Manuscript received Aug. 5, 2007; revised Feb. 5, 2008

Sustainable Forest Management Practices and Environmental Protection in Malaysia

KAMARUZAMAN JUSOFF
Faculty of Forestry
Universiti Putra Malaysia, Serdang 43400 Selangor
MALAYSIA
E-mail: kamaruz@putra.upm.edu.my http://www.upm.edu.my

DATO' HJ. DAHLAN HJ. TAHA
Forestry Department
Peninsular Malaysia Forestry Department Headquarters
Ministry of Natural Resource and Environment, Malaysia
Jalan Sultan Salahuddin
50660 Kuala Lumpur
MALAYSIA
E-mail: dahlan@forestry.gov.my http://forestry.gov.my

Abstract:-. Malaysia has large tracts of forest which have been converted to give way to settlements and agricultural and industrial areas. Despite logging is still being carried out annually, Malaysia can still boast to be able to maintain and protect the environment through vast areas of forested land as Permanent Reserved Forest which account about 14.39 million ha or 43.8% of its total land area at the end of 2006. At the same time forestry sector's share of GDP is 1.10% in 2006, and has contributed significantly to the economic growth and development of Malaysia through foreign exchange, employment opportunities, industrial development and revenue to the State Governments. How does Malaysia achieve this? The answer is through Sustainable Forest Resource Management (SFM). SFM involves not only the continuous functions and services provided by forest but also about meeting the global concerns and expectations in managing the forest with greater emphasis on environmental protection and conservation of biological diversity. Subsequently forest certification was introduced as market incentive to improve the quality of forest management including protection of environment. In this connection, Malaysian Criteria and Indicators were also formulated to enhance social and environment aspects; compliance of the activities will be rewarded with certificate. To date, 8 timber producing states in Peninsular Malaysia have been awarded the certificate by Malaysian Timber Certification Council after being assessed by independent assessors. Issuance of forest management certification manifested itself our commitment towards sustainable forest management through the three pillars viz, economically viable, socially well-aware and environmentally sound. Thus, the practice of SFM by Forestry Department Malaysia has proven that in managing the forest resource we are also able to protect the environment.

Key-Words: - Sustainable forest management, Tropical forest resources, Environmental protection, Forest certification, Forest harvesting

1 Introduction

Malaysia's forests are inhabited by over 8,000 species of flowering plants [1], of which over 2,500 are tree species [2] with an estimated 290 species reaching harvested size of at least 45 cm diameter

Manuscript received Aug. 5, 2007; revised Feb. 5, 2008

at breast height, thus making it one of the 12 countries endowed with extensive areas of valuable natural tropical rainforest of complex ecosystems. Forest being renewable resource has contributed significantly towards economic growth and development of Malaysia through foreign exchange earnings, Gross Domestic Product (GDP) growth, employment opportunities, government income and forest based industries.

According to International Tropical Timber Organization [3], sustainable forest management is defined as the process of managing permanent forest land to achieve one or more clearly specified objectives of management with regard to the production of a continuous flow of desired forest products and services without undue reduction of its inherent values and future productivity and without undue undesirable effects on the physical and social environment while FAO (1993) defines it as one which ensures that the values derived from forest meet present day needs while at the same time ensuring their continued availability and utilization to long-term development needs.

Sustainable Forest Management (SFM) is impossible to achieve if a country does not have a management system. In this regard, the use of more systematic approach in managing the forests in Peninsular Malaysia began in 1901 when the first Forest Officer was appointed [4].Since then, forest management practices in Peninsular Malaysia had been subjected to constant review and refinement so as to ensure their suitability in achieving forest renewal and sustained yield. This clearly reflected in the succession change of forest management practices used, from the Departmental Improvement Felling (DIF) in the 1920's, to Malayan Uniform System (MUS) in the late 1940's and to the Selective Management System (SMS) in the 1980's. In response to the needs to promote SFM, the Forestry Department Peninsular Malaysia has produced the Malaysian Criteria and Indicators (MC&I) that clarify major activities that have to be complied with sustainable basis. To ensure that the forest is better conserved, the annual coupe in Peninsular Malaysia has been scaled down for each Malaysian Plan starting from the 4th Malaysia Plan (1981-1985) of 74,869 ha/year to 36,940 ha/year under the 9th Malaysia Plan (2006-2010). However, understanding the limits of the forest ecosystem and reduce annual coupe are not sufficient to ensure the achievement of SFM. According to [4], several other critical factors that are deemed to be essential need to be addressed include forest policy and legislation, securing the Permanent Reserved Forest, integrated forest planning and management, harvesting control, research and development, and institutional frameworks.

Considering the significance of forests to the socio-economic development of nations and the maintenance of the environment, this paper focuses on Malaysia's experience especially actions taken by Forestry Department Peninsular Malaysia (FDPM) in managing the forest resource and protects the environment through SMS practices. As a result of changing values and priorities, there is now an increased recognition of the environmental, conservational and protective roles of forest, such as in the regulation of climatic and physical conditions, the safeguarding of water

Manuscript received Aug. 5, 2007; revised Feb. 5, 2008

supply, the maintenance of soil fertility, the provision of aesthetic and recreational amenities, as well as the conservation of biological diversity. These roles may be at the local, national, regional or even at the global level. The shift in management from solely sustained yield timber production to multi-functions forestry indicates our commitment to manage the forest in a holistic and balance manner.

2 Forest Resources & Legislation

Malaysian forest has been acknowledged to be amongst the most complex ecosystem in the world. The natural forests of Peninsular Malaysia can be classified into seven major forest types namely the Lowland Dipterocarp Forest (300m above mean sea level), Hill Dipterocarp Forest (altitudinal limits of 300m and 750m), Upper Dipterocarp Forest (altitudinal limits of 750m to 1,200m), Lower Montane Forest (altitudinal range of 1,000-1,500m), Upper Montane Forest (altitudes of less than 1,500m), Peat Swamp Forest and Mangrove Forest. Except for Lower Montane and Upper Montane Forests, the rest are commercial forests subjected to altitudinal limits.

As at the end of 2004, the total forested area in Malaysia was estimated to be 19.52 mil.ha or 59.5 % of the total land area. Of this total, it is estimated that some 17.15 mil.ha are the inland dipterocarp forests, with the remaining 1.54, 0.58 and 0.25 mil.ha being peat swamp forest, mangrove swamp and plantation forests respectively.

In order to maintain the important role of forests in contributing to socio-economic development, the conservation of soil, water and wildlife; and environmental protection, it is pertinent to set aside a total of 14.45 mil.ha (44% of land area or 74% of forested area) of its natural forests as the Permanent Reserved Forests (PRF) under full protection to be managed and developed under sustainable forest management. The forest management is in turn being assessed under the forest certification program using the Malaysian Criteria and Indicators (MC&I), the essence of which is to conduct good forest practices socially, economically and environmentally.

3 Institutional Provisions

3.1 Forest Policy

Under Article 74 (2) of the Federal Constitution, forestry comes under the jurisdiction of the respective State Governments. As such, each state is empowered to enact laws on forestry and to formulate forestry policy independently. The executive authority of the Federal Government only extends to the provision of advice and technical assistance to the states, training, the conduct of research and in the maintenance of experimental and demonstration stations. Sound forest policy and legislation is important for the efficient management, conservation (including soil and water) and utilization of forest resources. In this respect, a National Forest Policy was formulated and accepted by National Forestry Council (NFC) in 1977. The NFC serves as a forum for the Federal and the State Governments to discuss and resolve common problems and issues relating to forestry policy, administration and management. The decisions made in NFC are subjected to the State Governments to implement unless it is within the authority of the Federal Government. The National Forest Policy 1978 was later revised in 1992 to address and incorporate concerns raised

Manuscript received Aug. 5, 2007; revised Feb. 5, 2008

by both the local and world communities on the importance of the conservation of biological diversity, sustainable utilization of genetic resources, and the role of local communities in forest development [5].

3.2 Forest Legislation

To ensure effective implementation of the National Forestry Policy 1978, the National Forestry Act 1984 was formulated to strengthen in areas of forest management planning. In tandem with the revised National Forestry Policy 1978 (Revised 1992), the National Forestry Act, 1984, was amended in 1993. One of the most important sections under National Forestry Act (NFA) 1984 is Section 10. Except for Subsection 10(1) (a) which is for timber production under sustained yield, all the remaining 10 functional classes are for purposes of protection and according to the purpose or purposes for which the land is or intended to be used for soil protection forest, soil reclamation forest, flood control forest, water catchments forest, forest sanctuary for wild life, virgin jungle reserved forest, amenity forest, education forest, research forest and forest for federal purpose.

Perlis, Kelantan and Selangor states have amended the Act to add one more class, the 12th i.e 10(l)(l) State Park Forest. The classification of the PRFs are also based on parameters such as altitude, slopes, habitats, ecology, landscape features, education and research needs [6]. Thus, the PRFs will be further protected by the existence of National Forest Policy, supported by National Forestry Act and further classifying it into functional classes.

3.3 Forest Management

3.3.1 Management Practices

In managing the natural tropical forests of Peninsular Malaysia, the forests are classified into three broad forest types, namely Dry Inland Forest or Dipterocarp Forest, Peat Swamp Forest and Mangrove Forest. Except for mangrove forest, the forests are managed under two management systems either Selective Management System (SMS) for 30 years rotation or Malayan Uniform System or Modified Malayan Uniform System (MUS) for 55 years rotation. Under MUS all trees down to 45 cm diameter breast height (dbh) are removed in one single felling, while SMS encompasses the selection of cutting regimes based on pre-determined stocking and residual stand. Under both systems, a pre-felling inventory is conducted to determine the stocking and size-class distribution of the forest prior to harvest.

Previously, under the SMS, the cutting limit prescribed for the group of dipterocarp species would not be less than 50cm dbh, except for *Neobalanocarpus heimii* (Chengal) where the cutting limit would be above 60cm dbh, while the cutting limit prescribed for the group of non-dipterocarp species would not be less than 45cm dbh. Based on the decision of the 18th NFC held in 2004, the new cutting limits prescribed for Dipterocarp and Non-Dipterocarp is 65cm and 55cm respectively; for Chengal the new cutting limit is 70cm dbh. The increase in cutting limits is based on studies on growth and yield plots that most commercial tree species still growing until 80cm dbh.

Currently, the Peat Swamp Forest in Peninsular Malaysia is managed under the 'modified' SMS where higher cutting limits are prescribed and rotation cycle of 40 years

Manuscript received Aug. 5, 2007; revised Feb. 5, 2008

due to a lower stocking of natural regeneration in the stand. Research and development efforts are currently being taken to formulate more effective management system for this forest type in collaboration with Denmark International Development Agency (DANIDA) and United Nation Development Project (UNDP)/Global Environmental Facility (GEF).

In Peninsular Malaysia, the Mangrove Forest is managed under cutting cycles varying between 20 to 30 years in which mature trees are clear-felled with the retention of seven mother trees per hectare, and a three meter wide river bank and coastal strip for ensuring adequate natural regeneration and in the protection of the environment. In fact, Matang mangrove forest in Perak has been considered as the best managed mangrove forest in the world for its sustainability particularly in the production of poles and charcoal.

The present strategies of managing the natural forest, has led ITTO to conclude in its *1995 Mid-Term Review of Progress Towards the Achievement of the Year 2000 Objective* that Malaysia was one of three countries that were on track to achieve sustainable forest management in the overall context of the ITTO Year 2000 Objective [7]. Thus, ITTO's recognition of our Sustainable Forest Management, in itself is a manifestation of our good forest practice.

3.3.2 Harvesting Practices

Forest harvesting practices can be divided into three stages namely pre-harvesting, during harvesting and post-harvesting activities. The pre-harvest involve demarcation of boundary, pre-felling inventory, determination of cutting limits and timber tagging. During harvesting it involves road construction and directional felling while post-harvesting activities include evaluation after logging, post-felling inventory and prescription of silvicultural treatments.

Prior to pre-felling, a demarcation of boundary is carried out to ensure only approved areas are harvested and no encroachment occurred. A pre-felling inventory of 10% is conducted to provide reliable estimate of tree species population. The assessment includes sampling of all tree species 5cm dbh and above to produce stand and stock tables by dbh classes and species groups. A stock map is produced to show distribution of main commercial species of the sampling plots of the surveyed forest compartment. Mapping of the trees allows us to select trees and plan roads to minimize disturbance to the environment.

Based on the pre-felling information, the cutting limits for the forest area is determined for dipterocarp and non-dipterocarp groups. In practice the next cutting cycle is expected between 25-30 years. Criteria for cutting limits determination include maximum number of trees cut per quarter ha plot & per ha, enough residual stands, minimum economic cut and percentage of dipterocarp should be equal or more than the original stand after harvesting. The cutting limits prescription indicates our seriousness to allow only 'the correct trees to be harvested', thus reducing damage and conserving the environment.

Next, timber tagging is carried out on harvestable trees using plastic tags showing serial number of the trees and the number of merchantable logs. This activity ensure only marked trees are felled and to control the amount of volume of timber taken out from the forest. Only valid timber tags are

Manuscript received Aug. 5, 2007; revised Feb. 5, 2008

allowed to be transported out of the forest through the Forest Checking Station at the time of royalty assessment. The timber tagging system is proven to be an efficient system for chain of custody in controlling and tracking the movement and removal of logs and a very effective way in combating illegal logging from the forest. The placing of tags on the trees determines the direction of felling subsequently reduce the damage on residual stands and environment. This also shows our seriousness to protect the environment.

During harvesting only prescribed activities are allowed to be conducted in accordance with rules and regulation as stipulated in the harvesting license issued by FDPM. Forest harvesting and roads construction are indispensable and without roads no logging can be done. Many studies found that road construction represents the most harmful aspect of forestry activities [8, 9, 10, 11, 12, 13, 14] if are not well planned due to design, construction flaws or poor maintenance practices. To ensure that the detrimental effects of road infrastructures on the environment are minimized, FDPM have adopted "Standard Road Specifications" and "Forest Harvesting Guidelines" for strict adherence by all logging contractors, both at the planning and implementation level. Currently, before any logging can be carried out in the forest reserve, a licensee or logging contractor had to submit a harvesting plan including map showing proposed forest roads in accordance with Forest Roads Specification for Peninsular Malaysia 1999, to be approved by Forest Engineers. The forest engineers of the FDPM play an active role in providing technical advice and services on all matters pertaining to infrastructural development of the logging sector, such as in the design and construction of forest roads so as to enhance environmental stability and quality

In general the guidelines for road specifications that must be followed in order to achieve SFM are as follows: (a) Density of feeder roads of less than or equal 40m/ha and density of skid trails of less than or equal 300m/ha, (b) Right of way for feeder road of less than or equal 15m, (c) Gradient of feeder roads of less than or equal to 20% (11.3˚) but will follow natural benches and features and when using existing roads or as specific by Forest Engineer, (d) Road chamber of feeder roads of at least 1:20 (straight) (5%) with a cross-fall for feeder roads of at least 1:33 (3%), (e) Carriageway of feeder roads (single lane) with the width of at least 4m except at corners and lay-bys , (f) V-shaped side drains (earth) along feeder roads constructed with adequate culverts of log/concrete/metal/HDPE located at stream or river crossings, where required or as specified by the Forest Engineer, (g) Bridges of timber/concrete box culvert/steel of at least 3.5m in width at stream or river crossings, where required with silt traps in erosion prone areas along feeder roads, as specified by the Forest Engineer, (h) Buffer strips for permanent streams and rivers in Inland Forest and Peat Swamp Forest of at least 5m in width on either side of the stream or river. Buffer strips for stream and river protection are marked and felling of trees is prohibited

In addition to roads specification, no logging is allowed on steep slope more than 40 degrees and more than 1000m above mean sea level. At present, several logging methods are used worldwide such as wheeled or crawler tractors, winch-powered ground cables,

Manuscript received Aug. 5, 2007; revised Feb. 5, 2008

skyline cables and iv) helicopters or balloons; but a combination of crawler tractor-winch lorry systems are the most popular systems used in the forest harvesting in the dry inland forest of Peninsular Malaysia. Under this harvesting system the crawler tractor skids the logs from the felling sites to the skid trails where the winch lorry continues the transportation to the roadside landings. No doubt it can cause damage to residual stand because of adverse soil and terrain conditions but well planned roads can minimize damage. Besides implementing standard road specification and forest harvesting rules and guidelines, other measures taken to protect the environment include the choice of machinery, construction of water bars, silt traps and the control of pollution of rivers and water bodies resulting from logging. With regard to the use of machinery, an environmental friendly machine has been developed and being used in some states such as Log Fisher to haul or winch out the logs from the forest with less damage.

Indeed, these developments led to the use of concept of Reduced Impact Logging (RIL), which can be define as 'Well-planned and strictly supervise implementation of forest harvesting operations to minimize the impact on forest stands'. In fact the term RIL encompasses improved road construction, directional felling, extraction practices and proper use of harvesting machineries. We have shown the good forest practices including environmental friendly machine; we welcome any other solution to improve further.

4 Role of Forest Certification

Malaysia as a producer member country of the International Tropical Timber Organization (ITTO) is fully committed to achieve sustainable forest management in the overall context of sustainable development. Embedded to this commitment is the acceptance of forest certification demanded by developing countries. Forest or Timber Certification is the slogan in today forest harvesting. The main objective is to ensure forest products produced or import confined to domestic environmentally standards, regulations and rules. Malaysia started certification in 1994 in stages. In 1999, Malaysian Timber Certification Council or MTCC was formed to develop and operate a voluntary national timber certification scheme in Malaysia uses a phased approach scheme. The standard used in certification for the Malaysian Criteria and Indicators (MC&I) is based on the 1992 ITTO *Criteria for the Measurement of Sustainable Tropical Forest Management* and later the scheme was revised using 1998 and 1999 ITTO's *Criteria and Indicators for Sustainable Forest Management of Natural Tropical Forests*.

This revision was coordinated by MTCC through meetings with various stakeholders. The MC&I (2001) contain key elements for SFM covering economic, social, and environmental and conservation aspects. The MC&I contains 7 criteria, 64 indicators, 200 activities and 170 standards of performance were formulated at the national level; while 7 criteria, 56 indicators, 171 activities and 150 standards of performance were formulated for assessing sustainable forest management at the forest management unit. In Malaysia, the criteria, indicators, activities and management specifications at the national level would be used for

Manuscript received Aug. 5, 2007; revised Feb. 5, 2008

reporting progress towards achieving sustainable forest management, and in particular, the ITTO Year 2000 Objective. Those formulated at the forest management unit level would be used by the Forestry Departments to monitor and assess progress in sustainable forest management at the state level including forest certification by independent third party assessors.

In this regard, forest management certification or forest auditing can be defined as a process which entails an independent assessment of a forest management operation, according to specific economic, social, environmental and ecological criteria, indicators, activities and management specifications or standards of performance, while a Forest Management Unit is defined as an area of forest land that is managed by an organizational entity which decides on and subsequently implements forest activities to ensure the economic, ecological, biological and socio-cultural sustainability of the area[15]. It addressed the issues of forest inventory, management planning, silviculture, harvesting, forest road construction and other related forest management operations.

As forest certification is a market-driven and to further improve the certification scheme, Malaysia, through the MTCC, has also held discussion with the Forest Stewardship Council (FSC) since 1999 to promote co-operation, including FSC's participation in the formulation of a national standard for forest certification so as to ensure that the standard is compatible not only with the ITTO's criteria and indicators but also with the FSC's P&C. After numerous consultations with interested parties a new set of MC&I entitled "*Malaysian Criteria and Indicators for Forest Management Certification (MC&I)*" or MC&I (2002) was adopted and to be used in 2006. It is expected that the use of new set of MC&I will enhance our commitment to SFM and further protect the environment.

To date, eight forest management units in Malaysia, namely the states of Johor, Kedah, Negeri Sembilan, Pahang, Perak, Selangor, Terengganu and Kelantan covering 4.7mil.ha of the PRFs in Peninsular Malaysia have been certified using the set of MC&I (2001) and have been awarded the forest certification by MTCC after being assessed by independent third party assessors. Issuance of forest management certification manifested itself our success in implementing the sustainable forest management system.

5 Conclusions

Malaysia is fully aware of the need to manage the forest effectively from single use of sustained supply of timber to multiple-use of forestry including maintaining of the environmental stability, provide sanctuary for wildlife and to protect the biodiversity for use in biotechnology. In this regard, the forest is managed under strict and technically sound forest management objectives with management and harvesting practices are adhered to various guidelines and regulations. In the context of current environmental issues, striking the right balance between development and environment protection is necessary if forests are to continue to play their essential economic, social and aesthetic roles. Besides managing the forest, other important aspect that can lead to sustainable forest management is forest certification. The awarding of forest management certifications to 8 states

Manuscript received Aug. 5, 2007; revised Feb. 5, 2008

shows our commitment to manage the forests that are economically viable, socially well-aware and environmentally sound. Thus, in relation to environmental protection, the practice of SFM by Forestry Department has proven successful in protecting the environment.

References:

[1] Cranbrook, The Earl. 1988. Key Environment: Malaysia. Pegamon Press.

[2] Whitmore, T.C. 1975. Tropical Rainforest of the Far East. Oxford University Press, Walton Street, Oxford.

[3] ITTO. 1992. Criteria for the measurement of sustainable tropical forest management. ITTO Policy Development Series N3. Yokohama, Japan. 5p.

[4] Ismail Awang. 1996. *Sustainable* Forest Management in Malaysia- The Way Forward. Special Address at the 1996 Thailand Environment Institute Annual Conference, 9 July 1996, Bangkok, Thailand. 26pp.

[5] Zul Mukhshar M. S. 2000. The Role of Forestry Department Peninsular Malaysia in the Management and Conservation of Protected Areas. Paper presented at the Workshop on the Management and Conservation of Protected area: Adminstrative and Legislative Issues, Kuala Lumpur, 4-5 July, 2000. 14p.

[6] Chin, T.Y. 1999. Protected Forest Area Management in Malaysia. Paper presented at the International Experts Meeting on Protected Forest 2000. 7-12 Aug. 2000, Kuala Lumpur. Vol 1:7.

[7] Thang, H.C. 2004. Forest Management and Development in Malaysia. Paper presented during the Malaysian Timber Council's Familiarisation Programme for European Trade Representatives, 12 July 2004, Kuala Lumpur, Malaysia.

[8] Bockheim, J.G., Ballard, T.M. & Willington, R.P. 1975. Soil disturbance associated with timber harvesting in South-western British Colombia. Can. J.For. Res. 6:285-290.

[9] Kamaruzaman Jusoff & Nik Muhamad Majid. 1992. An analysis of soil disturbance from logging operation in a hill forest of Peninsular Malaysia. Forest Ecology and Management 47:323-333.

[10] FAO. 1999. Road Infrastructures in Tropical Countries: Road to development or road to destruction? FAO, Rome. 64p.

[11] Croke, J & Hairsine, P. 2000. Sediment delivery pathways in Managed forestry environments. XXI IUFRO World Congress

[12] Sidle, R.C. & Andrew Lo, K. F. 2000. Effects of forestry activities on surface erosion and slope stability. XXI IUFRO World Congress 2000. 7-12 Aug. 2000, Kuala Lumpur. Vol 1: 5-6.

[13] Mulong, S. 2000. Impacts of forest harvesting operations on soil properties. XXI IUFRO World Congress 2000. 7-12 Aug. 2000, Kuala Lumpur. Vol 1:552.

[14] Shamsuddin Ibrahim, Ismail Harun, Chung Phang Fee & S. Appanah. 2000. Reduced impact logging using long haulage cable system in hill production forest in Peninsular Malaysia. XXI IUFRO World Congress 2000. 7-12 Aug. 2000, Kuala Lumpur. Vol 2:65.

[15] Thang, H.C. 2003. Development and Application of Criteria and Indicators for Sustainable Forest Management in Malaysia. Paper presented at the Attachment Training of Bhutanese Foresters in Malaysia, Kuala Lumpur, Malaysia, 11-31 October 2003.