing the cutting rights as mentioned in the Agreement;

- The loan is only eligible for a Malaysian Company, Cooperative or Association registered under the Companies Act 1965, Cooperative Act 2007 or Association Act 1966;

- The loan amount will depend on the size or scale of the forest plantation. The scheme provides for three categories of loan i.e. large scale forest plantation more than 2500 ha, medium scale from 41–2499 ha and small scale from 4–40 ha. The loan amount for planting Rubber trees is RM10 000/ha for Peninsular Malaysia and RM13 000/ha for Sabah and Sarawak. For the other seven forest species, the loan amount is RM8000/hectare for all the three regions;

- The critical and important loan terms is that the timber produced must be used for local processing and FPDSB must be given the first right of refusal. The borrower must provide security document to FPDSB which include; 1) Charge on the land title or Deed of Assignment, Power of Attorney and Directors personal guarantee;

- The first instalment of payment will start in the 16th year of the loan period of 20 years. The interest rate of 3% per annum on the loan facility shall be chargeable from the date of disbursement of the loan facility. However, the payment of interest shall only become due by the borrower to the lender immediately upon the expiry of the grace period (15 years), upon which the interest chargeable during the grace period shall be capitalised/compounded and added for all purposes to the principal sum then owing and shall thenceforth continue to bear interest at the interest rate; and

- To date, a total of 62,000 ha of plantation forest has been established out of the 101 000 ha approved.

4.4 Drivers to Reforestation and Forest Rehabilitation

4.4.1 Plantation of Acacia mangium/ Latex Timber Clones

A major driver of reforestation and forest rehabilitation in Peninsular Malaysia is the establishment of forest plantation. There was a decline in domestic log production in Peninsular Malaysia owing to the reduction of agro-conversion forest opening and a rationalization of the annual coupe from the production permanent reserve forest. There was an inability to meet domestic processing capacities.The Forestry Department launched the "Compensatory Plantation Programme (CFP)" in Peninsular Malaysia. A major motive for CFP was linked to previous excessive forest openings for harvesting that require correction. Nevertheless, there was a moratorium on further plantings of Acacia Mangium in 1990s owing to issues pertaining to heart rot disease in Peninsular Malaysia (see section 4.3.1 for details).

An unexpected new, "artificial" source of timber has been rubberwood, which emerged as an important furniture wood in the 1980s. Its levels of production remained small compared to production from the natural forest even in the early 1990s. Rubber log supplies come from the felling of old rubber stand that was due for replanting. But during the 2000s rubber tree stands have declined owing to reduced replantings in favor of oil palm planting and conversions to other land uses.

In general, forest plantations did not grow as rapidly as anticipated. Private sector investment

in forest plantation was hampered by the long gestation period, the high initial cost of production, high accumulated interest charges and scarcity of large contiguous land for forest plantation. The Malaysian Government intervened in the interest of the wood-based industry through establishing a special purpose vehicle (SPV) company to provide financial loans to interested private forest plantation venture named Forest Plantation Development Sdn Bhd. A Forest Plantation Development Program was established to plant the following tree species *Hevea brasiliensis* (Rubber), *Acacia mangium / Acacia* hybrid, *Khaya ivorensis* (African Mahogany), *Tectona grandis* (Teak), *Azadirachta excelsa* (Sentang), *Neolarmarckia cadamba* (Kelempayan / Laran), *Falcataria mollucana* (Batai) and *Octomeles sumatrana* (Binuang). In Peninsular Malaysia, these lands must be on state lands or alienated lands and not on Permanent Reserved Forests (PRFs). In Sarawak, eligibility is only on areas with License for Planted Forest (LPF) while in Sabah, only areas approved as zone for Industrial Tree Plantation (ITP) under the Sustainable Forest Management License Agreement (SFMLA) is eligible.

As of January 2011, applications for the establishments of 76,000ha involving RM300 million loans have been approved of which 45% have started to embark on planting. Rubber was popular species in Peninsular Malaysia and Sabah while a mix of other 7 species were popular in Sarawak (*see also section 4.3.2 for other details on SPV).*

5 FORESTS AND FOREST TRANSITION IN THE FUTURE

5.1 Is There a Forest Transition in Malaysia?

In many developed countries, the area of forest is now increasing after long periods of decline. The change from shrinking to expanding forests has been termed as the forest transition (Grainger 1995)[107]. Similarly, China, India and Vietnam have recently experienced forest transitions from net deforestation to net reforestation. It is quite difficult to categorize Malaysia as having forest transition or otherwise due to its fluctuating forest areas as presented above (Table 3). The main question will be whether a transition from production forestry to forest conservation and protection can be efficiently managed by Malaysia, with or without international support, more so if the planned REDD+ implementation comes as early as 2015.

A case study on deforestation in Peninsular Malaysia from 1960 - 2010 found that the GDP, area of oil palm planted, export of timber products and population have significant influences on the rate of deforestations in Peninsular Malaysia. With the exception of population, the changes in the other three variables were related to rising deforestations. Instead, rising population in Peninsular Malaysia did not seem to increase deforestation.

A theoretical exploration of the Environmental Kuznets Curve (EKC) for deforestation is provided by Lopez and Galinato (2004)[108]. The implication of the model is that if the stock effects of forest resource (biomass) on agricultural production are internalised, then economic growth, in a typical developing country, would result in less deforestation (i.e. following an inverted U-shaped EKC path). If this is the case, the internalisation would be induced by government policy, contractual arrangements among producers, or by the institutions of individual private property ownership. The implication of this inverted U-shaped EKC is that, at an initial stage, an increase in income will accelerate the rate of deforestation, but that an income beyond a certain level (i.e. the turning point) will reduce the rate of deforestation. An investigation on the possible presence of the EKC in Peninsular Malaysian deforestation rates did not materialise. The EKC function was estimated by running the change in forest cover as the dependent variable with per capita gross domestic product (PCGDP) and $PCGDP^2$ as the independent variables. The result does not support the long-run inverted-U relationship between economic growth and deforestation rate in Peninsular Malaysia as shown in Figure 11 below (Mohd Shahwahid & Wan Razali)[109]. This implies that the despite a run of economic growths attained in the peninsula, deforestation did not seemed to lessen. There are still remnant stateland forests being converted to agricultural development. The empirical estimation of the above exercise is provided in the Appendix.

[107] *Ibid. Grainger, A. 1995.*

[108] *Lopez, G. and Galinato, G.I. 2004. Trade Policies, Economic Growth and the Direct Causes of Deforestation*.

[109] *Mohd Shahwahid H. O. & Wan Razali W.M. 2013. Determinants of Deforestation and Estimation of EKC Curve in Peninsular Malaysia*. *Malaysia Case Study #1 in the Research Agreement between APAFRI & UPM under the Project: Comparative Analyses of Transitions to Sustainable Forest Management and Rehabilitation.*

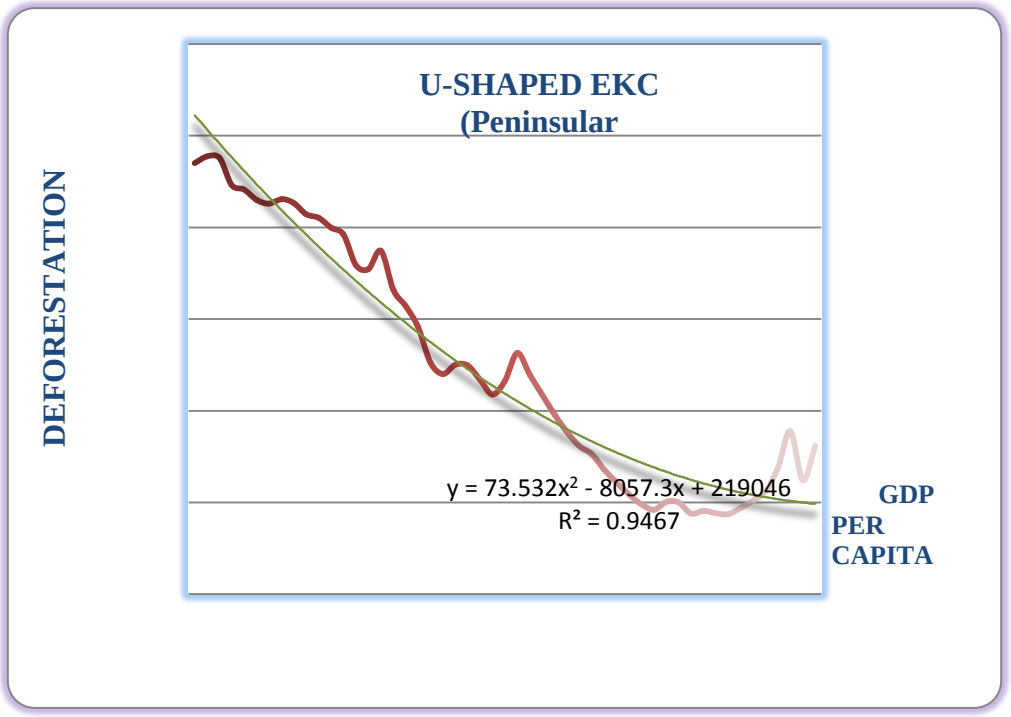


Figure 11. Relationship between deforestation and per capita GDP in Peninsular Malaysia.

However, if one broadens the perspectives of forest transitions to include, among other *a change in emphasis from production to protection and conservation* or *a shift from unsustainable to sustainable forest management* or even *a societal transition or a cultural change for the better forest management, utilization and conservation,* then Malaysia can be considered as transiting towards a sustainable forest management practice.

The forestry sector is one of the important economic sectors in Malaysia. Malaysia also recognises the immense importance of the forest resource in providing environmental protection, particularly those related to climate change. The following are policies that can be considered for managing deforestation:

1. The state land (conversion) forests were designated, from their inception, for eventual conversion to meet demands for additional lands for agricultural, urban or other non-forest purposes. Therefore, in order to manage any further forest loss from the conversion of land, all new developments are required by law to leave untouched 25% of the land area, to be designated as green space. Furthermore, all development projects require the filing of an Environmental Impact Assessment (EIA) and they must be approved by the Department of Environment, Malaysia;

2. Governments need to ensure that minimal forest degradation occurs in permanent production forests (no land use change) through Sustainable Forest Management (SFM) practices; and

3. Malaysia is implementing the MC&I (Natural Forests & Plantation Forests) based on international acceptable practices. Implementing the MC&I ensures that the production reserved forests are not degraded, not to mention deforested.

5.2 Forests in the future

Challenges of Sustainable Forest Management in Malaysia:

"When the final decision was taken, ministers were less influenced by any expert advice or facts than their political instincts, greatly swayed by pressure groups and political lobbies. A distressing reality, but a reality nevertheless."

(Lord Ashby 1977: Reconciling Man with the Environment).

■ Wood Consumption and Sustainable Timber Production

Today, Malaysia has sawmills, plywood mills, moulding and joinery plants, furniture mills and medium density fibre-board plants (see Section 2.3.3 for numbers as of the year 2011). Currently, most of the processing activities are still centred on sawmilling and plywood manufacturing that at the same time supports the furniture industry. The downstream processing industry will continue to grow, with value-added processing sector be given top priority. Investment incentives such as tax free period and tax relief have been granted to these processing industries. However, can Malaysia support these processing industries from its timber production? Simple analyses have indicated a scenario as presented in Table 5 below. Though the sustainable production of natural forest from 1995 to 2000 was about 16 to 17 mil cu m per year, the actual average production was about 28 mil cu m per year. This was so in order to support the existing annual installed processing mill capacity in Peninsular Malaysia (~14 mil cu m), Sabah (~8 mil cu m, and Sarawak (~6 mil cu m). The difference could be accounted for from other sources, mainly log production from Stateland Forest and to a minor extent over-logging.

Table 5. Sustainable log production vs. domestic demand vs. export availability (mil cu m roundwood equivalent).**

Region	Year	Sustainable Log Supply (from NF only)*	Domestic Consumption	Export Availability***
Peninsular Malaysia	1995	4.8	4.29	0.51
	2000	4.8	4.66	0.14
	2015	4.8	5.76	-
	In Perpetuity	5.70	-	-
Sabah	1995	1.67	0.41	1.26
	2000	1.24	0.44	0.80
	2015	2.80	0.55	2.55
	In Perpetuity	4.50	-	-
Sarawak	1995	10.15	0.49	9.66
	2000	10.15	0.53	9.62
	2015	7.00	0.65	6.35
	In Perpetuity	7.54	-	-
Malaysia (Total)	1995	16.62	5.19	11.43
	2000	16.19	5.63	10.56
	2015	14.60	6.96	7.64
	In Perpetuity	17.74	-	-

**NF=Natural Forest. Supply from Plantation Forest & Rubberwood are excluded here.*
***Source: see Wan Razali (1990)[110] for details.*
****Pen. Malaysia completely banned log export.*

A reduced availability commensurate with the level of sustainable log production from the natural forests should be viewed as an urgent need for the industry to restructure itself – practice intensive natural forest management or grow their own resources via industrial plantations.

[110] *Ibid. Wan Razali Wan Mohd .(1990).*

■ Timber Industry: Grow and Manage Your Own Resources

Perhaps, the simpler between the two options is to establish industrial plantations for own use, as intensive natural forest management is something not the obvious but not impossible either. Monoculture plantation eases management but carries high risk of diseases and fire. If one is in the reconstituted wood industries, such as pulp and paper, block board, etc the establishment of plantation is second to none for long fibered wood, which is not normally and easily found in large quantity in species from tropical natural forests. Except for the already established Acacia plantations in Pahang, Johor, Negri Sembilan and Selangor, only Sabah and Sarawak can offer a contiguous track of land to establish an economic size industrial plantation. The pros and cons to establish industrial plantation have to be weighed accordingly. Some species to choose from include fast growing and/or high quality species: Acacia hybrids, Teak, Sentang, Khaya, Jelutong, Pulai, Merawan; even Ramin, Rubber and Kelempayan.

■ Intensive Management of Natural Forests

Intensive management of natural forests is not a new idea at all but its implementation needs a big investment. Several researches (e.g. Leslie 1987[111], Keto *et al*. 1990[112]) have argued that investment in natural forest management does not pay. Many tropical countries neglect natural forest management in favor of plantations for financial reasons, especially if grant aid is available for plantation establishment. Plantations are also more visible and look like "development".

Few can substantiate the current failure of tropical forest management. But by most standards tropical forestry is in crisis. Forest sector is moving from a surplus situation to a deficit. For examples Thailand, Philippines, Brazil, Peru, Cote d'Ivoire and Nigeria once had surplus forest resources but are now approaching a deficit due to excessive deforestation and exploitation. Demands on the tropical forests are growing while the resources are declining in both extent and quality. There are many challenges in managing natural forests: economic, political, social, institutional, managerial and silvicultural factors all contribute (Wyatt-Smith 1987)[113].

In our opinion, one turning point for the management of tropical forest for timber production came as a result of ITTO's report (Poore *et al.* 1989)[114] which revealed that less than one mil ha of forest were successfully managed under sustainable management. This report shocked many in the industry. The report also indicated why sustainable management had not been fully achieved, identified many causes of failure and recommended several steps toward sustainable management. In many cases the nature and complexity of tropical moist forests have been used as a "scapegoat" for failure (or limited success) of natural forest management. However, promising regeneration and growth rates following harvesting suggest that sustainable timber production should be possible. Our experience shows that following supervised logging and silvicultural treatment, the residual forest may grow at 3cu m/ha/yr compared to less than 1.5cu m/ha/yr in unsupervised and untreated stands (Wan Razali 1989)[115]. Intensive management coupled with improved and high yielding species could be a headway to counter this challenge.

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[111] *Leslie, A. J. 1987. A second look at the economics of natural management systems in tropical mixed forests. Unasylva 155(39): 46 – 58*

[112] *Keto, A.I., M.F. Olsen, and K.Scott. 1990. The environmental impact of forestry operations and implications for sustainable development. Paper presented at UNDP Workshop on Environmental Management and Sustainable Development in the South Pacific, Fiji, April 1990.*

[113] *Wyatt-Smith, J. 1987. The management of tropical moist forest for the sustained production of timber: some issues. IUCN/IIED Tropical Forest Policy Paper No. 4.*

[114] *Poore, D., P. Burgess, J. Palmer, S.Reitbergen, and T.Synnott. 1989. No timber without trees: Sustainability in the tropical forest. London, Earthscan. 252 pp. .*

[115] *Wan Razali Wan Mohd. 1989. Summary of growth and yield studies in tropical mixed forests. Project Paper UNDP/RAS/86/049, UNDP. FRIM Reports No. 49. Pp. 17-33.*

■ Increasing Cost of Production & Pressure on Forest Product Companies

With rapid development of Malaysia's economy, the country is also experiencing some of the perils of a developed economy in the form of labour scarcity and higher costs. This has somewhat erode one of its traditional competitive factors, that is, a cheap labour force. Malaysia has to compete with other countries such as China, Vietnam, and Cambodia in every aspect of its forestry activities leading to a low price advantage of products manufactured in those countries.

Forest product companies are highly vulnerable to environmental issues and attention from some NGOs because they depend almost entirely on forests as natural resources for inputs. At present, it requires about 300kg of natural resources to generate USD100 of income in the world's most advanced economies: given the size of these economies this represents a massive scale of environmental alteration (Carey and Dixon 1999)[116]. Malaysian companies are no exception to the NGOs. Therefore, act and look green!

■ Increasing Business Opportunities

Regulatory, market and public interest in corporate environmental performance is growing, as can be seen by the increasing media coverage of issues such as climate change, product legislation, recycling, publication of company environmental report, certification and SFM. This increased scrutiny creates opportunities for companies to lower their risk and enhance their image, market share and competitive position by implementing a proactive environmental strategy. In the forestry sector, one of the highest leverage opportunities to improve image and positioning is enhancing forest management practices.

■ Production Efficiency and Productivity

Generally, production efficiency in the timber sector in Malaysia is still low. Sawmills and plywood mills could achieve a recovery rate of greater than 60%. The outdated machinery must be upgraded or replaced. Mill wastes must be converted to more effective use and high value products.

■ Changing Markets and Product Diversification

The market place in the 21st century has witnessed significant economic and social changes of consumer behaviour in various countries. Traditional markets have to be supplemented with new markets. The Asia-Pacific region is now one of the biggest importer and trader of timber products compare to the traditional EU and US market. New products must be manufactured by Malaysian timber exporters. Malaysian timber manufacturers will need to obtain up-to-date market information on designs and consumers preference, focusing on quality and cost-saving manufacturing to achieve success in the market place. With new technology advancement, new and improved products are being developed very rapidly. Medium & High Density Fibreboard (MDF & HDF), Oriented Strength Board (OSB), Laminated Veneer Lumber (LVL), and Fibre Reinforced Plastic Composites (FRPC) are examples of such products.

■ International Cooperation

The globalization of the world economy will mean increased competition in international trade. Factors determining comparative advantage have been changing. To Malaysia, competitive advantage has to be viewed throughout the production chain: right from manufacturing, ensuring quality, to delivery and marketing services. The companies must be in this "ball game", with the government assisting the industries towards achieving international linkages and cooperation. Through many relevant institutions in Malaysia, it is hope that a conducive environment be fostered, where security of resources and government support is available. This is to encourage both local and foreign investments to go into the value-added processing industry, and for aggressive marketing at the international level.

[116] *Carey, C and Dixon, F. 1999. The future of the forest industry: Maximising environmental benefits and market returns. A WWF International Research Report. 18p.*

6 REFLECTIONS AND POLICY RECOMMENDATIONS

6.1 What Can Be Done?

Forest in Malaysia has been regarded in the past as an inexhaustible land reservoir for conversion to other uses and as a storehouse of raw material to be turned to liquid assets, whereas, in fact, they are the country's most valuable resource (renewable) for the supply in perpetuity of many vital goods and services.

The looming problems of expected timber shortage are not of course without solutions. It can be avoided given the social and political will. In fact, prudent decisions taken may not only avert disaster but may even create opportunities for a bigger industry. The key lies in the proper management of the forest resources, its conservation, its utilization, and its sustainable development. There is a need to review critically today's policies if Malaysia's timber sector is to be sustained, vis-à-vis:

(1) It is imperative for the Government to review the policies on:
- logging especially with respect to the annual cut and to ensure that the land remains in forest use after harvesting/ logging, and
- log export with the aim of restricting such activity;

(2) There is a need to accelerate, especially in Sabah and Sarawak, a programme of industrialization into downstream activities for higher value added products;

(3) There must be sufficient efforts and funds allocated for reforestation of the logged-over forests to ensure continued productivity;

(4) Effort must be taken to silviculturally treat the logged-over forests to ensure higher productivity per unit basis;

(5) There is still considerable wastage during logging and processing stages. Such harvesting losses are estimated to be as high as 40% of the commercial volume in Peninsular Malaysia. Bigger losses are likely to occur in Sabah and Sarawak. Similarly, recovery rate for processed wood is low as 30% of the utilisable volume. Concerted effort should be aimed reduce such losses and wastage; and

(6) Concerted effort must be given to ensure the success of industrial forest plantations in order to offset the anticipated shortfall from the natural forests. Establishment of plantation of high value and market proven or speciality timber species must also be encouraged.

Many other policies, strategies and actions can be taken to avoid the expected timber shortage and at the same time to promote sustainable forest management practices. The problem of shifting cultivation, the current forest policy and administration, the present forest management and silviculture operation, and the need to have stronger research capabilities must be given due attention and appropriate action taken for Peninsular Malaysia; more so for Sabah and Sarawak.

6.2 Forestry Scenario in the 21st Century

The scenario for forestry in the 21st century is expected to be substantially different from what it is today and highly unpredictable. A 21st century forestry will crisscross institutions, disciplines, organizations, specialization, roles, and identities. Foresters will enter the debates on when, where, why, and how forests should be managed, including for what purpose and by whom. No longer foresters be specially authorized to determine how forests are managed. Nevertheless, it is essential to construct a plausible picture, based on calculated projections in order to plan for future forestry activities, as follows:

1. The future source of ligno-cellulosic material for industrial processing will mainly come from the production forests of the PRFs, plantations and agriculture crops (for examples, rubber and oil palm);

2. Second rotation logging in production forests will have to be more environmentally friendly. Logs will decline in supply, and cost more partly due to the forest management and product certification requirements;

3. In addition, labour costs in Malaysia will also increase with industrialization. Under these circumstances, the wood-based industries will have to adopt high technological manufacturing processes to stay competitive;

4. Greater use of biotechnology for producing improved planting stock will become a norm, as nature is cyclic and unpredictable in producing the much needed seed supply;

5. Plantation species will not only be planted for single target markets like general utility timber or pulp and paper, but also for multi-purpose usage. Plantations of high quality timber species on long rotation will be accorded equal importance as the fast-growing exotics;

6. Greater integration of forestry and agricultural sector could be realized through the wider adoption of agro-forestry practices. Rubberwood and oil palm stems and fronds would be treated as both forest and agriculture resources. Such a trend is in line with the decision of the Consultative Group on International Agriculture Research (CGIAR) to accept both forestry and agro-forestry into its system; and

7. Forestry practices would come under even greater scrutiny from the environmental perspective. Unless policies and legislation are matched with political commitment at the highest level, and environmental issues given high priority, international actions such as timber certification and/or (eco)-labelling and anti-tropical hardwood campaigns could seriously affect the country's' timber industry.

7 CONCLUSIONS

The future development of forest management and industries has to be integrated and synchronized with the changing external environment, vis-à-vis the need to ensure the forestry sector will continue to bring about socio-economic development to the nation.

Concerns over the future of tropical forests transcend national boundaries and forestry R&D is going to be extremely important. Malaysia needs to adopt a proactive and an open attitude to tap suitable foreign expertise and technologies, to exchange information and to actively participate in the activities of the international forestry community.

Appendix

MALAYSIA CASE STUDY UNDER THE APFNet-APAFRI PROJECT:

Determinants of Deforestation and Estimation of EKC Curve in Peninsular Malaysia[117]

[118]Mohd Shahwahid H. O. & Wan Razali W.M.

1.0 Introduction

Deforestation is an important issue in Malaysia with Peninsular Malaysia experiencing an annual declining rate in forest area of 1.94% while Sabah and Sarawak experiencing higher reduction of 11.64% and 3.49% respectively. Sabah has the highest deforestation rates during the period of 2000–2010. The total forest area for these three regions together declined from 18 764 000 ha in 2000 to 17,812,000 ha in 2010 (Table 1).

In Peninsular Malaysia, the total forest land reduced from 9 645 000 hectares in 1960 to 5 864 000 ha in 2010. Total forest areas available were steadily decreasing from 1960–1980, but post 1980 there were a slowdown in forest loss. Of concern is what factors are causing this forest loss situation.

Large-scale deforestation for agricultural and industrial purposes transforms rich and diverse habitats to barren arid lands. The forest resources are rapidly declining and large scale forest destruction has occurred due to many reasons such as commercial logging (Capistrano 1994), agriculture expansion (Angelsen 1999), population growth (Myers 1993), and income per capita growth (Bilsborrow & Geores 1991). The damages to the land and soil have prevented healthy re-growths on these areas once the forests are cleared.

Table 1. Trends in Total (Net) Forest Cover ('000ha) in Peninsular Malaysia, Sabah & Sarawak 2000–2010.

Region	Forest Area in 2000	Forest Area in 2010
Peninsular Malaysia	5,980	5,864
Sabah	4,562	4,031
Sarawak	8,204	7,917
Total Region	**18764**	**17812**

Sources: FDPM, FDS and SFD
* Forestry Department Peninsular Malaysia
* Forestry Department Sarawak
* Sabah Forestry Department

Various countries around the world show significant positive relationships between the loss of the forest cover and developmental growths. There are a number of important issues that have been studied in order to identify the factors that have contributed to deforestation. Various determinants of deforestation in these countries include population growth rate, the extent of forest area, total geographical area and foreign exchange earned through the export of timber production, agriculture expansion and GDP per capita growth.

In addition, several studies have so far tested the Environmental Kuznets curve (EKC) hypothesis for deforestation with cross-country or panel data (Shafik & Bandyopadhyay 1992, Koop & Tole 1999, Vincent & Mohd Shahwahid 1997, Bhattarai & Hammig 2001, Culas 2007) with various forms of conformity in the inverted U shapes of the EKC.

The general objective of this case study is to understand what are the underlying causes of deforestation in Peninsular Malaysia for the time period of 1960–2010. Specifically, the objectives are:

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[117] *Malaysia Case Study #1 in the Research Agreement between APAFRI & UPM under the Project:* ***Comparative Analyses of Transitions to Sustainable Forest Management and Rehabilitation.***

[118] *Respectively Professor and Dean, Faculty of Management and Economics and Professor, Faculty of Forestry, Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor, Malaysia.*

i. To determine factors which influence the rate of deforestation in Peninsular Malaysia; and
ii. To test whether the loss in forest cover in Peninsular Malaysia is following an inverted U-shape relationship ala' the Environmental Kuznets Curve (EKC) between income per capita and deforestation rates.

This study is an update of previous studies undertaken by Vincent and Mohd Shahwahid (1997) and Abdul Rahim *et al*. (2009). This current research is needed because of a new finding by Culas (2012) who has found that the Asian region does not follow the inverted-U pattern of the EKC as shown in the Latin American and African regions. Furthermore, this research is done with an updated time series data ranging from the year 1960 to 2010.

2.0 Model Specification and Estimation

2.1 Determinants of deforestation and findings

i. Model

To identify the determinants of deforestation, the empirical model is specified as:

$$\ln FA = \alpha + \beta_1 \ln GDP_t + \beta_2 \ln POP_t + \beta_3 \ln OP_t + \beta_4 \ln TP_t + \varepsilon_t \qquad (1)$$

where changes of the forest area is represented by (FA), area of oil palm planted by (OP), population by (POP),income level by (GDP) and export of timber products by (TP). The model is a multiplicative function hence it is linear when the above dependent and independent variables were converted into natural logarithmic form. In the first model, OP is the area of oil palm planted in Peninsular Malaysia as representing agro-conversion areas while major export of timber products (TP) that included sawn timber, plywood and veneer as the variable expressing the growth of the forest-based industries. ε_t is a stochastic error term. The proxy for the dependent variable to measure deforestation was the total forest area instead of area of forest loss or cleared. From the data it was found that the forest area loss was not always positive, because there were years where no forests were lost. It is not possible to have a logarithm value for zero. Hence the declining trend in forest cover is used as a proxy to indicate deforestation.

Annual data of variables selected in the above models ranging from the year 1960 until 2010 were obtained from the Department of Forestry in Peninsular Malaysia, Malaysian Palm Oil Board (MPOB) and also Department of Statistics, Malaysia.

In order to capture the cause-and-effect relationship between the changes in forested area and the factors that contribute to its variation, An Autoregressive Distributed Lag ARDL model was developed in this study. According to Abdul Rahim and Mohd Shahwahid (2009), increasingly several studies have used the ARDL model to analyse the forest issues. For instance, Abdul Rahim and Mohd Shahwahid (2009) used the ARDL model to assess the impact of sustainable forest management practices on the West Malaysian domestic log market.

ii. Estimation Method

In obtaining the final results of the model estimated, various econometrics diagnostic tests were undertaken including testing for spurious regression in particular for stationarity of the variable data.

The ARDL approach (Pesaran & Pesaran1997) was used to estimate the determinant of deforestation function for Peninsular Malaysia of Equation 1 during the period of 1960–2010.There are some advantages of ARDL bounds test. According to (Pesaran & Pesaran 1997), there are no restrictions imposed on the order of integration of each variable. Besides that, small sample size are better and efficient when using the ARDL model as compared to the Johansen (1988), Johansen and Juselius (1990), and Engle and Granger (1987). Finally, the ARDL bounds test is applicable when the explanatory variables are endogenous, and simultaneously they are sufficient to correct the residual serial correlation.

The first step of this ARDL approach is to establish a long-term relationship among variables by employing the unrestricted error correction model. In this study, the model is specified as:

$$\Delta \ln FA_t = \alpha + \beta_0 \ln FA_{t-1} + \beta_1 lnGDP_{t-1} + \beta_2 lnPOP_{t-1} + \beta_3 lnOP_{t-1} + \beta_4 lnTP_{t-1}$$

$$+\sum_{i=0}^{P} \alpha_5 \Delta \ln FA_{t-i} + \sum_{i=0}^{P} \theta_6 \Delta \ln GDP_{t-i} + \sum_{i=0}^{P} \delta_7 \Delta \ln POP_{t-i} + \sum_{i=0}^{P} \phi_8 \Delta \ln OP_{t-1} + \sum_{i=0}^{P} \gamma_9 \Delta \ln TP_{t-i} + \varepsilon_t \quad (2)$$

Δ lnFA	=	Changes in log of annual total forested land ('000 hectares)
lnGDP	=	Log real gross domestic product (RM million)
lnPOP	=	Log population ('000)
lnOP	=	Log area oil palm planted (hectares)
lnTP	=	Log export of timber product ('000)
ε_t	=	Stochastic error term

In the above Equation 2, α is the drift component, and ε_t is the white noise error component. The null hypothesis that there is no co-integration among the variables is expressed as $\beta 0=\beta 1=\beta 2=\beta 3=\beta 4$. We can conclude that there is a co-integration relationship among them, if the calculated F-statistics is more than the upper critical bound given by Pesaran *et al*. (2001). If the F-statistics is lower than the lower critical bound, then it is judged that there is no co-integration. The decision regarding co-integration will be inconclusive, when the F-statistic lies within the upper and lower critical bounds.

Once a co-integration relationship among the variables is established, the next step is to obtain the equilibrium equation for deforestation and its determinants for the long-run. We can derive the reduced-form solution from Equation 2 as:

$$\ln FA_t = \lambda_0 + \lambda_1 \ln GDP_t + \lambda_2 \ln POP_t + \lambda_3 \ln OP_t + \lambda_4 \ln TP_t + \varepsilon_t \quad (3)$$

where $\lambda_0 = -\alpha/B_0$, $\lambda_1 = -B_1/B_0$, $\lambda_2 = -B_2/B_0$, $\lambda_3 = -B_3/B_0$, $\lambda_4 = -B_4/B_0$.

To evaluate the goodness of fit of the model, we use several criteria. These include classical assumption test, R-squared and adjusted R-squared, lowest standard error of regression, lowest AIC, lowest SIC, and model stability test. The technique employed to test model stability is cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ). If the plots of CUSUM and CUSUMSQ statistics stay within the critical bounds of 5% level of significance, the null hypothesis that all of the coefficients in the given regression are stable and cannot be rejected.

iii. Findings

Table 2 below shows the ARDL estimation for the equilibrium long run deforestation model for Peninsular Malaysia. All the explanatory variables included in this equation significantly affect the deforestation in Peninsular Malaysia. The variables with statistical significant coefficients at the one percent level were LnGDP and LnOP while LnPOP and LnTP were significant at the 5% level. Hence as reported by other researchers earlier, national income, agricultural conversion of forest, population and trade of forest products are indeed important determinants of deforestation in Peninsular Malaysia.

The coefficients of a deforestation function are often used in economic analysis to estimate deforestation elasticities with respect to the individual determinant. For instance, the deforestation elasticity of GDP is defined as the percentage rate of deforestation as GDP increases by 1%. This is often estimated by multiplying the differential of the deforestation function with respect to a particular

determinant (e.g. GDP) to the ratio of that determinant over the amount of deforestation for a given year. It could be proven mathematically that since a double logarithmic functional form is a multiplicative function, the coefficient obtained for each determinant is already the elasticity. Hence given that the coefficient of LnGDP is -0.10, then this coefficient suggests that a 1% increase in the GDP of Peninsular Malaysia, has contributed to a decline in 0.1% in forest cover. It is suggested that additional income raises consumption of land-intensive goods and increases deforestation.

Likewise a deforestation elasticity of oil palm area of 1% increase in oil palm planted area would lead to a conversion of 0.062% forest cover in Peninsular Malaysia. This implies that an increase in agricultural production such as oil palm does promote the conversion of forest lands to agricultural lands. Therefore, the area planted with oil palm in Peninsular Malaysia will gradually motivate the incidences of deforestation in future. Nevertheless, it should be noted the forests affected are mainly the stateland forests not those earmarked as reserve forests. This finding is aligned to that of Barbier and Burgess (2001) who mentioned that agricultural expansion is being supported by the lowering of input prices that occurred when procuring forest land rather than other agricultural land, as well as increased credit availability and technological progress that facilitate pioneering into the hinterland.

In the case of trade in forest products, a 1% increase in the export value of timber products could lead to a decline in 0.014% of forest area. The lower percentage change in forest cover in the latter is due to the fact that rising timber products production and trade may not necessarily come from forest conversion but a big component would be from production forest reserves where the land area would still remained as forest. Further as Peninsular Malaysia has imposed an export ban of logs from 1972 onwards, timber product export value increases since then was derived from a rise in value of the processed products rather than quantity of unprocessed and low value added timber products. These finding neutralised the conjectures by Wolf (1996) who suggested that logging was primary cause of deforestation in Southeast Asia. It was also alleged that large amounts of timber traded in the world market are harvested illegally. The increase in illegal logs will decrease the production of the legal logs and may cause higher deforestation at the same time. While these assertions may be true elsewhere, it is believed not to be widespread in Peninsular Malaysia where the trade is regulated tightly.

In the case of population, the elasticity obtained was positive. This implies that an increase in population will not necessarily lead to a decline in the forest area. Almost similar finding is obtained by Templeton and Scherr (1999) who have noted that the population pressure on forest resources will increase at first, but it will change along with efficiency in production processes into the direction of the conservation of the remaining forest resources. This result might be related to the technological or institutional innovation induced from population pressure.

3.0 Environmental Kuznet Curve

i. Model

For the second investigation, a simple quadratic form of an EKC model were analysed to test the hypothesis. The functional form estimated is as stated in

$$DEF_t = \beta_0 + \beta_1 GDPP_t + \beta_2 (GDPP)^2_t + \varepsilon_t \quad (4)$$

Table 2. Estimation Results of the Long-run Deforestation Model.

Variables	Coefficients	Standard Error	T-Statistics	P-Value
LNGDP	- 0.10035	0.035222	-2.85	0.007 ***
LNPOP	0.29570	0.14151	2.09	0.043 **
LNOP	-0.062004	0.016602	-3.73	0.001 ***
LNTP	-0.014170	0.00709	-2.00	0.053 **
Constant	15.1483	1.03290	14.67	0.000 ***

Note1: ARDL (1,0,1,0,0,) was selected on the basis of SIC
*Note2: The symbol indicates ** 5% significance and *** 1% significance*
Note 3: R^2 = 0.99

Where DEF_t is the annual rate of deforestation, $GDPP_t$ is gross domestic product per capita, and $GDPP_t^2$ is gross domestic product per capita squared. The subscript t refers to year t. The DEF denotes deforestation, which is the dependent variable in Equation 4, is calculated according to the definition of the World Resources Institute (WRI) as

$$DEF = F_{t-1} - F_t \quad (5)$$

F represents the forest cover area.

For the estimation of the EKC function, exogenous factors such as GDP per capita (GDPP) were used to test for the relationship with deforestation while the GDP per capita squared ($GDPP^2$) was used to test the curvilinear shapes in the EKC. A quadratic functional form model was adopted using ordinary least squares (OLS) method to determine the coefficients and their signs to test whether the changes in forest cover in Peninsular Malaysia is following an inverted U-shape relationship resembling the Environmental Kuznets Curve (EKC) between the GDP per capita and deforestation. Further, if indeed an EKC existed for Peninsular Malaysia, then the model estimated would be used to determine the threshold level of per capita income when deforestation ceased and began to reduce. The per capita income turning point (ITP) is obtained at the maximum level of the Kuznets curve of Equation 4. When deforestation has reached a maximum, then $\partial F/\partial GDPP$ is zero, hence

$$\partial F/\partial GDPP = \beta_1 + 2\beta_2 GDPP = 0$$

$$GDPP = -\beta_1/2\beta_2$$

The EKC hypothesis for deforestation in Peninsular Malaysia would be accepted, when the coefficient of the GDP per capita is positive and the coefficient of GDP per capita squared is negative in Equation 4.

The estimation of an EKC function for Peninsular Malaysia uses data on deforestation and income per capita covering a period of 1960 to 2010. Real GDP per capita is measured using the base year = 2010. The data on the forest cover area was obtained from the Forestry Department Peninsular Malaysia (FDPM). For the GDP, which is the most important data in the explanatory variables, we employ the real GDP per capita using the base year 2010 that is obtained from Department of Statistics (DOS).

ii. Findings

The ordinary least squares estimation of Equation 4 revealed that the coefficients of GDPP and $GDPP^2$ were statistically significant at 1 and 5% respectively (Table 3). Both variables have the reverse signs of the expected EKC. Therefore, they do not provide the expected support for an estimated EKC relation as indicated in Figure 2. The red scatter points are actual deforestation (ha/year) at various levels of per capita annual gross domestic product while the blue scatter points are the forecasted deforestation rates (ha/year) using the econometric model estimated (Deforestation (ha/year) = 268,623.9 – 22.35116 GDPP + 0.000454 GDPP). As GDP increases during the early development, the rate of deforestation declines immediately. There is no evidence of an increase in deforestation rates followed by a fall as GDPP increases. This is different from the Kuznets relationships found by Bhattarai and Hammig (2001) for countries in Africa, Asia and Latin America, and by Ehrhardt-Martinez *et al*. (2002) for less developed countries. The results with a negative sign for the coefficient of GDP per capita and positive coefficient for GDP per capita squared did not show the existence of the inverse U-shaped relationship – instead it depicted a U-shaped curve between deforestation and GDP per capita. This is because as GDP per capita increases, planned intense deforestations occurred in the seventies but deforestation rates declined rapidly in the following decades. This finding is consistent with the recent empirical evidence of Culas (2012) who suggests that a U-shaped EKC would apply to Asian countries.

It is a major pursuit in this study to try to estimate income turning points (ITPs) if the EKC existed since it would offer important policy implications. But since the coefficients of the GDPP and the $GDPP^2$ variable were contrary to the hypothesis, then no ITP existed.

Table 3. Estimated EKC for Peninsular Malaysia

Variables	Coefficients	Standard Error	T-Statistics	P-Value
GDPP	-22.35116	7.945685	-2.81	0.007***
$GDPP^2$	0.000454	0.000220	2.07	0.044**
C	268623.9	57700.32	4.66	0.000**

Note1: *** & ** indicate 1% and 5% significant levels respectively.

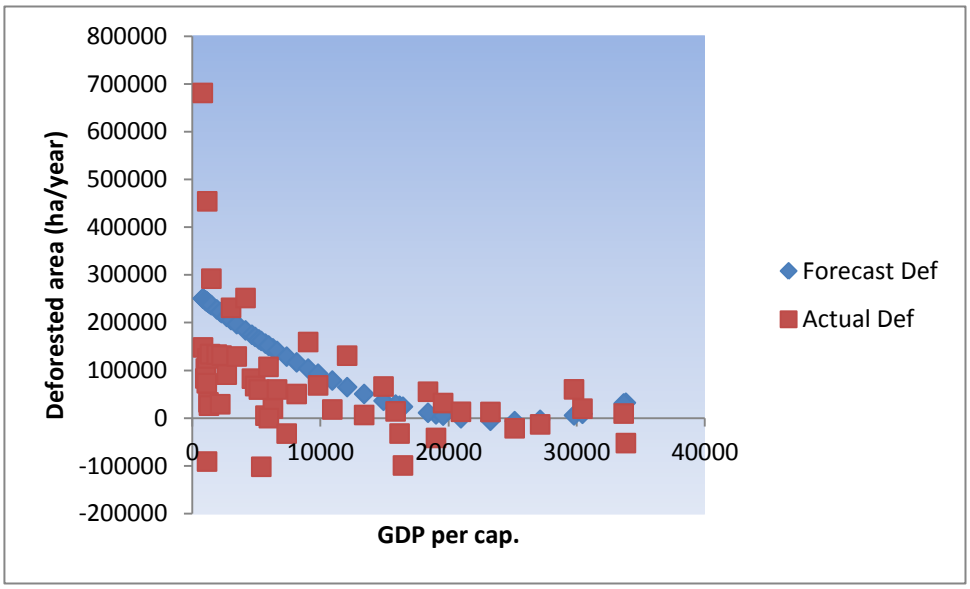

Figure 2. The Forecast of EKC Curve

4.0 Conclusion and Recommendations

This case study on deforestation in Peninsular Malaysia from 1960–2010 found that the GDP, area of oil palm planted, export of timber products and population have significant influences on the rate of deforestations in Peninsular Malaysia. With the exception of population, the changes in the other three variables were related to rising deforestations. Instead rising population in Peninsular Malaysia did not seem to increase deforestation.

An investigation on the possible presence of the EKC in Peninsular Malaysian deforestation rates did not materialise. The result does not support the long-run inverted-U relationship between economic growth and deforestation rate in Peninsular Malaysia.

The forestry sector is one of the important economic sectors in Malaysia. Malaysia also recognises the immense importance of the forest resource in providing environmental protection, particularly those related to climate change. The following are the policies that can be considered for managing deforestation:

1. The Stateland (conversion) forests were designated, from their inception, for eventual conversion to meet demands for additional lands for agricultural, urban or other non-forest purposes. Therefore, in order to manage any further forest loss from the conversion of land, all new developments are required by law to leave untouched 25% of the land area, to be designated as green space. Furthermore, all development projects require the filing of an Environmental Impact Assessment (EIA) and they must be approved by the Environmental Protection Agency (EPA);

2. Governments need to ensure that minimal forest degradation occurs in permanent production forests (no land-use change) through Sustainable Forest Management (SFM) practices; and

3. Malaysia is implementing the MC&I (Natural Forests), modelled after the Forest Stewardship Council (FSC) and Programme for Endorsement of Forest Certification (PEFC) templates. Implementing the MC&I ensures that the production reserved forests are not degraded, not to mention deforested.

Acknowledgements

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CASE STUDY 2

Sustaining Timber Production - An Achievable Goal for Malaysia?[119]

[120]Wan Razali W.M. & Mohd Shahwahid H. O.

1.0 Introduction

1.1 Background

Current environmental issues including global warming and climate change, deforestation and economic crisis call for the scientific community to concentrate efforts to address for new and better approaches that can help reduce deforestation, induce rehabilitation and foster sustainable forest management. Deforestation and forest transition studies of the last two decades have generally failed to provide workable models and tools that can be effectively used to achieve these objectives. The change from shrinking to expanding forests has been termed as forest transition[121]. However, if one broadens the perspectives of forest transition to include, among other *a change in emphasis from production to protection and conservation*, *a shift from unsustainable to sustainable forest management* and even *a societal transition or a cultural change for the better forest management, utilization and conservation,* then Malaysia can be considered as transiting towards a sustainable forest management practices. Hence, a specific objective of this study is to recommend strategies to enhance the capability and capacity of the forestry sector in reducing deforestation, raising rehabilitation and attaining sustainable forest management. Has effective government forest policies decrease deforestation and raise rehabilitation and hence move towards sustainable forest management and timber production? This case study analyzed Malaysia's position in coping with deforestation, fluctuating forest areas from 1980s until today, and attaining sustainable forest management practices to produce sustainable timber supply for the country.

1.2 Forests: Malaysia's natural heritage

Located in tropics, Malaysia straddles across the South China Sea – Peninsular Malaysia is at the tip of mainland South East Asia while the states of Sabah and Sarawak are on the island of Borneo (Figure 1). Malaysia is a federation of 13 states and three federal territories comprising two distinct regions – Peninsular Malaysia, with eleven states, and the states of Sarawak and Sabah (East Malaysia) in Borneo, with a total land mass of about 33 million hectares. In 2010, the country's estimated population was 27.9 million people and it is ranked 66th out of 182 countries in UNDP's Human Development Index (UNDP 2009)[122]. Malaysia is fortunate to be endowed with vast stretches of evergreen tropical rainforests – a natural heritage rich in plant and animal life. The Malaysian tropical rainforest is one of the most complex and species – rich ecosystems on planet earth.

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[121] *Grainger, A. 1995. The forest transition*: an alternative approach. Area 27: 242-251.

[122] *UNDP (2009). Human Development Report 2009. United Nations Development Programme, New York, United States.*

Figure 1. Malaysia Geographic Position.

Malaysia reports its forests according to three major forest categories: permanent reserve forest – PFR (or permanent forest estate – PFE), state alienated forest and national park and wildlife/bird sanctuary. In 2011, Malaysia has about 14.61 mil ha of PFR (Peninsular Malaysia = 4.92 mil ha; Sarawak = 6.09 mil ha; Sabah = 3.60 mil ha), 2.04 mil ha of state alienated forest, and about 1.83 mil ha of national park and wildlife/bird sanctuary. From the log production viewpoint, Malaysia has about 13.42 mil ha (11.38 mil ha from PFR and 2.04 mil ha from state alienated forest) and totally protected 5.06 mil ha (3.23 mil ha from PFR and 1.83 from national park and wildlife/bird sanctuary). This is summarized in Figure 2 below.

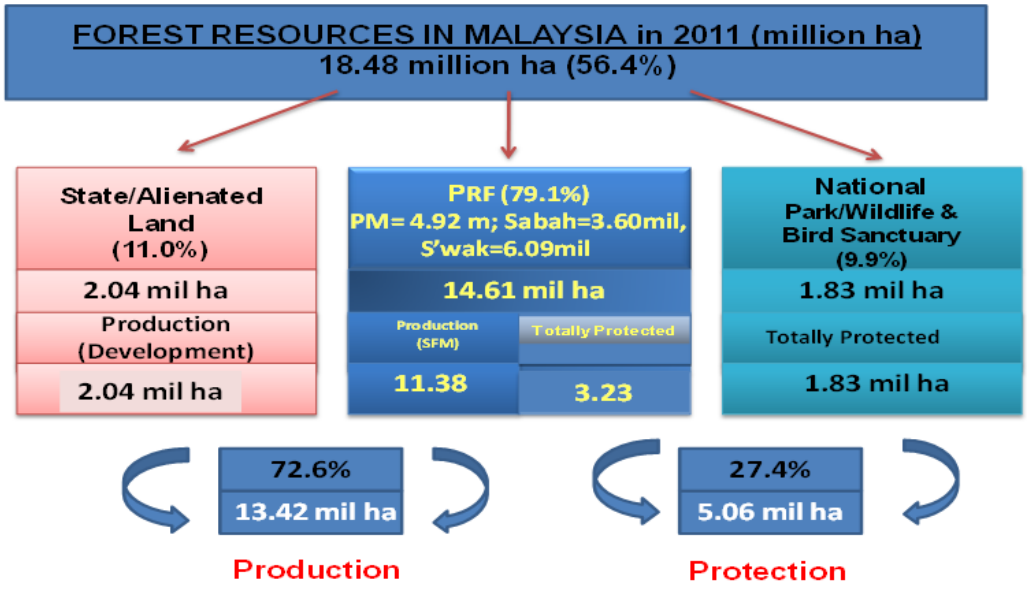

Figure 2. Forest land areas in Malaysia 2011.
(Source: Abd. Rahman A.R.)[123]

[123] *Abd. Rahman Abd. Rahim. 2012. The state of our forest in Peninsular Malaysia. The public awareness campaign on forest conservation in Malaysia, 1 February 2012, Sunway Pyramid Shopping Centre, Selangor, Malaysia.*

These forests are gazetted in accordance with the National Forestry Act (1984, Amended 1993) in Peninsular Malaysia and the relevant state forest ordinance/enactment in Sabah and Sarawak. A significant proportion of the total PFR (i.e. natural forests and planted forests combined) has been demarcated on the ground. Licensed land surveyors mark the boundaries of the PFR by the placement of permanent boundary stones; the painting of trees with three rings of red paint at 10-m intervals; and the construction of notice boards at 800 m intervals and at all entrances to the forest. In Peninsular Malaysia, an estimated 65% of the production PFR has been demarcated in this way, 6% in Sabah and 72% in Sarawak. About 25% of the protection PFR has been demarcated in Peninsular Malaysia, 41% in Sabah and 80% in Sarawak (FAO 2011)[124].

1.3 Timber production and trade

Forests have contributed significantly toward the socio-economic development of Malaysia. For example, in 1988 alone, the total export of timber and timber products amounted to RM7.12 billion (USD2.64 billion) or about 13% of the total gross export earnings of the country. At the same time, it provided direct employment to 146 000 people. Similarly in 1989 and 1990, the total export of timber and timber products increased to about RM8.98 billion (USD3.33 billion) and RM8.94 billion (USD3.31 billion) respectively; contributed about 13.2% for 1989 and 11.2% for 1990 of the country's total export earnings, and provided direct employment to 176 666 people in 1989 and 177 317 people in 1990. In 2009**,** total Malaysian industrial log production was 18.0 mil m^3 (mostly from natural forests), down from 24.7 mil m^3 in 2004 (ITTO 2011)[125]; in 1990 the estimated total industrial log production was 39.1 mil m^3 (FAO 2011)[126]. The main wood-based industries are sawmilling, wood-based panel products, wood moulding and furniture manufacture. The contribution of wood-based products to export earnings is significant: in 2008, for example, the export of wooden furniture from Malaysia was valued at more than USD2 billion and the value of plywood exports was nearly USD1.9 billion. The total value of all wood-based product exports in 2008 was USD6.6 billion (FAO 2011)[127]

1.4 Deforestation and degradation.

Apart from its monetary value, forest also play important role in maintaining environmental stability, in minimizing damage to riverine ecosystem by erosion and agricultural lands by floods, in storing the germplasm of wood and non-woody resources (rattan, bamboo, etc.) and plant species of potential pharmaceutical significance, and lastly, in providing important sources of food, fuel, and other materials to satisfy the basic need of rural population. Therefore, Malaysian forests have always been regarded as great importance to the nation and prudent measures have been instituted to ensure their conservation and effective management and viability as a renewable and sustainable resource.

According to FAO (2010a)[128], Malaysia's total forest area decreased by 434 000 ha between 2005 and 2010 (an annual decline of 0.42%) and by 1.92 mil ha between 1990 and 2010. The Malaysian government reported that a total of 12 359 ha of forest were formally converted to agriculture in the period 2004–07 (all in Peninsular Malaysia because data were unavailable for Sabah and Sarawak),

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[124] *FAO .2011. State of the world's forests 2011. Food and Agriculture Organization of the United Nations Rome, 2011*

[125] *ITTO. 2011. website accessed March 2011). Annual Review statistics database (available at http://www.itto.int/annual_review_output/?mode=searchdata).*

[126] *Ibid. FAO (2011).*

[127] *Ibid. FAO (2011).*

[128] *FAO. 2010a. Global forest resources assessment 2010 country report: Malaysia (available at http://www.fao.org/forestry/ fra/67090/en/).*

while just over 53 000 ha were formally added to the forest estate in the same period. An estimated 20 000 ha were converted illegally in Sabah FAO (2010b)[129]. Human-induced forest fire was reported to be negligible, as was illegal harvesting. FAO (2011)[130] estimated a total area of primary forest of 3.82 mil ha and Peninsular Malaysia reported 191 000 ha of degraded primary forest in the PFE (Table 1). There were an estimated 2.70 mil ha of secondary forest in Sabah's PFE, the only region for which data on that parameter were available.

Countries can be categorised regarding their forest cover (>50% = high forest cover) and deforestation rate (>22% p.a. = high deforestation)[131]. Malaysia is categorised as a HFLD (high forest cover with low rates of deforestation) country.[132] Malaysia has a negative but decreasing annual change rate of the total forest area of -0.42% from 2005 to 2010 (in comparison to -0.66% in 2000 to 2005). The area of planted forest was 1.81 mil ha and increased with an annual growth rate of 2.81% from 2005 to 2010[133].

Table 1. Forest area and area change in some forested countries in Asean.

Country / area	Extent of forest 2010			Annual change rate			
	Forest area (1000 ha)	% of land area (%)	Area per 1000 people (ha)	1990–2000		2000–2010	
				1000 ha	(%)	1000 ha	(%)
Brunei Darussalam	380	72	969	-2	-0.4	-2	-0.4
Cambodia	10 094	57	693	-140	-1.1	-145	-1.3
Indonesia	94 432	52	415	-1 914	-1.7	-498	-0.5
Lao People's Democratic Republic	15 751	68	2 538	-78	-0.5	-78	-0.5
Malaysia	**20 456**	**62**	**757**	**-79**	**-0.4**	**-114**	**-0.5**
Myanmar	31 773	48	641	-435	-1.2	-310	-0.9
Philippines	7 665	26	85	55	0.8	55	0.7
Thailand	18 972	37	282	-55	-0.3	-3	0

(Source: FAO 2011. State of the world's forests 2011. Food and Agriculture Organization of the United Nations Rome, 2011)

2.0 Sustainable Yield Management of Natural Forests through Proper Silvicultural and Management Systems

Sustain yield forest management in simple term means achieving, at the earliest practicable time, a balance between net growth and harvest, either by annual or somewhat longer periods so that the desired products can be obtained in perpetuity (Davis 1966)[134]. Any form of sustained yield management requires the maintenance of an adequate growing stock. Annual or periodic yields

[129] *FAO. 2010b. Forests and Climate Change in the Asia-Pacific Region. Forests and Climate Change Working Paper 7. FAO, Rome, Italy.*

[130] *Ibid. FAO. 2011.*

[131] *GCP, 2008, The little REDD Book*

[132] *Meridian Institute. 2009. Reducing Emissions from Deforestation and Forest Degradation (REDD): An Options Assessment*

[133] *UN Global Forest Resources Assessment 2010 available online: http://www.fao.org/forestry/fra/fra2010/en/, accessed November 2012.*

[134] *Davis, K. P. 1966. Forest Management: Regulation and Evaluation. McGraw-Hill Book Co, New York.*

should be determined in such a way that the actual growing stock is not depleted or gradually liquidated.

The estimated volume of forest available for logging will vary according to the silvicultural system employed and according to the average size and quality of timber to be produced. In Malaysia, under the current Selective Management System, a net volume of 30–40 m^3/ha (in some difficult terrains 50 m^3/ha) is usually adopted as the economic volume to be obtained at the time of logging. This estimated of volume must be periodically re-evaluated and re-adjusted, in keeping with changing silvicultural and economic requirements. Without any clear idea of what constitutes an economic growing stock of forest, sustained yield management is hardly possible.

In Malaysia, just like in other tropical countries, the concern to practice sustained yield management came about as a result of, firstly, diminishing forest resource base, mainly timber, due to extensive logging of natural forests, dependency on timber for export and partly due to unplanned conversion of forested land for agricultural and other related development; and secondly, inadequate resource replacement and development due to many reasons[135].

Since the late forties until mid-seventies, all lowland forests in Malaysia were managed under the Malayan Uniform System (MUS) and its variant as have been applied in Sabah and Sarawak. The MUS has been used as the silvicultural system in Malaysia. Under the MUS all trees greater than 45cm diameter at breast height (dbh) are removed in one single felling. This felling operation is followed by poison-girdling of defective relics and non-commercial trees down to a minimum dbh of 5 cm, in order to enhance growth of seedlings and saplings. This system has not been very widely applied in the form prescribed because of severe security restrictions that accompanied the emergency (1948–1960), and due to various other reasons, such as inaccessibility of the area concerned.

However, since the late seventies, most of the lowland forests have given way to agricultural development, and the bulk of present forest consists mainly of hill forest or lowland forests on relatively poor sites. The primary condition for the MUS, that is, the availability of an adequate, well-distributed stocking of seedlings of economic species, is generally not present in these remaining forests. The second condition for the MUS, that is, the ability to postpone logging in an area until the first condition can be met, is generally unenforceable. The third condition, that is, to carry out enrichment planting in areas where the first and second condition are not met, is not a practical or economic proposition because of the extensive areas involved, most of which generally become inaccessible within a year or so after logging has been completed.

Even if all these three conditions could be met, it would still have been necessary to critically review the objectives and relevance of the MUS in relation to other, mainly economic, factor present today. The objective of producing second and subsequent rotation dipterocarp forest, mainly from seedling regeneration (either natural or artificial) must be reviewed from the cost-benefit viewpoint (Tang 1980)[136]. The rather arbitrary definition of “economic or marketable” species, and continuing rapid depletion of tropical rainforests around the world have strengthened the argument for adopting a “conservational approach” to the silviculture and management of our forests. The traditional poison-girdling of “unwanted” tree species to make way for the more valuable “marketable” seedlings and saplings (if present) has come under increasing and stronger criticism in recent years, particularly as there is very little, if any, reliable evidence to show that the species of the trees being poison-girdled today will not become marketable by the time the seedlings or saplings for which they are being sacrificed, attain harvestable size.

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[135] Wan Razali Wan Mohd. 1994.Sustainable forest management in ASEAN with special reference to sustainable timber production in Malaysia. FRIM Reports No. 61. Forest Research Institute Malaysia (FRIM), Kuala Lumpur. 50pp.

[136] Tang, H.T. 1980 .Factors affecting regeneration methods for tropical forests in Southeast Asia.11th Commonwealth Forestry Conference, Trinidad.

3.0 A Move Towards the Selective Management System

These factors have resulted in the use of selective management system in Peninsular Malaysia and Sarawak. The use of trees of intermediate size classes to form the next rotation presupposes that these trees will be able to respond vigorously to the opening of the canopy through logging and, therefore, would yield higher growth increment.

In theory, such a system would offer several advantages, principally, a reduced cutting cycle and reduced total silvicultural costs. Such a system can be effectively applied only if the residual stand contains an adequate number of undamaged trees of "regeneration" species which are capable of responding vigorously to the "release" created by the logging operations.

Consequently, the Selective Management System (SMS) was introduced in Peninsular Malaysia to allow for more flexible cutting limits but nevertheless requires a residual stand at least 32 trees per hectare (currently commercial and undamaged tree of good form) of 30-45cm dbh or its equivalent be left behind after harvesting (Thang 1988)[137]. The system also discourages the girdling of trees and, hence, is very much environmentally and biologically preferred. Minimum cutting limits of 45 cm dbh for non-dipterocarps and 50 cm dbh for dipterocarps species have been fixed under this system. The cutting limits selected enable the management to expect a possible growing stock of at least 30–40 m^3 /ha net in a 30-year cutting cycle. This approach to forest management, not only helps to conserve the resource but sustain the yield in perpetuity. The SMS was acclaimed to be also practiced in Sarawak but with a 25-year cutting cycle. In Sabah the MUS is still being practiced with a cutting cycle of 60 to 80 years, but with modification to include a series of treatment applied to the forest before and after logging.

4.0 How Far Has The SMS Being Practiced?

Although in theory, the SMS would offer several advantages as mentioned before, its implementation on the ground is not without problems. In order to achieve the objective of the SMS it is necessary to ensure the following four activities:

(i) Pre-felling stand inventory;
(ii) Tree marking;
(iii) Residual stand inventory after logging is completed; and
(iv) Timber stand improvement (Silvicultural treatment)

Pre-felling inventory in the SMS aims at determining an economic cutting limit to produce about 30–40 m^3/ha net, and to leave at least 32 trees per hectare of 30–45cm dbh or its equivalent. Therefore, this inventory may result in a forest area to be left uncut for now on one extreme or to be completely clear-cut on the other extreme. How far this pre-inventory being practiced in Malaysia? It is very difficult to determine the extent of this practice. In many logging areas, the cutting limits were imposed without referring to the results of the pre-felling inventory which were usually analyzed by the Federal Forestry Department in the case of Peninsular Malaysia and by the State Forestry Headquarters in the case of Sarawak. The cutting limits for an area were simply set at the minimum level: 50 cm dbh for dipterocarps and 45 cm dbh for non-dipterocarps – just to comply with the concept of SMS. The reason for not referring to the results of the pre-felling inventory were at least two-fold,

(i) state/ district forestry department received the results very late and in some cases never recived them at all.
(ii) social and political elements highly influenced management and consequently this activity has been sacrificed at the expense of timber production and revenue maximization.

Tree marking was done on a limited scale for trees to be felled, but no tree marking at all for residual trees to be retained. The main reasons given for this activity not being carried out are the lack of manpower and high cost. Consequently, the need to ensure the marking of 32 residual trees per hectare to be retained is not fulfilled. The present concept and practice of SMS in Peninsular Malaysia

[137] *Thang, H.C. 1988. Selective Management System: Concept and Practice. Forestry Dept. HQ, Kuala Lumpur, Malaysia. 19pp.*

requires no marking of residual trees for retention (Thang 1988)[138]. This is a shortcoming in the present SMS as the marking of residual trees is necessary to ensure the retention of an adequate number of healthy and good form advanced regeneration as the future crop.

After the trees have been felled in a pre-determined direction, a residual stand inventory should be carried out so as to determine the quantity and state of damage to residual trees. This operations should be considered mandatory. Although in most cases this was done, the silvicultural treatments were often delayed. Furthermore, the guidelines on the SMS fell short of details on what would be necessary silvicultural treatments after the logging operation ceased.

5.0 Rehabilitating Logged-over Forests – A Much Needed Commitment

The period of 70s coincided with the rapid increase of the world's demand for tropical hardwoods which further stimulated logging activities in Malaysia (Table 2). Silvicultural treatments failed to keep pace, thereby leading to the accumulation of large areas of untreated forests. At the end of 1988, there were approximately 2.29 mil ha of logged-over forests in Peninsular Malaysia, 1.92 mil ha in Sarawak, and about 2.25 mil ha in Sabah (Table 3). These logged-over forests are within the permanent forest estates which form part of forest area for sustained yield.

Where needed, appropriate and timely silvicultural treatments, such as climber cutting and poison-girdling of bad form trees, have been carried out - and will have to continue – in order to improve logged-over forests and to enhance their future yield, consistent with the concept of sustained yield. At the end of 1988, about 0.99 mil ha of the logged-over forests in Peninsular Malaysia have been silviculturally treated. Sabah and Sarawak silviculturally treated about 0.40 mil ha and 0.26 mil ha respectively. Therefore, while much efforts have been directed to developing silvicultural and management systems, larger areas of logged-over forests are awaiting to be silviculturally treated, which constitute an enormous effort and commitment needed by the Government in order to ensure that these forests are to remain productive in perpetuity.

6.0 Sustaining Timber Resource: Will There Be Any Forests?

6.1 Peninsular Malaysia.

There is no doubt that the long-term productivity, renewability and sustainability of the forest in Peninsular Malaysia depend mainly on the productive portion of the PFE. As of January 1988, the total standing merchantable volume of all trees with diameter greater than 45 cm dbh was estimated at 525 mil m^3 in the Dipterocarp forest and 22 mil m^3 in the swamp forest (Forest Dept. 1989)[139]. It was observed that forests in the east coast states of Peninsular Malaysia were lightly and selectively logged compared to forests in the west coast states. The forests in the east coast states possessed a greater number of residual trees for the next cut, and formed likely areas to be managed on the 30-year cutting cycle. On the other hand, the west coast forests were logged more intensively leaving behind less trees for the next cut, and became more likely areas to be managed on 55-year cutting cycle.

The expected total outturn under the 5th Malaysian Plan period (1986–1990) annual coupe of the PFE was about 4.8 million m^3 annually. Of this volume, 2.65 mil m^3 comes from the 43 235 ha, that grows at the rate of 2.55 m^3/ha/yr and assuming a 20% harvesting loss managed under the 30-year cutting cycle. Another 2.15 mil m^3 comes from the 27 965 ha, that grows at the rate of 1.75 m^3/ha /yr and assuming a 20% harvesting loss, managed under the 55-year cutting cycle. Following relogging operations, which would be carried out in areas that are then available for second cuts, the supply of timber will then be available on a sustained basis.

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[138] Ibid. *Thang, H.C. 1988.*

[139] *Forest Dept. 1989. Sustained yield management in Malaysia. Unpubl. Paper. Forestry Dept. HQ, Kuala Lumpur, Malaysia. 18pp.*

Table 2. Area Logged in Malaysia (Figures in bracket represents average area logged/year).

Year	Total Area Logged in Hectare (PFE and Stateland Forests)		
	Pen. Malaysia	**Sabah**	**Sarawak**
1971 – 1975 (2nd Malaysian Plan)	1 830 000 (366 000)	1 501 000 (300 200)	240 000 (48 000)
1976 – 1980 (3rd Malaysian Plan)	1 592 000 (318 400)	1 139 000 (227 800)	520 000 (104 000)
1981 – 1985 (4th Malaysian Plan)	1 114 300 (222 860)	779 000 (155 800)	1 068 000 (213,600)
1986 – 1990 (5th Malaysia Plan)	1 176 168 (235 200)+	750 500 (150 100)+	1 341 000 (268 200)+
2011 – 2015 (10th Malaysian Plan)	(39 833++)	(60 000++)	(155 000++)
Total (end of 1990, exclude 2011–2015)	**5 712 468**	**4 169 500**	**3 169 000**

(Sources: Forestry Statistic 1971 to 1987. Forestry Department Headquarters, Peninsular Malaysia, Sabah and Sarawak)

++*Planned annual allowable cut (AAC) or harvest per year, showing reducing trend from 2nd Malaysian Plan to 10th Malaysian Plan.*

	P. Malaysia	Sabah	Sarawak
+Average	1986 : 247 700 ha	175 000 ha	293 000 ha
	1987 : 204 400 ha	215 000 ha	310 000 ha
	1988 : 250 500 ha	179 800 ha	251 000 ha
	1989 : 235 800 ha	125 700 ha	311 000 ha
	1990 : 237 600 ha	102 700 ha	319 000 ha

Table 3. Status of forested land in Malaysia as of December 1988
(Excluding National Parks & Wildlife Sanctuaries).

Status	Area (million ha)			Loggable forest (million ha			Year all undisturbed Forest logged			Year Logged-over Forest available for relogging		
	P.M'sia	S'wak	Sabah	P.M'sia	S'wak	Sabah	M'sia	S'wak	Sabah	P.M'sia	S'wak	Sabah
Permanent Forest Estate												
i) Undisturbed Forest	0.56	1.85	0.75	0.56	1.85	0.58	2002	2010	1995[3]	-	-	-
ii) Logged-over forest	2.29	1.92	2.25[1]	1.00	1.92	1.54[2]	-	-	-	2010	NA	2018
iii) Protective forest	1.90	0.83	0.35	-	-	-	-	-	-	-	-	-
Total	**4.75**	**4.60**	**3.35**	**1.56**	**3.77**	**2.17**						
Stateland Forest												
i) Undisturbed forest	0.16	3.60	0.85	0.16	NA	0.87	1994/95	2010	1994/95	Forest alienated for agricultural and other uses.		
ii) Logged-over forest	0.51			0.38	NA							
Total	**0.67**	**3.60**	**0.85**	**0.54**	**NA**	**0.87**	**-**	**-**	**-**	**-**	**-**	**-**

NA: Not Available

Sources: KPU (1989). Malaysian Rainforest: A Living Resource
KPU (1989). Forestry in Malaysia.

[1]Of this, 1.92 million ha is in CFR; Made up of loggable forest stands (1.54 million ha) and treeless and shifting cultivation areas (0.71 million ha)
[2]Comprise:
(1) Good stands (Stratum I) : 285,000 ha, standing volume >140 m^3 /ha
(2) Average stands (Stratum II) : 260,000 ha, standing volume 100-140 m^3 /ha
(3) Poor stands (Stratum III) : 533,000 ha, standing volume 50-100 m^3 /ha
(4) Very poor stands (Stratum IV) : 460,000 ha, standing volume 0-50 m^3 /ha
[3]With the exception of about 685,000 ha within the Sabah Foundation Concession areas

The general trend in Malaysia is a declining forest area for timber production, i.e. the PFR or PFE. Notwithstanding the reduction of forested areas, our policy analyses have indicated a favourable scenario in ensuring the continuous supply of timber from sustainably managed forests. In Peninsular Malaysia, forest management had been practiced to sustain:

(1) A minimum commercial logs production of :
- 3.2 mil m^3/year from 1991 to 1995, and
- 2.7 mil m^3/year from 1996 until the year 2011,

from the undisturbed (virgin) natural forests in accordance with the set annual allowable cut (AAC) - (Figure 3).

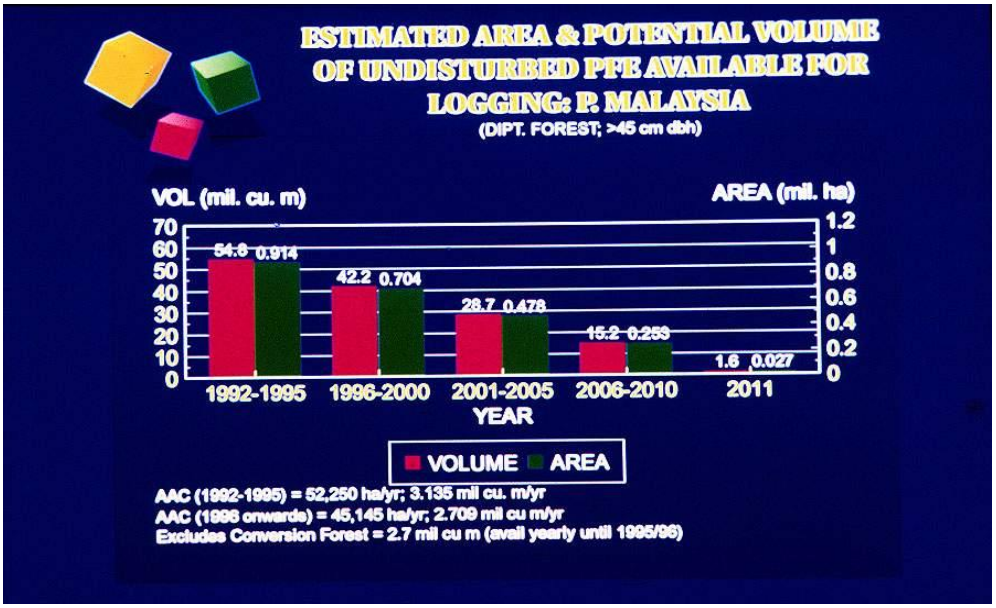

Figure 3. Estimated area and potential volume of undisturbed PFE available for logging in Peninsular Malaysia.

2. A continuous production of commercial logs from second cycle natural forests managed under MUS/ SMS, about

- 12 mil m^3 in 2012 to about 6 mil m^3 in 2020 (Figure 4),

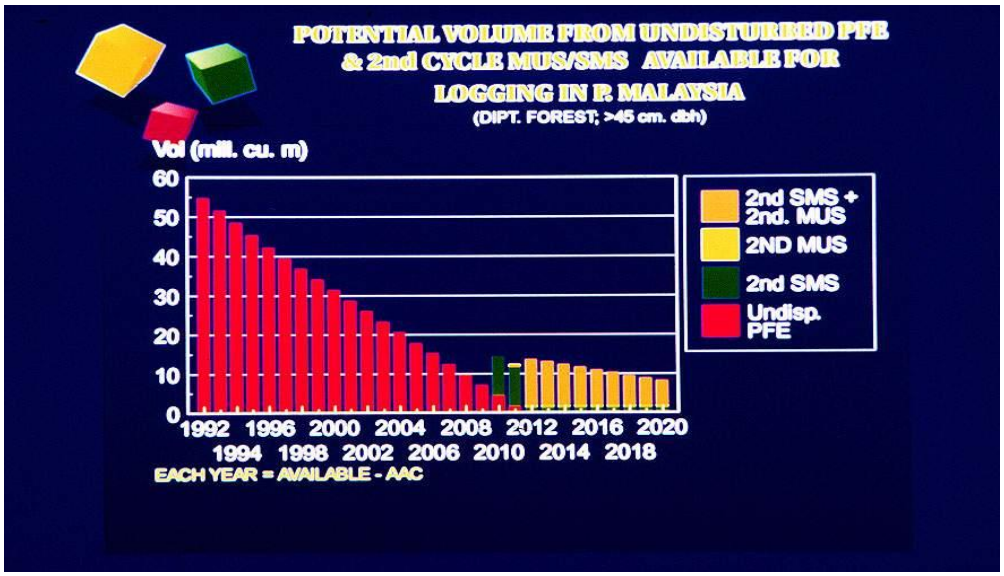

Figure 4. Potential volume of undisturbed PFE and second cycle MUS / SMS available for logging in Peninsular Malaysia.

3. A further production of commercial logs from second cycle natural forest managed under MUS until the year 2045 (Figure 5)

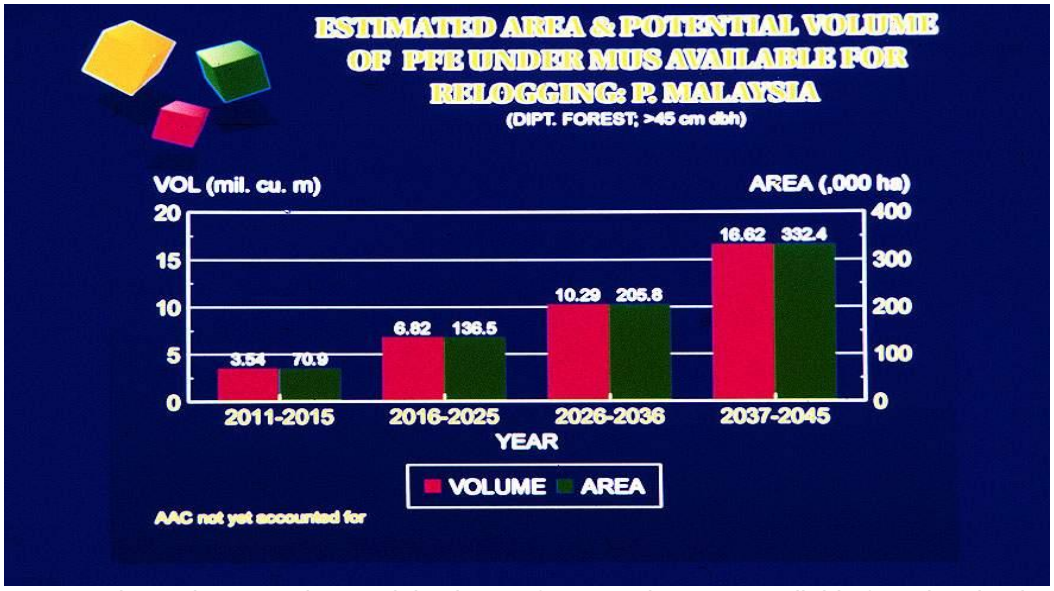

Figure 5. Estimated area and potential volume of PFE under MUS available for relogging in Peninsular Malaysia.

4. A complementary supply of commercial logs from both plantations of Acacia and rubber,

- between 1 to 3 mil m^3/year from the year 2000 onwards (Acacia); and
- about 1.5 to 2 mil m^3/year from 1994 onwards (Rubberwood).

From Table 4, the current timber production from the natural forest had more than sustain the domestic consumption until the year 2000. The availability of rubberwood logs and plantation logs is an added bonus to Peninsular Malaysia. However, in the year 2015, the timber production from natural forests alone would not be enough to sustain the domestic consumption, but with the availability of logs from plantation forests and rubber plantations domestic consumption can be created for easily.

The timber processing activities for export demand will have to get logs from elsewhere to keep mills in production. By the year 2015 about 3 mil m^3 of logs are expected from the plantation forests. This is important as the log supply from natural forest will no longer meet even the domestic consumption.

By the year 2020 at least 0.47 mil ha (out of a total of 1.87 mil ha) of logged-over forests within the PFE will be available for relogging as they were managed under Malayan Uniform System under a 55-year cutting cycle and were harvested well before 1966. The only question that remains is whether the forest at the end of the cutting cycle will yield the expected volume.

Current research by FRIM, in cooperation with Forestry Department, Peninsular Malaysia indicates that forests, logged and managed under the Malayan Uniform System (MUS) in the 1960s and early 1970s, which formed the bulk of the present logged-over forests, are capable of producing a mean annual increment (MAI) of 1.0 m^3/ha/year (Wan Razali 1989)[140]. Hence, the expected total outturn after allowing for a 20% harvesting loss (high stumps, short-log, damage, etc.) is estimated to be 44 m^3/ha after 55 years.

[140] *Wan Razali Wan Mohd (1989). The environment and forestry: problems, prospects and outlook. Info paper, PECC VII, Nov 12–15, 1989, Aucland, New Zealand. 7pp.*

Table 4. Projected sustainable log production and domestic consumption and export demand up to the year 2015 compared with 1987 (mil m^3 – roundwood equivalent).

Region	Year	Sustainable log supply			Domestic consumption[4]	Export demand[5]		Supply avai. minus domestic consump.	Supply avai. minus domestic consump. & export Demand
		Natural Forest	Plantation Forest	Rubber Plantation		Logs	Processed Products	Surplus (+) Deficit (-)	Surplus (+) Deficit (-)
Peninsular Malaysia	1987	8.06	-	1.16	3.69	0.054	5.78	+ 5.97	+ 0.14
	1995	4.80	-	2.4[1]	4.29	0.020	6.98	+ 2.91	- 4.08
	2000	4.80	1.13	2.6[1]	4.66	0.020	6.98	+ 3.87	- 3.12
	2015	4.80	3.00	2.0	5.76	0.020	6.98	+ 4.04	-2.95
	Perpetuity	5.70	2.30[2]	2.0	-	-	-	-	
Sabah	1987	11.50	-	-	0.35	7.50	1.98	+ 11.15	+ 1.67
	1995	1.67	3.00	-	0.41	8.50	2.85	+ 4.26	- 7.09
	2000	1.24	4.00	-	0.44	8.50	2.85	+ 4.80	- 6.55
	2015	2.80	8.10	-	0.55	8.50	2.85	+ 10.35	- 1.00
	Perpetuity	4.50	4.68[3]	-	-	-	-	-	
Sarawak	1987	13.66	-	-	0.41	12.64	0.18	+ 13.25	+ 0.43
	1995	10.15	-	-	0.49	10.00	0.70	+ 9.66	- 1.04
	2000	10.15	-	-	0.53	10.00	0.70	+ 9.62	- 1.08
	2015	7.00	-	-	0.65	10.00	0.70	+ 6.35	- 4.35
	Perpetuity	7.54	-	-	-	-	-	-	
Malaysia (Total)	1995	16.62	3.00	2.4	5.19	18.52	10.53	+ 16.83	- 12.22
	2000	16.19	5.13	2.6	5.63	18.52	10.53	+ 18.29	- 10.76
	2015	14.60	11.10	2.0	6.96	18.52	10.53	+ 20.74	- 8.31
	Perpetuity	17.74	6.98	2.0	-	-	-	-	-

[1][See: FRIM Reports No.49 (1988) – pg. 29: Columns 3 & 5, allowing 10% harvesting loss]
[2]Based on 188,000 ha and rotation period of 15-years for sawlog production with a net volume of 180m^3 /ha
[3]Based on 390,000 ha and rotation period of 15-years for sawlog production with a net volume of 180m^3 /ha
[4]Domestic consumption based on average per capita wood consumption of 0.27m^3 and 2% population increase per year (base year 1987)
= 13.684 million people – Peninsular Malaysia
= 1.305 million people – Sabah
= 1.555 million people – Sarawak
[5]Export demand assumed constant. Processed products include timber, plywood, veneer, and moulding.

Since late 1970s and until the present time, the MUS had given way to the Selective Management System (SMS) in the hill dipterocarp forest of Peninsular Malaysia. The traditional MUS was found to be unsuitable for managing hill dipterocarp forest because of the comparatively more difficult terrain, uneven stocking, and sparse natural regeneration. Forest logged and managed under the SMS were found to respond differently in diameter and volume growth, depending on the basal area or volume removed at the time of logging. Present studies indicate that forests logged and managed under this system are capable to produce an average of 2.5 m^3/ha/year over the 30-year cutting cycle if given appropriate and timely silvicultural treatment to residual stands. Hence, the expected outturn after allowing for a 20% harvesting loss would be 60 m^3/ha.

Therefore, with the above arguments and that the areas logged in 1960s and early 1970s (under MUS) are best managed on a 55-year cutting cycle and that the areas logged in late 1970's and 1980's (under SMS) are best managed on 30-year cutting cycle, then Peninsular Malaysia will have three sources of log supply from its natural forests by the year 2020:

(iv) from the existing remaining natural forests within the PFE,

(v) from the regenerated forests, logged and managed under the SMS with 30-year cutting cycle [note that the forests logged and managed under SMS with 30-year cutting cycle will re-loggable as early as the year 2010], and

(vi) from the regenerated forests logged and managed under MUS (about 470 000 ha available by the year 2020).

That the natural forests of Peninsular Malaysia are capable of sustained and increased productivity is not seriously in doubt at least from a technical point of view. The 2.85 mil ha of forests, out of which 1.30 mil ha are to be managed on a 30-year cutting cycle and 1.55 mil ha on a 55-year cutting cycle, will be able to sustain production in perpetuity of not less than 3.84 mil m^3/year of log: 2.60 mil m^3 from the 1.30 mil ha and 1.24 mil m^3 from 1.55 mil ha respectively. Meanwhile, the production of plantation logs will play a much significant role to support the existing and future domestic consumption and export oriented wood-based industries. The above management scenario, supplemented by the plantation forests and rubberwood will no doubt give Peninsular Malaysia an advantage or an edge in sustaining its resources, thus ensuring the supply of timber in perpetuity.

6.2 Sabah

Under the Sabah Constitution, forestry is a state matter and forestry development plans are formulated as the state level. These plans are prepared within the overall perspective of national development objective and strategies.

The continuous "mining" of the state's primary forest resources may present a bleak prospect on the future of the state if left unchecked. In 1975 the total forest areas was 5.54 mil ha or about 74.9% of the total land in Sabah. In 1987 the areas have been reduced to about 4.44 mil ha or 60.3% of the total land area. In 2010, the area is further reduced to 3.60 mil ha of PRF. However, of significant importance is the gazettment of 3 348 641 ha (about 45.4% of the total land area) as Permanent Forest Reserves (PRF) in consonance with the National Forest Policy of Malaysia. These stateland forests would ultimately be logged for non-forestry uses. As January 1988, Sabah has approximately 272 mil m^3 and 14 mil m^3 of standing merchantable volume (greater than 45 cm dbh) in Dipterocarp and swamp forests respectively (Forest Dept. 1989)[141].

Sustaining the future: The long term productivity, renewability and sustainability of Sabah's natural forests depend on the PRF's productive portion [Commercial Forest Reserve (CFR)] which is about 2.67 mil ha or 36.3% of the total land area. Additionally, the stateland forests are also available for commercial logging but its production will not be sustained as they have been allocated for other purposes. At the end of 1987, about 4 mil ha (Table 2) of both CFR and stateland forests have been logged

[141] *Forest Dept . 1989. Sustained yield management in Malaysia. Unpubl. Paper. Forestry Dept. HQ, Kuala Lumpur, Malaysia. 18pp.*

The timber industry of Sabah is traditionally oriented the export of round logs. The typical "exploit and export" phase of forest development is characterized by a harvest rate in excess of the productive capacity of the forest, a rate which depends initially on the standing timber in unlogged primary forests. This is evident from the fact that the long-term sustained yield level prescribed for the forests in Sabah is only 2.5 mil m^3/year (although the long term sustainable timber supply is about 4.5 mil m^3/year – Table 4) whereas the timber requirements by the existing industry about 3 mil m^3/year. Inspite of this, the actual production has been steadily on the increase, averaging about 10 mil m^3 in the last two decades.

It is evident from the above total log production figures and from Table 4 that beyond 1991 the timber from natural forest will still be sufficient to meet the domestic consumption. As Sabah continues its policy to export about 8 mil m^3 of logs and about 3 mil m^3 of processed products (Table 4), then Sabah faced a critical supply problem around year 1995. This deficit cannot be even supplemented by the supply from forest plantation.

6.2.1 Forest plantations: The future resource of Sabah

The log production from forest plantations of fast-growing exotic was able to supplement the shortfall in the supply of logs from natural forests by 2015. By the year 2015, Sabah is expected to produce about 8 mil m^3 of plantation log and many fulfil the export quota to about 7.5 mil m^3/year (Table 4). Two questions that remain are whether the market will accept these plantation logs and, if so, at what price.

The sustainability of forest resources from Sabah in the year 2015 looks bleak provided that the:

(iv) current level of activities within the timber industry is maintained,

(v) timber from plantations are suitable for the current timber industry, and

(vi) log export target can be reduced in consonance with the sustainable log supply.

Any increase in the present level of industrial activity will result in increased rate of depletion of natural forests, unless the market is able to accept more intensive use of species that are currently no so "marketable". However, the present forest plantations in Sabah will not be sufficient in view of the anticipated increase in the level of wood-base industry, especially beyond the year 2000.

The natural forests of Sabah are capable of increased and sustained productivity, at least from a technical point of view. The long-term sustainable timber production of the CFR, estimated at about 4.5 million m^3 will be available by the year 2018 (30-year cycle) when the present CFR would have regenerated and ready for harvest (Table 3). Meanwhile, the production from plantation forests will play a much more significant role to support the wood-based industries. Beyond the year 2010, the sustainable management of both of natural forests and plantation forests will definitely be important as to supply the resources in perpetuity of the state of Sabah.

6.3 Sarawak

Sarawak is about 69% larger than neighbouring Sabah in terms of its land area. It is to be noted that different sources provide conflicting estimates of the total forested areas, often differing by as much as 1 mil ha. Recent figure (for the year 2011) from Forestry Department, Sarawak[142] indicates that about 8.53 mil of its 12.38 mil ha land area are forested, although an area of about 6.1 mil ha forests is still being quoted[143].

[142] *Wan Razali W.M. .2013. Preparation of the guidelines and procedural documents on planning of forest resource inventory in Sarawak with the application of hyperspectral technology.*

[143] *Ibid. Abd. Rahman Abd. Rahim. 2012*

6.3.1 Sustained yield natural forest management: An achievable goal for Sarawak?

Peat swamp forests have been exploited for decades. By now, most of the valuable stands of Ramin may have been logged, although a significant amount of commercially desirable but silviculturally difficult to treat *Shorea albida* still remains. The forest industry is a key element in the national economy as current and potential agricultural development is limited to approximately 22% of the total land area due to poor or restricted soil suitability. .

As of 31 December 2011, 4.15 mil ha has been designated as Permanent Forest Estate (PFE) for sustainable forest management practices, with the aim of increasing it to 6 mil ha; 0.49 mil ha for Totally Protected Area (TPA), with the aim of increasing it to 1 mil ha; and the remaining areas (3.89 mil ha) fall under the category of stateland forest. There are, however, a number of important factors which may affect the implementation of sustainable forest management, and hence sustained timber yield, in Sarawak. One of the most important factors is shifting cultivation which is regarded an impediment to such efforts. As logging roads penetrate further into the forests, shifting cultivation spreads beyond the navigable river valleys where it has been traditionally practiced. Areas which have been converted to shifting cultivation will no longer contribute to sustainable management of forest in Sarawak. Short term licenses of 5–10 years duration do not promote sustainable forestry practices either. Furthermore, difficulties in enforcement of rules and regulation due to a lack of infrastructure and accessibility problem in the state, are further constrains to sustainable forest management.

6.3.2 Future timber harvest: The Sarawak scene

Present and future harvests in both swamp and hill forest come from two sources:

(1) virgin or old growth forests, and

(2) logged-over forests.

Since the 1970s, Sarawak had logged more than 3 mil ha of its forests (Table 2). The current production rate of logs from Sarawak forests is about 8 mil m^3/year[144]. Selective harvesting in the hill forests removes between 6–10 trees/ha. The hill forests produce an average gross volume of 44 m^3/ha and the swamp forests produce an average gross volume of 62 m^3/ha. At this rate of harvesting, the remaining hill forests (both the PFE and stateland) are expected to last for 22 years, that is by the year 2010 (Table 3). Relogging operations of the regenerated forests would continue to supply timber on a sustained basis. However, this timber still will not be enough to sustain the planned export production of 10 mil m^3/year after 1990.

Assuming that the current processing capacity remains unchanged, there will be an excess supply of 9 mil m^3/year from the natural forests to meet log export demand (Table 4). Sarawak will face a critical supply shortage scenario by the year 2015 by about 4.4 mil m^3 if the annual log export target of 10 mil m^3 is to be achieved. Although Sarawak can still sustain its local and domestic processing consumptions, by then the planned export production of 10 mil m^3/year will have to be revised in accordance with the sustainable timber production of the forest of about 7.5 mil m^3/year. In the case of Sarawak, the shortfall in production from both swamp and natural forests cannot be supplemented by the resources from plantation forests. In Sarawak, a priority is given to the management of the natural forests for ecological and economic reasons. Plantation forests are only established on areas inside the PFE which have been disturbed by shifting cultivators. A planned target to plant about 2,000 ha/year is unlikely to be achieved and even if achieved, it is too small and too late to have any impact.

The long term annual harvestable increment of Sarawak natural forests is about 2 m^3/ha/year. With only 4.15 mil ha in PFE, of which only 3.77 mil ha are productive, the long term average sustainable timber production would be around 7.5 million m^3 per year. This considerably less than the present level of log production which has averaged 8–10 mil m^3 annually. From the year 2000 to 2015 the productive forests of Sarawak will be able to produce only about 7 million m^3 of log/year, gradually increasing to about 7.5 mil m^3 in perpetuity. This critical stage needs a second look or evaluation by

[144] *WWF . 2012. WWF-Malaysia Strategy 2012–2020, p. 5.*

the Sarawak Government, perhaps having to change it export target to that of what the forests can sustain annually (Table 4).

7.0 Summary

7.1 Forest management for sustainable log supply: The country's perspective.

As much as the Government of Malaysia pledged to ensure that at least 50% of its land area remains permanently under forest cover[145] The forest area of Peninsular Malaysia had been in a state of flux: from 20.10 mil ha in 1988 to 18.48 mil ha in 2011, then fluctuating between the years 1989 to 2010 as shown in Table 5.

Table 5. Changing Forest Area of Malaysia.

Year **Hectare** (%)*	**Year** **Hectare** (%)*
1988 ~ 20.10 mil ha (61%)	2003 ~ 19.54 mil ha (59%)
1989 ~ 19.47 mil ha (59%)	2005 ~ 18.31 mil ha (56%)
1992 ~ 19.15 mil ha (58%)	2007 ~ 18.23 mil ha (56%)
1994 ~ 19.00 mil ha (58%)	2010 ~ 20.46 mil ha (62%)
1996 ~ 18.87 mil ha (57%)	2011 ~ 18.48 mil ha (56%)
Approval and adoption of National Forestry Policy 1978 (Revised 1992)	
Enactment of National Forestry Act 1984 (Amended 1993)	**(of total land area: about 33 million hectares)*

In many developed countries, the area of forest is now increasing after long periods of decline. It is quite difficult to categorise Malaysia as having forest transition or otherwise due to its fluctuating forest areas as presented above. However, if one broadens the perspectives of forest transition to include, *a shift from unsustainable to sustainable forest management or a change for the better forest management, utilization and conservation,* then Malaysia can be considered as transiting towards a sustainable forest management. From the perspective of log production, can Malaysia sustain it?

From the above discussion, Malaysia had no doubt able to sustain its log production from natural forests until 1995 (Table 4). With this available log supply, all the three regions (Peninsular Malaysia, Sabah and Sarawak) were able to meet their domestic consumptions for logs, with Sarawak being able even to meet the domestic processing requirement for export of processed or secondary products. Sabah, on the other hand, had to depend on plantation logs to meets its domestic processing requirements for export of secondary products.

The entire country will be able to sustain its domestic consumption and the export of processed timber through the year 2015. Further analysis by FAO (2011)[146] indicates the following scenario:

"In the period 2011–15, total annual log production is projected to be 29.2 mil m^3. Production from natural forests will decline to 15.5 mil m^3 but the harvest from forest plantations will grow to 11.8 mil m^3, with most of the expansion occurring in Sarawak (and 1.90 mil m^3 will also be harvested in rubber plantations). In the period 2016–2020, annual natural forest production will decline to 11.5 mil m^3, while production from plantations will increase to 16.1 mil m^3. Thus, annual log production from natural

[145] *Greening of the world to a better living-siri ucapan penting: Jabatan Perkhidmatan Penerangan Malaysia, Kementerian Penerangan Malaysia, May 1992, p.16*

[146] Ibid. *FAO .2011.*

forests is expected to decline from 19.3 mil m^3/year in 2006 to 11.5 mil m^3 in 2020, but total log production (i.e. from natural and planted forests combined) will increase. Over the period, the decline in annual log production in the PFE in Peninsular Malaysia, Sabah and Sarawak will be due mainly to the introduction of more conservative forest-harvesting practices and stringent enforcement. Most of the projected decline in natural-forest production in Sarawak (from 11.5 mil m^3/year in 2006–10 to 8.0 mil m^3/year in 2016–2020) is due to a reduction in log production from non-PFE natural forests. There will be a slight reduction in the harvest in the PFE, from 8.5 mil m^3 to 8.0 mil m^3."

7.2 Conclusions: What can be done?

Forest in Malaysia has been regarded in the past as an inexhaustible land reservoir for conversion to other uses and as a storehouse of raw material to be turned to liquid assets, whereas, in fact, they are the country's most valuable resource (renewable) for the supply in perpetuity of many vital goods and services.

The looming problems of expected timber shortage are not of course without solutions. It can be avoided given the social and political will. In fact, prudent decisions taken may not only avert disaster but may even create opportunities for a bigger industry. The key lies in the proper management of the forest resources, its conservation, its utilization, and its sustainable development. There is a need to review critically today's policies if Malaysia's timber sector is to be sustained, vis-à-vis:

(i) It is imperative for the Government to review the policies
- on logging especially with respect to the annual cut and to ensure that the land remains in forest use after harvesting/ logging, and
- on log export with the aim of restricting such activity;

(ii) There is a need to accelerate, especially in Sabah and Sarawak, a programme of industrialization into downstream activities for higher value added products;

(iii) There must be sufficient efforts and funds allocated for reforestation of the logged-over forests to ensure continued productivity;

(iv) Effort must be taken to silviculturally treat the logged-over forests to ensure higher productivity per unit basis;

(v) There is still considerable wastage during logging and processing stages. Such harvesting losses are estimated to be as high as 40% of the commercial volume in Peninsular Malaysia. Bigger losses are likely to occur in Sabah and Sarawak. Similarly, recovery rate for processed wood is low as 30% of the utilisable volume. Concerted effort should be aimed reduce such losses and wastage; and

(vi) Concerted effort must be given to ensure the success of industrial forest plantations in order to offset the anticipated shortfall from the natural forests. Establishment of plantation of high value and market proven or speciality timber species must also be encouraged.

Many other policies, strategies and actions can be taken to avoid the expected timber shortage and at the same time to promote sustainable forest management practices. The problem of shifting cultivation, the current forest policy and administration, the present forest management and silviculture operation, and the need to have stronger research capabilities must be given due attention and appropriate action taken for Peninsular Malaysia; more so for Sabah and Sarawak.