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Working Paper

Technology and Employment Programme

**Sustainable Development and Employment:
Forestry in Malaysia**

by

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Working Papers are preliminary material circulated to stimulate discussion and critical comments

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Preface

This Working Paper reports on questions surrounding the sustainability of forestry in Malaysia and, accordingly, the sustainability of the livelihood gained from this economic activity. The study has been carried out as part of the World Employment Programme. Its main finding is that Malaysian rain forests are not being logged on a sustainable basis and that future employment associated with the exploitation of native forest resources is not secure.

Although long or medium-term employment in forestry is insecure, new employment opportunities are being generated as the loss of native forests forestalls agricultural land use - predominantly the production of rubber and palm oil. The balance of employment in the conversion from forestry to agriculture, appears to be positive. However, a decisive judgement in this respect is difficult for a number of reasons. First, the log processing industry in Malaysia produces mainly semi-finished products and merely handles 20% of the total cut. Hence, employment in the Malaysian timber processing industry has remained underdeveloped. The paper advances various explanations for this, not least the unsustainability of supply. Second, the paper suggests that logging technology might take greater environmental care and use more labour in doing so. In addition, productive employment is foregone in silvicultural activities presently neglected, such as liberation thinning. Third, rapid depletion of forests inhibits potential lateral employment opportunities associated with the rain forests, including eco-tourism, hunting, gathering and collecting. Of course, if these lateral activities require sustainable logging rates, they themselves ought to be managed within the constraint of sustainability. Fourth, the loss of native forests brings a reduction of the *diversity* of employment opportunities.

Employment considerations aside, other factors weigh heavily in an assessment of the sustainable use of the forests. Central are (a) the displacement of native tribes practising traditional "swidden" agriculture in forest areas now earmarked for logging and (b) the environmental costs of the loss of tropical rain forests in Malaysia as in other parts of the world. These further considerations have led to a prominent international debate in recent times - a debate in which the ILO has played a part by its adoption of Labour Convention 169 concerning the rights of Indigenous and Tribal People.

Unfortunately, the international debate has held limited sway with the relevant Malaysian state authorities. To date, neither the plight of indigenous peoples, nor the cause of environmental conservation have put in place policies compatible with sustainable exploitation of the forests. This unwillingness on the part of government is not justified by a desire to generate additional employment. The employment balance of a shift to agriculture is not unequivocal and logging actually proceeds with the help of immigrant labour. Rather, and in common with environmental lessons from many countries, it seems that the driving force of Malaysian forestry is found in the maximisation of short-term logging revenue. The maintenance of revenue in this calculation is not considered consequential since, both in terms of commerce and politics, future revenue is being subjected to a high discount rate.

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Sustainable Development and Employment: Forestry in Malaysia

1. Introduction

Problem Statement

In recent years, world attention has focused on deforestation of tropical areas, particularly the Amazon basin and Southeast Asia. Environmental consequences of such activity includes soil erosion, water pollution and increased carbon dioxide in the atmosphere leading to the greenhouse effect and global warming. The main causes of this deforestation include: (1) poor forestry or logging practices, (2) harvesting greater than sustainable yields, and (3) forest clearance with replacement by agriculture or animal husbandry practices.

Many environmental nongovernmental organisations and some developing countries have advocated an anti-tropical hardwood campaign to limit use and to boycott hardwood imports from countries which do not use sustainable practices. Malaysia, particularly, has resisted these charges, arguing that it is the developed countries who are responsible for the greenhouse effect and global warming as (1) they have deforested their own countries, and (2) they utilise the bulk of fossil fuels leading to air and marine pollution. Malaysia is the world's third largest timber exporter (behind Canada and the U.S.) and the largest tropical timber and wood products exporter representing approximately US \$2.9 billion in 1990. They view their current and future comparative international trade advantage to include the timber and wood-based products industry, including semifinished and finished wood products.

Case Study: Malaysia's Forestry Sector and Policies

In Malaysia, according to the World Bank, 80 percent of the country was covered in forests in 1958. By 1985, this had fallen to 62 percent and it is estimated that by the year 2000, all of Malaysia's lowlands will be logged except for parks. Exports represent 13-15 percent of total foreign exchange earnings in Malaysia. In the states of Sabah and Sarawak, revenues from logs approximate two-thirds of foreign exchange and 50 percent of government revenues.

This export emphasis is compounded by the fact that forestries and the wood-based industries employ a relatively small number of people in Malaysia, approximately 150,000. By contrast, agriculture employs more than 1,700,000 and is about 24 percent of Malaysia's total employment. Land clearance and conversion to agriculture has been viewed as a viable employment policy in Malaysia, although it is recognised that a large proportion of agricultural employment includes informal and family labour estimates as well as more formal plantation employment. The former figures include substantial underemployment.

Experts in the forestry and wood products area estimate that Malaysia's harvest is twice the sustainable yield with Peninsular Malaysia particularly at risk. This result is understated if environmental and ecological concerns are considered along with timber harvesting in any sustainability definition.

The case study examines Malaysia's policies and practices relative to land use for forest based products and services. Special focus is on the State of Sarawak for several reasons: (1) Sarawak has the largest land area remaining in forests, (2) it has attracted international attention with respect to harvest practices and the protests of indigenous people, and (3) Sarawak has been the subject of several recent study delegations examining their forest management practices.

Technology appears in the controversy at several levels. Some view traditional clear cutting or "swidden" agricultural practices by indigenous people as environmentally benign and thus sustainable. Government officials claim they are primarily responsible for deforestation. Modern technology has its supporters and detractors. Inappropriate technology ("cable logging," imported plantation practices, poorly designed transportation systems) is viewed as a major factor in deforestation by some analysts. Proponents of new technology argue that technology interventions such as new species introduction, development of new products, and techniques that reduce wood waste would increase the sustainable yield of Malaysia's forest products.

Findings suggest that forestry practices including annual harvests ignore stated policy toward sustainable annual forest yields, that monitoring resources are meagre and that a multiple objective use of Malaysia's forest resources is not considered in practice. Thus, sustainability has not been achieved in the narrow or single objective context of timber harvesting. Sustainability in the broader economic-ecological sense of the social and amenity values, biodiversity and watershed concerns, as well as timber harvesting, has all but been ignored. Harvesting in Sarawak is three times the sustainable yield in narrow timber harvesting terms and perhaps four to five times the sustainable yield in economic-ecological terms. Adequate supplies of timber may be unavailable in the mid 1990's to support the wood-based products industries in Peninsular Malaysia.

Outline of Work

Section 2 provides a broad overview of the question of optimum rotation or sustainability from a biological and economic perspective. A single objective (timber harvesting) is considered first, then the impact of amenity values of forests are included.

The following section looks at land use and forest area in Malaysia. Malaysia's forest policies are briefly illustrated and implementation practices and strategies are discussed. Shortcomings or deviations from these sustainability practices are indicated as well. The State of Sarawak practices are presented.

Section 4 provides a discussion and evaluation of some of the policies proposed or adopted by Malaysia in addressing the narrow and broad issue of sustainability of forest products and services. This is followed by a summary and conclusions.

2. Forest Management: Analytical Concepts and Issues

This section provides an overview of biological and economic dimensions of forest management. First, management efficiency is examined within the context of a single objective; timber production. Then, multiple objectives of the forest are considered, incorporating amenity and ecological considerations, biodiversity attributes as well as timber production. How these considerations affect timber harvesting decisions are highlighted.

Finally, policy issues are identified. These include the potential technology impact on harvesting, policy variables capable of altering private sector harvesting decisions and the special role of indigenous peoples. The impact of forest management decisions affect the long term sustainable prospects for employment and income in the timber and wood-based products industries.

2.1 Efficient Timber Models: Optimal Rotation

Biological Dimensions and Sustainable Yield

Historically, in much of the forestry literature, harvesting decisions were based upon a volumetric basis. Tree growth is measured by cubic feet on a particular site by sampling. While tree growth depends on many factors and there is tremendous variability among tree stands and species, the general behavioral pattern of growth reflects a third degree polynomial; slow initial growth, followed by rapid intermediate growth. Finally, there is a slowing down of growth with full maturity, perhaps even complete cessation.

The biological harvest (and restocking) decision is to cut the forest when the mean annual increment (MAI) to growth per unit of land is maximised. Figure 2.1.1 illustrates this concept. Total volume of tree growth per land unit is maximised at T_m . But, the last years of growth are slow and the largest maximum sustainable yield over all time periods occurs by cutting the forest earlier when the mean annual growth (in cubic feet) is at a maximum. In Figure 2.1.1 this occurs where the line from the origin is tangent to the growth curve at T_b . In more familiar economic terms, maximising MAI is equivalent to maximising average product over all time periods.

This measure, MAI, can be converted to a more useful measure of sustainable annual yield (SAY) in a straightforward fashion.

$$SAY = A \times (B \div C)$$

where

A = Area of forest (hectares)

B = First Cut Volume (cubic meters)

C = Cycle of Harvest and Replant (years)

Volume of Timber
per Unit of Land

Figure 2.1.1
Optimal Rotation: Maximize Mean Annual Increment (MAD)

In terms of the prior discussion, the forest manager's harvest rule of MAI yields values for B (the volume of timber harvested) and C (the rotation period or time between harvests). In other words, $MAI = (B \div C)$.

Some illustrative data from Sarawak, Malaysia are as follows. It is estimated that the first cut volume of timber is 38-40 cubic meters per hectare. This volume is low because ideal harvesting is done on a selective basis of certain species which are over a specified diameter at the base. Forestry personnel argue that the cycle to regenerate (based on MAI) is 35 years. Based on current and anticipated land use patterns, there are 5.9 million hectares of land potentially available for timber production (ITTO, 1990). Thus, the sustainable annual yield for Sarawak from all forest lands:

$$SAY = 5.9 \times (40/35) = 6.74 \text{ million cubic meters per annum.}$$

This yield includes land under dispute by indigenous peoples and land not suited for forestry (slopes too steep) and subject to environmental degradation. By contrast, actual harvests in Sarawak in 1989 was 18.2 million cubic meters (Malaysia Profiles, 1990).

Economic Aspects of Harvesting

The economic model adds the benefits and costs of "waiting" to harvest the timber to the biological model. In this case, net timber prices, discount rates, costs of planting/harvesting are considered. Initially, amenity or ecological values are ignored. Essentially, this model follows that developed originally by Faustmann in 1849 (Bowes and Krutilla, 1985).

The benefits include the value of timber (later that of amenities as well). The costs of waiting an additional year represents two opportunity costs; the foregone income on the sale and investment of timber proceeds and the foregone income from forest land use - either in new forest, clear cut agriculture or urban use. Optimal rotation is depicted by the usual marginal conditions where benefits to waiting equal costs of waiting.

The initial model is presented in Table 2.1.1 and depicted in Figure 2.1.2 (Deacon, 1985). For simplicity, harvest costs are ignored or rather are deducted from the price of timber, so (p) represents net price. The annual growth (Δf) of timber is the marginal product per period of time. Looking at costs, the foregone income and user costs are represented by (r.p.f) and (L), respectively. In this model, r is the real rate of interest, p the net price of timber and f the volume of standing or uncut timber. The real rental or user cost of land is L/P.

Marginal Benefit (MB)
and
Marginal Cost (MC)
of
Waiting

Figure 2.1.2
Optimal Rotation: Economic Criteria

Table 2.1.1
Optimal Rotation Conditions

Production

- Volume of Timber $F = f(T)$
- Annual Growth Δf

Benefits (of Waiting)

- Net Timber Receipts $TR = p.\Delta f$

Costs (of Waiting)

- Foregone Income $FI = r.p.f.$
- User cost of land $L = \max. (L^F, L^A) = rNPV_{F,A}$

Model and Equilibrium

- Marginal Benefits (of Waiting): $p.\Delta f$
- Marginal Costs (of Waiting): $r.p.f + L$

$$p\Delta f = r.p.f + L$$

$$\Delta f = r.f + L/P$$

The user cost, (L) or (L/P) , reflects the actual or imputed value of land in its next best alternative. Assume it is timber use. The L term depends on the real timber prices, replant costs and interest rates. In short, it depends on the net present value (NPV_F) of the alternative use. If the current stand of timber grows one more year, this NPV_F is delayed one more year and the opportunity or user cost of land is $L = r NPV_F$. Other alternate uses of land may be more important (NPV_A) so the user cost of land is $L = r.\max (NPV_F, NPV_A)$.

The equilibrium conditions are familiar:

$$\Delta f = r.f + L/P$$

Harvest occurs when the real marginal benefits (Δf) of waiting equals the real marginal costs ($r.f + L/P$) of waiting. Figure 2.1.2 illustrates equilibrium at period T_1 . Replanting occurs if $L^F > L^A$. Otherwise, the land is clear cut for alternative uses under competitive market conditions. As L^F basically depends on the biological growth rate of timber, net timber prices and the real interest rate, it is quite likely that reliance on market guidance rules alone would result in alternative use options dominating forest sustainability. However, the analysis so far ignores amenity, biodiversity and watershed values of forests; or that social discount rates differ from private discount rates.

A number of comparative static results are of interest and can be illustrated with Figure 2.1.2. Some affect the optimum rotation and are discussed here.

Discount rate. An increase in r shortens the optimum rotation since both foregone income ($r.f$) and user costs (L/P) are increased as a result.

Replant, Harvest Costs. An increase in costs lengthens the optimum rotation since this decreases the NPV of new forests relative to standing forests and thus the user cost of land.

Net Price. If the relative real price of timber is rising at a constant rate over time, the optimum rotation would lengthen. Prices rising at a constant rate reduce the effective discount rate.

Severance tax. Either an *ad valorem* or a per cubic meter tax on timber would increase the optimum rotation. Essentially, this acts in the same manner as planting, harvests costs.

Property taxes. If applied to timber land only, property taxes shorten the optimal rotation and encourages land conversion to alternatives. If applied to all land uses, there should be no effect.

Alternate uses. If there is no other use except timber production ($L^A = 0$), the optimum rotation will increase. Conversely, population pressures and agricultural demands will shorten the optimum rotation with alternative use patterns competing for timber production.

2.2 Multiple Use of Forests: Optimal Rotation

Forests, and particularly tropical forests, have value other than for timber production. Forest land services include timber production, watershed catchment and erosion control, habitat protection, hunting and gathering, recreation and indigenous shifting cultivation. In tropical forests, biodiversity of species is an additional value. In Malaysia's forests, which are 130 million years old, it is estimated that there are more than 2,500 species of trees and 8,000 species of plants (Nor, 1983).

Except for timber production, the value of the remaining services is in the standing unharvested forest. These non-timber services are monotonically increased with the age of the forest; at either a constant, increasing or more likely a decreasing rate. In any event, capture of timber revenues through harvesting is at the expense of the amenity services of non-timber production.

Multiple use management is practised in most forested regions of the world. In many cases, the management rules adopted are arbitrary or *ad hoc*. One solution is to adopt multiple use practices on all parcels of land (Clawson, 1978). But this is inefficient and economic principles of specialisation may be applied instead to multiple use management. For instance, preserving hillside and riverside forests will aid water catchment and erosion objectives. Preserving some areas in perpetuity for non-timber uses, and allocating other areas for sustainable production will aid both non-timber and timber objectives. An important social objective is sustainability of economic activities which the timber and non-timber services provide. This includes the size and the time and spatial distribution of income and employment dependent on these timber and non-timber services.

To modify the simple timber model developed in Section 2.1, amenity and social benefits of the standing forest will be added (Hartman, 1976). Assume that amenity values ($a(T)$) of the forest increase with age. The marginal benefits of the forest are now:

$$MB = \Delta f + a(T)$$

where (Δf) is real timber returns as before and $a(T)$ is the marginal benefit of delaying harvest one more year. With our marginal costs defined as previously, we have equilibrium at:

$$\Delta f + a(T) = r.f + L/P$$

This relationship is depicted in Figure 2.2.1.

In considering Figure 2.2.1, the following points are noted. First, the optimal rotation period increases unambiguously with the formal inclusion of amenity benefits. Like a positive externality, failure to recognise amenity benefits leads to too little production of amenities through shorter rotation periods. Second, if amenity values are sufficiently large and increasing with age, the standing forest may never be harvested. Instead, it is left in wilderness area in perpetuity (Tietenberg, 1988).

While the introduction of amenity benefits yields results corresponding to intuition (increased rotation periods), multiple use harvesting policies are extremely complex. Operational models rarely yield "even flow" unchanging harvesting policies as long term goals and they are critically dependent on initial conditions and assumptions in the model (Bowes and Krutilla, 1985). In addition, valuation of the non-timber services is in a very incomplete stage of development. In such instances, amenity values can be made as large or small as politically desirable.

2.3 Policy Issues in Tropical Forest Management

There are other conceptual policy issues in forest management in addition to annual yield determination. These include the monitoring of the yield plan, the use of appropriate technology to minimise environmental side effects while maximising yield and the ownership of forest lands.

Table 2.3.1 summarises the steps in the production process for timber harvesting and processing. At each step the major environmental impact is identified as well as some of the technology or management options to mitigate these damages. It is assumed in Table 2.3.1 that the determination of annual permissible yield has been determined and concessions granted for harvesting. The determination and implementation of the sustainable annual yield is critical to the sustainability of the direct and indirect employment levels dependent on the timber and non-timber services provided by the forest.

In areas designated for commercial timber production, a selective cutting system is used in tropical forests; only trees of a certain species above a certain diameter at a height breast high (i.e., 50 cm of dbh) are harvested. The remaining trees and species are left to

Figure 2.2.1
Optimal Rotation: Timber and Amenity

regenerate. This contrasts with the temperate zone countries where uniformity of species and age is likely to exist in a plot ready for harvesting.

Unfortunately, a selective harvesting system can lead to considerable damage to the remaining stand of trees if poor harvest practices are used. In a study by the Food and Agriculture Organisation (FAO, 1981), moderate to severe damage was found to 40-70 percent of the remaining species after harvesting occurred in tropical rainforests.

Inappropriate harvesting of trees on steep slopes accelerates soil erosion and flooding of lowlands. Failure to leave a band of trees along rivers and streams aggravates the water siltation problem, leading to water quality and fish habitat problems. In these cases, appropriate harvest technology is known. The issue is monitoring of concessionaires; a principal-agent concern. Remote sensing or aerial photography provides one technology option for monitoring yield allotments.

The construction of logging roads raises two concerns as Table 2.3.1 illustrates. One is that roads are often poorly constructed and maintained, accelerating water runoff and soil erosion. The other is more intractable; the logging roads provide access to previously closed areas into which landless settlers follow to clear cut forests for non-timber uses. In some countries (e.g., Brazil), there is unofficial acceptance of this policy to alleviate urban or population pressures.

The forestry cycle, the number of years before reentry on a sustainable basis, is subject to management practices and technology choices. Rapid growing species like *Acacia mangium* or *Eucalyptus* would shorten the cycle. "Liberation thinning", the practice of removing small noneconomic species to allow more rapid growth of the remaining species, would increase annual incremental growth - resulting in a greater yield/hectare or a reduced cycle to harvesting or both. It would also increase forestry employment, most likely of indigenous peoples.

Transport of raw cut logs is generally by truck transport or water, although high valued tropical timber is sometimes removed by helicopter. Storage of logs awaiting processing or loading for export is also in rivers or streams, often for months at a time. With time, leaching of the logs occur and water pollution results. BOD values ranging from 40-60 mg per litre are not uncommon in these areas. This is comparable in strength to weak sewerage. Simple technologies are available, including debarking the logs on site or storage of logs in closed ponds.

If sawmill operations exist in-country, further potential environmental problems exist. These relate to the volume and disposal of sawdust and wood waste. Disposal methods include incineration (often open burning), sawdust used as landfill with subsequent water pollution or dumped directly into rivers and streams. In addition, toxic preservatives used in sawmills are often burned or dumped in rivers. Laws usually prohibit all these practices, but they usually carry low penalties or are not enforced.

Table 2.3.1
Environmental and Social Concerns of Timber Processing at Different Stages of the
Production Process

	<u>Environmental/ Social Concerns</u>	<u>Technological and Management Considerations</u>
Sustainable Yield ($SAY = A \times (B \div C)$)	<ul style="list-style-type: none"> ● Deforestation ● Loss of Timber, Amenity Values ● Unsustainable Employment 	<ul style="list-style-type: none"> ● Multiple Use Objectives ● Determine/Monitor Annual Quota
Production Process		
Harvesting	<ul style="list-style-type: none"> ● Erosion, Siltation ● Timber Stand Damage ● Safety/Health 	<ul style="list-style-type: none"> ● Monitor Harvest Practices
Transport Logging Roads	<ul style="list-style-type: none"> ● Erosion ● Access to Land 	<ul style="list-style-type: none"> ● Monitor Construction ● Monitor Access
Water Channels	<ul style="list-style-type: none"> ● Pollution 	<ul style="list-style-type: none"> ● Debark at Site ● Closed Ponds
Sawmills		
Wood waste	<ul style="list-style-type: none"> ● Disposal ● Toxic Preservatives 	<ul style="list-style-type: none"> ● Improve Recovery Rate ● Use for Pulp/Paper ● Restrict Dumping
Sawdust	<ul style="list-style-type: none"> ● Disposal 	<ul style="list-style-type: none"> ● Use for Pulp/Paper ● Closed Burning
Land Stewardship		
Private	<ul style="list-style-type: none"> ● Amenity Values Ignored 	<ul style="list-style-type: none"> ● Quotas with Market Based Incentives
Public	<ul style="list-style-type: none"> ● Non-optimal practices ● Short run time perspective 	<ul style="list-style-type: none"> ● Quotas with Market Based Incentives
Indigenous	<ul style="list-style-type: none"> ● Loss of cultural base, amenity values ● Economic activities lost 	<ul style="list-style-type: none"> ● Indigenous Lands set aside

The control of wood waste is subject to technology and management intervention as well. The recovery rate of wood at sawmills depends on the quality of logs, sawmill techniques and supervision of workers using band saws. Wood waste is capable of recovery for use in the pulp and paper industries. Alternatively, wood waste can be used to provide energy on site.

In the timber harvesting and processing stages in Table 2.3.1, safety and health issues abound. Forestry worldwide is a high-risk industry. In tropical forests, including Malaysia, they are exacerbated. In Sarawak Malaysia, it is estimated that there are 7 fatalities per 1 million cubic meters of harvest (ITTO, 1990). Failure to use safety equipment is officially attributed as the reason. However, while workers receive good wages, they are paid on a piece work basis (loggers, equipment operators and truck drivers). As a consequence, quantity of cut and removal is stressed by workers and managers. Harvesting often continues at night.

The final item in Table 2.3.1 concerns land management or stewardship. Is private management preferred to public management? If timber production alone is the concern, then private managers have incentives to adopt efficient rotation. This assumes efficient size operations to take advantage of any scale economies. It also assumes that the amenity and social values of the standing forest are small or that they can somehow be captured by the owners. This seems unlikely in the case of tropical forests. Thus, efficient forest management with significant amenity and social values is unlikely to occur with private sector management. On the other hand, public management systems also suffer from deficiencies. With multiple use objectives, they have no clear cut criteria for weighing the multiple values. Elected government officials may have an even shorter time horizon (higher discount rate) than private owners with the consequence that long term amenity values will also be downgraded.

Finally, land ownership and use of forested areas is confounded by the claims of indigenous peoples. While most countries have laws recognising and protecting such customary lands, natural resource development often proceeds while conflicting claims to land ownership languish in the various layers of courts. Media attention has made agencies and political jurisdictions more sensitive (perhaps also more antagonistic) to indigenous peoples' land claims.

3. Malaysia's Forestry Sector

3.1 Country Overview

In 1990, Malaysia was a country of 17.8 million people (6.83 million in the labour force) with a per capita GNP of US \$2,197. Comprised of 11 states in Peninsular Malaysia, plus the states of Sabah and Sarawak on Borneo, the combined area is 329,758 square kilometres (32.8 million hectares). Figure 3.1.1 identifies the individual states.

Figure 3.1.1

Since independence in 1957, the Malaysian economy has seen almost continuously sustained growth and considerable diversification. Manufacturing has expanded rapidly and has replaced agriculture, forestry and fishing as the largest economic sector. In 1990, manufacturing accounted for 27 percent of real GDP, agriculture 18.4 percent, government services 10.3 percent, mining and quarrying 9.3 percent and construction 3.2 percent. All other sectors combined total 31.3 percent (see Table 3.1.1).

The Malaysian economy is relatively open with total merchandise exports and imports equal to 185 percent of GNP. As a result, Malaysia is highly dependent on the international trading system and it is subject to external developments and price movements to a great extent. In fact, the recession in 1985-86 was a result of a 20 percent decline in Malaysia's terms of trade which cost the country more than US \$3 billion in commodity earnings. By rank order, Malaysia's major exports are manufacturing products, petroleum and timber products. Rubber and oil palm remain important commodities as well.

The population of 17.8 million is multicultural with about 32 percent Chinese, 55 percent Malays and indigenous peoples and 13 percent Indian. Population is heavily concentrated in cities on the west coast of Peninsular Malaysia, especially in the Kuala Lumpur/Klang river valley. Sabah and Sarawak, by contrast, have very small populations and the population density is very low. Peninsular Malaysia in 1987 had 13.65 million people (81.2 percent), Sabah 1.3 million (7.8 percent) and Sarawak 1.5 million (9 percent).

The distribution of employed persons in Malaysia is depicted in Table 3.1.1. While agriculture, forestry and fishing are declining in terms of relative contribution to GDP, they remain the largest employer of labour with 1.9 million persons or 29 percent. But manufacturing exhibits the most growth and 18 percent of the work force is employed here. The educational level, skills and relatively low wages in manufacturing make this a growth sector for the near future as well. Malaysia is now the third largest world producer of semiconductors and a major producer in consumer electronic and electrical products, textiles and apparel.

Labour migration is important in Malaysia. Malaysia exports labour to Singapore, especially in construction and clerical positions. To a lesser extent, Malaysians also work in the Middle East. Malaysia imports labour as well from Indonesia, the Philippines and Thailand. Most of the immigrants are illegal and they come to Malaysia to seek low skill-low wage jobs that Malaysians avoid. Indonesian and Filipino workers are important in Sabah and Sarawak and are critical to the plantation and logging/timber industry throughout Malaysia.

Table 3.1.1
Employment and GDP by Sector
(000's and Percent)

Sector	Employment (GDP Percent)		
	1980	1985	1990
Agriculture, Forestry and Fishery	1800.5 (23)	1759.6 (21)	1985.7 (18.4)
Mining and Quarrying	62.2 (10)	44.4 (10)	39.4 (9.3)
Manufacturing	748.8 (20)	855.4 (21)	1239.2 (27)
Construction	269.9 (5)	429.4 (5)	453 (3.7)
Government Services	649.3 (10)	819.5 (12)	853.9 (10.3)
All Other Sectors	1304.5 (32.0)	1716.3 (31.0)	2268.7 (31.3)
Total	4835.2 (100)	5624.6 (100)	6839.9 (100)

Source: Malaysia Department of Statistics, Yearbook of Statistics.

3.2 Malaysia Forestry Sector

The tropical rainforest of Malaysia presents a complex and varied ecosystem, estimated to harbour 8,000 species of flowering plants, of which 2,500 are tree species, 200 species of mammals, 600 species of birds, 110 species of snakes and 80 species of lizards (Ministry of Primary Industries, n.d.).

The forest types are the lowland and hill dipterocarp forests, the mangrove forests along coastal areas and peat swamp forests in inland swamp regions. The tropical rainforest is generally taken to be synonymous with the species-diverse lowland and hill dipterocarp forests.

Land Use and Forest Resources

As recently as 1960, 72 percent of Peninsular Malaysia (PM) was covered in natural

forests. In 1987 the figure was 47.7 percent. The preponderance of these losses are permanent land use conversions of lowland forests to agriculture use. In documenting the conversion of 730,162 hectares in PM during 1971-80, some 453,000 hectares or 62 percent was for rubber, oil palm, coconut and cocoa land use; 29 percent went to state and regional agencies for subsequent development and 8 percent went to the private sector (Nor, 1988).

The Land Capability Classification (LCC) program in the early 1970's biased land use, especially lowlands, toward agriculture. All good soils and soils on low and flat terrain were classed as agricultural land. Forests were relegated to residual land use status, on poor soils or steeper slopes (Nor, 1988). States used the LCC as a basis for converting forests to agriculture or plantation uses.

The patterns of land use in Malaysia is depicted in Table 3.2.1. Forests still cover a significant portion (62.4 percent) of Malaysia due to the remaining abundance of forest lands on Sabah and Sarawak.

Table 3.2.1
Forest and Land Use: Malaysia 1988
(000's hectares)

<u>Region</u>	<u>Land Area</u>	<u>Forests Forested</u>	<u>Percent</u>	<u>Rubber</u>	<u>Oil</u>	<u>Percent "Trees"</u>
Peninsular	13,160	6,280	47.7	1,559	1,569	71.4
Sabah	7,370	4,770	64.7	87	276	69.6
Sarawak	12,330	9,470	76.8	207	41	78.8
Malaysia	32,860	20,520	62.4	1,856	1,887	73.8 ¹

¹ Figure is 75.6 percent if coconut, cocoa plantations (600,000 h) added.

Source: Ministry of Primary Industries, Forestry in Malaysia, Department of Statistics, Yearbook of Statistics, 1989.

Officials point out that the conversion of forest to agriculture in most instances involves the planting of another tree crop: rubber, oil palm, coconut or cocoa. Thus, plantation forests replace natural forests and provide some of the protective values (i.e., water catchment) the original forest provided. With this interpretation, adding these monoculture tree crops to the natural forests results in almost 74 percent of Malaysia's land having tree cover. Obviously, however, biodiversity is lost as are amenity values such as recreation, etc.

With states using LCC as a justification to clear cut forests for alternate uses, efforts made to protect forest reserves led to political acceptance of the concept of a Permanent Forest Estate (PFE) in the National Forest Policy of 1978. Each state was to establish a PFE

and manage it on a long term basis incorporating timber harvesting, environmental protection and amenity values. In practice, PFE were established in lands unsuited for agriculture and often after very time consuming negotiations.

The designation of PFE and state forest lands are depicted in Table 3.2.2.

Table 3.2.2
Forest Resources in Malaysia
(000's hectares)

Region	Peninsular Malaysia	Sabah	Sarawak	Malaysia Total
Permanent Forest Estate (PFE)	4,750	3,350	4,640	12,740
●Productive	2,850	3,000	3,240	9,090
●Protective	1,900	350	1,400	3,650
National Parks and Wildlife Areas	590	490	250	1,330
State Forest Lands	940	930	4,580	6,450
Total	6,280	4,770	9,470	20,520

Source: See Table 3.2.1.

Under the National Forest Policy, a PFE is to establish:

- (1) Protective forests. Land to safeguard water supplies, soil fertility and to minimise damage by floods and erosion.
- (2) Productive forests. Land to supply all forest produce in perpetuity as required for agricultural, domestic and industrial uses.
- (3) Amenity forests. Lands with unique flora and fauna for recreation, research and conservation.

Of Malaysia's 12.7 million hectares of PFE, 9 m hectares are productive forests to be managed on a sustainable basis, 3.7 m hectares are protective and amenity forests with no timber harvesting permitted.

An additional 1.3 m hectares are set aside for national parks, wildlife and bird sanctuaries. This includes the huge Taman Negara National Park covering 434,340 hectares in parts of three states in PM. To maintain biodiversity of species, some 81 Virgin Jungle

Reserves (VJR) representing all forest types were established covering 91,000 hectares (Ministry of Primary Industries, n.d.).

State forest lands are not subject to long term sustainability principles. Much of state forests are scheduled for land use conversions to monoculture tree crops; either plantation forestry or rubber, oil palm, etc. Particularly on Sarawak, much of this land area will be subject to deforestation unless more land is gazetted to PFE, a very time-consuming process.

In summary, while 20.5 million hectares or 62 percent of Malaysia remains forest, the establishment of PFE provides a policy statement that 14.07 million hectares or 43 percent of Malaysia's land area will remain as forest, if policy is matched by enforcement. A significant percentage of land use converted will be to monoculture tree crops, however.

Production, Employment and Revenues

The economic impact of the timber and wood-based products industry to Malaysia is considerable, as the next several tables illustrate. Annual production of saw logs and sawn timber are provided in Table 3.2.3. Log harvests are approaching 40 million cubic meters per year. A little over 20 percent is further processed in sawmills for downstream activities or export. But the bulk of timber harvests, in volume terms, is for the log export market.

Table 3.2.3
Annual Production of Logs and Sawn Timber

	Logs (MCM)	Sawn Timber (MCM)
Malaysia		
1980	27.9	6.2
1986	29.8	5.2
1990	39.8	8.4
Peninsular		
1980	10.4	5.3
1986	8.5	4.0
1990	12.4	6.2
Sabah		
1980	9.0	.54
1986	9.8	.80
1990	9.0	1.73
Sarawak		
1980	8.4	.35
1986	11.4	.37
1990	18.4	.51

Source: Department of Statistics, Yearbook of Statistics, Economic Report 1990/1991.

Primary (sawmills) and secondary (plywood/veneer, mouldings) processing primarily occurs on Peninsular Malaysia. Of the sawn timber production in 1989, 80 percent is on PM. Sarawak and Sabah are primarily exporters of logs to Japan (52 percent), Taiwan (16 percent), and South Korea (15 percent). It is part of Malaysia's plans to encourage the development of the wood-based products industry, increasing value added and employment with primary and secondary processing and reducing the export of raw logs.

Estimates of employment in the timber and wood-based products industry are provided in Table 3.2.4. The employment impact of downstream processing is immediately apparent. With two-thirds the annual harvest of Sarawak, PM has twice the number of estimated employees due to further processing. And PM has not developed its processing capabilities completely. Furniture manufacturing in particular is a designated target in Malaysia's plans (Economic Report, 1991).

Table 3.2.4
Employment in Timber and Wood-Based Industries:
1989 Estimates¹

Sector (firms)	Peninsular		Sarawak	Sabah
Logging (NA)	21,000	31,520	16,462	
Sawmills (1035)	28,000	5,428	8,816	
Plywood/Veneer (60)	15,930	2,222	4,070	
Moulding (122)	5,000	769	935	
Furniture (2000)	<u>10,000</u>	<u>NA</u>	<u>NA</u>	
Total	79,930	39,939	30,283	
Total Malaysia	150,152			

Source: Malaysia Profile of Primary Commodities 1990 and author estimates.

¹ Data available for Peninsular Malaysia. Estimates for Sarawak and Sabah from output/employment ratio for logging, employment/firm ratios for sawmills, plywood, moulding.

There are constraints on the development of a wood-based products industry which have been recognised by the Government. These include:

- (1) Firms often of inefficient size, use of outdated equipment and techniques. Waste is high and quality of finished product is poor.
- (2) Training of workers inadequate and supervision poor.
- (3) Future supply of logs depends on Sabah and Sarawak, but sawmills, plywood/veneer and moulding firms predominantly on PM.
- (4) Transportation, energy and labour resources are scarce on Sarawak and Sabah.
- (5) International competition from existing countries and new emerging countries (Indonesia, Philippines).
- (6) Tariff and non-tariff barriers in consuming countries.

- (7) Downstream firms will require a reliable, low cost source of log supply. Thus, sustainability of the forests in Malaysia is necessary for sustainability of the wood-based products industry.

The current revenues from timber harvesting and the wood-based industry are significant as Table 3.2.5 details. In terms of total economic activity, timber and the wood-based products industry represent about 10 percent of GDP and about 2.5 percent of total employment. Government timber royalties, premiums and cess charges represent 1.7 billion Malaysian Ringitts. This is almost 20 percent of all Federal revenues. Alternatively, it represents more than 50 percent of the State revenues of Sarawak and Sabah.

Table 3.2.5
Forest and Wood-Based Revenues: 1989
(Malaysian Ringitts 000,000's)

Total Value	9,600
Total Government Revenues	1,794
Peninsular	266
Sabah	878
Sarawak	614
Exports	
Total Value	8,714
Log Value	5,228
Log Volume (MCM)	20.9

Source: Malaysia Ministry of Primary Industries Forestry in Malaysia; and Profiles: Primary Commodities, 1990.

Exports of all timber and processed products represent 13.2 percent of all exports from Malaysia. Of this amount, about 60 percent of export revenues comes from logs.

3.3 Malaysia Forest Policies and Practices

Policy

In Malaysia, responsibility for land use, conversion and management rests with the State governments, not the Federal government. Thus, Malaysia has 13 separate forest policies coordinated by but independent of Federal Government control. In practice, coordination in the 11 states of Peninsular Malaysia is much stronger than in the eastern states of Sabah and Sarawak. Each state has its own Forestry Department with broadly similar responsibilities. In PM, the Department of Forestry dates to 1883. There is a Federal Forestry Department as well, which advises/coordinates forestry management with State Forestry Departments. The Federal department has a sophisticated research unit, the

Forest Research Institute of Malaysia (FRIM).

Several reconnaissance surveys of Malaysia's forest resources occurred in the 1960's (PM only), the early 1970's and early 1980's (National Forest Inventories). As a result of documented land use patterns, and increased pressures for land use conversion to agriculture, the National Forest Policy of 1978 was adopted by all states. This formed the policy basis to establish in each state a Permanent Forest Estate (PFE) for productive forests (timber management), protective forests (water catchment, erosion/siltation control) and amenity forests (unique areas, recreation). The National Forestry Act of 1984 provides implementing legislation.

Further, the Fifth Malaysia Plan (1986-1990) provides an entire chapter devoted to environmental protection, not only of forest products and resources, but air and water quality concerns as well. In forestry, the Fifth Plan calls for further forest "set asides" of unique areas and gazettement of more state lands into PFE. In addition, it calls for the enforcement of environmental impact assessments (EIA) for development projects affecting the forests including land use conversions, drainage of wetlands and logging of forest areas greater than 500 hectares. EIA are required under the Environmental Quality Act of 1974; in practice they are often not done.

In the National Forest Policy of 1978 and subsequent 5-year plans of Malaysia are provisions for the promotion of a wood-based industry in Malaysia (National Forest Policy, 1978). The Malaysia Industrial Development Authority in 1985 prepared an Industrial Master Plan including the Wood-Based Industry (Volume II, Part 4). The basic objectives are to transform the wood-based products industry to a major source of employment and export revenue by developing primary, secondary and tertiary processing of timber. This would discourage log exports and encourage use in domestic and foreign value added activities (IMP, 1985). With development strategies in place, the Master plan called for 20 MCM of Malaysia's logs (of 29 MCM) to be processed within downstream industries in Malaysia by 1995, thus leaving only an estimated 9 MCM of log exports in 1995.

Implementation of the above policies has not always gone smoothly. All states do have established PFE, but gazettement of lands is often time consuming and logging activities continue. The individual states often ignore Federal advice/guidelines in forestry management, and EIA studies on land development schemes are still haphazard. While progress has been made in developing the wood-based products industry, especially in PM, it seems improbable that the goal of processing 20 of 29 MCM of logs will occur by 1995. In 1990, less than 8 MCM of 39 MCM logs were processed within Malaysia.

Forest Management

Over the years, Malaysia's forest management system has evolved from the Malaysia Uniform System (MUS) to the Selective Management System (SMS) reflecting changes in terrain and species diversity, marketability of new species and optimal rotation concerns. The MUS involves the removal of all trees in one felling with poison girdling of the remaining noneconomic tree species. Applied to lowland forests, the result was the creation of an "open canopy" where sunlight would penetrate and seedlings would grow quickly. Regeneration of seedlings would result in a forest area of roughly similar aged trees for

future harvesting. The MUS dominated Malaysia forest practices from 1949-1980 although it is still practised in some areas today, particularly on Sabah and Sarawak.

The MUS was replaced by the SMS in the late 1970's and early 1980's. The SMS involves a use of a pre-harvest inventory to identify those trees selected for harvesting. Trees above, say, 45 cm of diameter breast high (dbh) of certain species are selected for cutting. This leaves a stand of trees 30 cm or greater as well as smaller trees. If trees grow at 1 cm per year, this means reharvesting can occur in 25-30 years. A post-harvest inventory is to assess the remaining stock to determine the amount of silviculture treatment necessary - poison girdling of noneconomic species, removal of vines/limbs restricting growth ("liberation thinning").

The advantages and potential difficulties of SMS have been identified (Nor, 1988). The advantages over MUS:

- (1) Regeneration of seedlings (under MUS) takes too long, 50-80 years to get trees at 50 cm or greater. Under SMS, the cycle is reduced to 25-30 years.
- (2) The hill forest in contrast to lowland forests is much more heterogenous. Thus, "open canopy" felling would increase waste. There is less poison girdling necessary as well.
- (3) MUS in hill forests would accelerate water catchment and soil erosion losses.
- (4) Silviculture costs are reduced (less replanting, poison girdling, thinning) in SMS over MUS. In fact, SMS relies on natural regeneration to a great extent.

There are potential problems with the SMS. Under SMS proper pre-harvest inventories and proper logging practices are essential. The SMS relies on minimal damage to the crowns, bark, roots, etc. of remaining trees to ensure appropriate tree growth rates, and it assumed that the remaining forest has an adequate stand of trees of all sizes. This means that monitoring of harvest practices and appropriate post-harvest silviculture treatment is necessary. In practice, the lack of Forest Department manpower prevents careful pre- and post-harvest inventories and monitoring of logging practices.

Qualitatively, the SMS is more labour intensive than is MUS, as it involves more non-logging labour effort than does MUS, and potentially over a longer period of time. This includes Forestry Department monitoring practices described above and silviculture treatment as well. While SMS relies more on natural regeneration than MUS, post-silviculture treatment is practised, including selective poison girdling, vine clearance or liberation thinning and selective replanting.

The sustainable annual harvest estimated by the Forestry Departments is impacted by whether the MUS or SMS is followed. By way of illustration, data from the Fifth Malaysian Plan (1986-1990) for Peninsular Malaysia (PM) is provided in Table 3.3.1. Total annual sustainable yield is 4.9 MCM. However, with the SMS, the cutting cycle is 30 years versus 55 years under MUS. Yield per hectare is 62.4 m³ under SMS and 79.1 m³ under MUS. With a common 55 year time horizon, the SMS will yield approximately 124.8 m³/h versus 79.1 m³/h under MUS. In line with the discussion in Section 2, the SMS shortens the optimal rotation considerably.

Table 3.3.1
Peninsular Malaysia: Annual Coupe from PFE only

Total Annual Area (h)	71,200
●30 year Cycle (SMS)	43,235
●55 year Cycle (MUS)	27,965
Mean Annual Increment in Growth	
●30 year Cycle (m ³ /h/yr)	2.6
●55 year Cycle (m ³ /h/yr)	1.8
Total Annual Harvest PFE	
●SMS area	
YRS x MAI x .80 x area	
30 x 2.6 x .80 x 43,235	2,697,864
●MUS area	
YRS x MAI x .80 x area	
55 x 1.8 x .80 x 27,965	2,214,828
Total	4,912,692

Ideally, the actual annual coupe or harvesting within the area set aside each year (i.e., 71,200 hectares) is determined by the pre-harvest inventory of the State Forestry Department. Trees are measured and marked for felling. The Forestry Department provides its estimates and recommendations for the annual harvest to the Chief Minister of the State. As this is advisory only, the Chief Minister's revenue requirements often is at variance with the Forestry Department's annual harvest recommendation. State revenues arise from forest royalty, premium and cess charges on logging. Cess charges are to be allocated to silviculture treatment.

Once the annual harvest is determined, the licensing of new concessions takes place. There are two broad classes of permitting. One class includes long term permits for large sawmills, State corporations and timber complexes who pay a premium (similar to a stumpage fee) for harvest rights. The second class of permits are short term permits to individuals based on a bid or tender system. Of the individual permits, there is a quota allocation or reservation of some areas for minorities (Bumiputras) to comply with affirmative action provisions of the New Economic Policy of 1971.

The duration of the permit depends on the size of the lease and capacity of the logger. The length of time is decided by the Chief Minister with advice from the Forestry

Department. Shorter leases increase State revenues at the cost of careful logging practices and sustainability criteria. Abuses of the permitting system have been noted in Malaysia's daily newspapers and, prior to one hotly contested election, a list of licenses in one state revealed strong family ties to the incumbent Chief Minister.

Silviculture treatment of logged-over forests is a key to estimates of sustainability. The SMS relies more on natural regeneration of the remaining stand of the forest; but it does require more careful logging practices and post-silviculture treatment as necessary. Such treatment includes selective poison girdling, vine clearance or liberation thinning and replanting of species if the volume and variety of the residual stand is inadequate.

A "cess" charge is imposed on loggers to be utilised for silviculture treatment. Logging firms may do the treatment and apply for reimbursement of cess, or, the State Forestry Department may provide the treatment.

What constitutes adequate silviculture treatment is a source of interpretation and dispute. Regardless of the quality of treatment, there is a big backlog of land area to be treated; approximately 291,000 hectares in 1990. The annual rates of silviculture treatment versus harvesting are also instructive; PM annual rates, 73, 625 hectares silviculture, 71,200 hectares harvest; Sabah annual rates, 12,000 hectares silviculture, 138,000 hectares harvest; Sarawak annual rates, 9,500 hectares silviculture, 110,000 hectares harvest (Profiles, 1990). Thus, the rate of forest rehabilitation on Sabah and Sarawak are far less than forest harvesting.

A final management strategy practised on some state lands, primarily in PM, is the development of plantation forests emphasising rapid growing species like *Acacia mangium*, *Gmelina arborea* and *Batai*. To meet PM domestic timber needs, a Compensatory Plantation Project began in 1982 to plant 188,200 hectares of rapid growing species on a 15 year cutting cycle. By 1990, some 53,000 hectares were planted. The quality of the wood is recognised as inferior to natural forest species, however.

Supply and Demand Concerns

Peninsular Malaysia (PM), the focus of the wood-based products industry, faces an imbalance in natural log supply versus anticipated log demand requirements during the latter part of the 1990's as Table 3.3.2 suggests. A sharp fall in natural log production is expected in 1994 or 1995 due to the clear cutting of state lands and the reliance on the PFE for remaining supplies (4.2-4.8 MCM per year). The balance must come from plantation forests (1-2 MCM per year) or rubberwood plantations (1.-1.3 MCM per year). Ignoring quality concerns of the latter two supply sources, puts PM's near-term annual log supply at 5.5-7.0 MCM per year and long-term supply at 8.0-8.5 MCM per year.

Table 3.3.2
Sources of Log Supply: Peninsular
Malaysia 1988-2010 (MCM)

Years	Natural Forest ¹	Forest	Rubber	Total
1988-1990	8.20	-	1.60	9.80
1991-1995	8.20	-	2.25	10.45
1996-2000	4.80	-	1.20	6.00
2001-2005	4.80	1.75	1.50	8.05
2006-2010	4.80	2.00	1.30	8.10

Source: Ministry of Primary Industries, Forestry in Malaysia.

¹ After 1994, harvest is from PFE.

However, PM sawmill capacity is 8.0-9.0 MCM per year and plywood/veneer capacity is 2.2 MCM in 1990. Growth in PM wood-based products industry will be restricted and perhaps curtailed entirely without a continued and dependable source of quality logs. PM will face a natural log deficit for domestic processing after 1994.

The logical source of log supply for PM would be Sabah and Sarawak which have only limited processing capabilities. However, both states are intent on developing their own wood-based products industry through downstream processing. These states have export levies to encourage domestic processing and these levies apply to PM as well as to foreign countries.

At the least, PM will suffer a reduction in logging employment. In 1989, with log production at 12.0 MCM, employment was 21,000. By 1995-96, employment will be no more than 10,500 in logging if output/employment ratios hold constant. If logs from Sabah and Sarawak are not forthcoming, employment growth (perhaps employment levels) in sawmills, veneer/plywood, mouldings and furniture will also be reduced. In any case, the transportation costs and export levies will give PM an additional cost disadvantage for downstream products.

3.4 The Case of Sarawak

Controversy over harvesting of Malaysia's tropical rainforest has been highlighted by recent events in the State of Sarawak. Deforestation coupled with indigenous land claims have led to protests, blockages, arrests and NGO intervention in the state. Threats of timber boycotts followed. Several study missions examined harvest practices in Sarawak (U.S. House, 1989; ITTO, 1990) as a result, prompted further by a request from the Government of Malaysia and the Chief Minister of Sarawak to undertake research concerning sustainable forest management in Sarawak.

The International Tropical Timber Organisation (ITTO) representing countries containing more than 75 percent of the tropical forests in the world and 95 percent of the international trade, conducted the Government study. The major consuming countries also belong to ITTO and headquarters are in Yokohama, Japan. The ITTO mission objectives were to "assess the sustainable utilisation and conservation of tropical forests and their genetic resources as well as the maintenance of the ecological balance in Sarawak . . . to make recommendations. . . .".

The State of Sarawak is represented in Figure 3.4.1. Representing an area of 124,449 square kilometres (12.33 million hectares), it contained a population of about 1.55 million persons in 1987 with a population density of only 12.5 persons per square kilometre. The capital and largest city Kuching has less than 100,000 people. Of the population, 29 percent are Chinese, the rest Malays, Indians and indigenous peoples. As Figure 3.4.1 suggests, nearly three-fourths of Sarawak's land area is forested, about one-fourth is utilised by agriculture including shifting cultivation by Malays and indigenous peoples. Production on rubber and palm oil plantations is limited to about 250 thousand hectares. Shifting cultivation may represent up to 2.0-2.5 million hectares according to Government estimates.

The ITTO summary report indicates:

- (1) "In a sentence, the mission's overall assessment is that sustainable management of the forests of Sarawak is being partly achieved . . .
- (2) Admirable features include . . . PFE, a Forest Policy which sets watershed protection as a primary objective, the reservation of areas for biodiversity, . . . system of tracing and controlling movement of logs . . .
- (3) A major impediment to sustainability is overcutting of hill forests and inadequate catchment management and control of felling operations.
- (4) Network of totally protective areas (TPA) is insufficient and procedures for gazetting TPA and PFE excessively slow."

The ITTO made three recommendations: hire more Forestry staff, improve standards of water catchment in hill forests, and phase down annual harvests to 9.2 MCM (including state forests). As production averaged 13.5 MCM in 1987-1988, this represents a 30 percent reduction. Instead, log production in 1989-1990 increased to 18 MCM per year.

The ITTO report was highly criticised as were logging practices and the treatment of indigenous peoples land claims. Another mission (U.S. House, 1989) to Sarawak found:

- (1) Current logging is unsustainable and have degraded the environment, e.g., by erosion, flooding and siltation, loss of habitat and wild game and fish.
- (2) Government response to native peoples land claims is inadequate. Competing land claims remain unresolved.
- (3) Up to one-third of Sarawak's 1.5 million people may be negatively impacted by logging activities.
- (4) Timber revenues benefit local population very little, except for concessionaires.
- (5) A hiring freeze of Sarawak's Forestry Department limits supervision and management of logging practices.

Figure 3.4.1

- (6) Cultural diversity of native peoples threatened. No local control of rate of logging and/or economic development.
- (7) Tremendous waste in timber industry from harvesting through end use consumption. For example, poor harvest practices damage the remaining stand of trees. Poor sawmilling practices and outdated technology and poor supervision of workers results in a low recovery rate of wood at sawmills.

In detailed sections, both study missions found Sarawak's forestry practices to be non-sustainable. Sarawak, like PM, is attempting to develop its own wood-based products industry. Unlike PM, which may suffer a log supply deficit, Sarawak suffers competitive disadvantages in skilled labour, capital and energy supplies and transportation difficulties. With a very small local market, Sarawak would further be at the mercy of international market prices and quality standards for almost their entire wood-based products output. It appears that for Malaysia as a whole, it would be economically more efficient to continue to develop the wood-based products industry on Peninsular Malaysia on account of its existing infrastructure, processing facilities and skilled and semiskilled labour. This would necessitate Sabah and Sarawak eventually exporting logs to PM, either with or without the export levies currently paid by other importers.

4. Malaysian Forest Policy Alternatives

There is no doubt that current timber harvesting levels in West Malaysia, Sabah and Sarawak are not sustainable in biological or economic terms. In part this reflects planned changes in land use patterns on state lands from forestry uses to plantation agriculture or urban conversion. But annual harvesting on permanent forest estates (PFE) is also not sustainable. In addition, the demand by indigenous peoples for rights to their customary lands (in both permanent forest and state lands) has not been resolved even though these rights are protected by law. Resolving this issue would further reduce any annual sustainable yield.

The problem is not policy; Malaysia's national policies and implementing institutions are in place. Rather, practices fall short of policy pronouncements. Management plans for forestry management are required; in practice they are often record keeping and revenue collection activities of what has occurred. The Forestry Department of each State provides estimates of sustainable yield on a biological basis. However, these are advisory only and State government officials are more concerned with short term revenue returns of timber harvesting than sustainability. Often forestry law governing timber extraction is not enforced due to lack of qualified personnel. Fines and penalties are too low to be effective.

The consequences of continuing current practices unabated are well known. Government projections indicate total annual log production on Peninsular Malaysia will decline after 1993; the decline is more pronounced if natural forest sources only are considered. Sabah's annual production has already declined. Sarawak's forests will be completely harvested in 11 to 15 years at current levels of production (approximately 340,000 hectares per year). After this period, logging would cease until land logged in early 1970's

would be ready for reharvesting.

With continued deforestation, the loss of amenity values will be exacerbated. This and the need to reduce annual yields is being recognised within Malaysia. The question is how much and by what mechanisms. The next section examines efforts to define sustainable yield in Sarawak and critically evaluates policy alternatives designed to achieve sustainability in practice.

4.1 Determination of Sustainable Annual Yield

Sarawak, on which this section focuses, has attracted worldwide attention in recent years due to protests by indigenous peoples and the support of environmental non-governmental organisations. Under pressure, the Government of Sarawak made a decision to invite a study mission of its forestry practices (ITTO, 1990). As mentioned above, the study results have been widely criticised.

Sustainability Definitions

At an abstract and non-operational level, sustainability generally means the attainment and maintenance of a natural resource stock yielding a continuing and non-declining flow of products and amenity values at levels for each which reflect the values of society. One among the non-trivial questions reflecting society's values, involves the relation of humans with nature. Does nature exist for humans to exploit and is this compatible with a harmonious relationship with the natural environment? An ecological extreme view puts man subservient to nature with a belief in biospecies' equality and promotion of biological diversity, espoused by the Convention on International Trade of Endangered Species (CITES). Complete biological diversity would occur only when the forest is undisturbed.

Within the broad definition of sustainability, troublesome policy issues exist in Malaysia and elsewhere. These include the following:

- (1) **Policy versus Practice.** Does the government have a forest policy promoting sustainability of timber and non-timber objectives? In Malaysia, the answer appears to be yes with regard to policy and no with respect to practice. The 1978 National Forestry Policy and the 1984 National Forestry Act (Act 313) provide the guiding principles for: the establishment of permanent forest estates (PFE) and their management along multiple use provisions; forest rehabilitation, harvesting and development of a wood-based industry; as well as research and development. Licensing requirements, permits, royalties, cesses and fines for violations, are carefully spelled out in the 1984 law. Each State has a Forestry department with a long tradition of professionalism. Sustainability criteria in practice are achieved through the advice, monitoring, collection and research activities of the State Forest Departments.
- (2) **Sustainable Policy for Non Timber Values.** Even within the policy context, timber values dominate non-timber amenities. Policy emphasis is on sustainable yield of timber benefits; non-timber benefits receive less focus. Logging in the steep slopes of the hill country reduce water catchment values and encourage erosion and river siltation.

With non-timber values neglected, the income and employment consequences of these

values are also neglected. These include, among other concerns, tourist-related activities, non-timber products related to the forests' biodiversity (cosmetics, drugs, etc.), and the maintenance of the indigenous peoples' lifestyle.

Contrary to the latter objective, indigenous peoples are sometimes considered a nuisance or are considered responsible for Sarawak's deforestation by State Forestry and Government officials (Lau, 1979; ITTO, 1990; Profiles, 1990). This seems to be a view accepted by several representatives of the Sarawak Mission as well (ITTO, 1990).

- (3) **Sustainability: PFE and State Lands.** Another issue relates to what forest areas are being considered for sustainable management. For this purpose, the major distinction is between PFE, which are to be managed for forest timber and non-timber uses, and State lands, representing all other lands which are to be used for a multiplicity of purposes. Some state lands are clear cut and converted to plantation or other agriculture. Other lands are for urban and industrial purposes. Finally, some state lands are regenerated for subsequent forest production. Sustainability thus depends upon a distinction between current land use versus planned land use and on the desirability of conversion of existing forest lands to agricultural, industrial or residential purposes.

Sustainability Arithmetic for Sarawak

To illustrate the nature of the difficulties in determining sustainable yield, calculations will be presented utilising data from Sarawak. The calculations are based on estimates from the Sarawak Mission of 1990 (ITTO, 1990), the response by environmentalists (Castelleja, 1990) and modifications prepared for this report. It should be emphasised that all estimates of sustainability here are biological in nature, following the MAI concept.

To define sustainability requires first a definition of the area in Sarawak available for forestry timber and non-timber uses. Table 4.1.1 provides estimates (ITTO, 1990) based on government reports, plans and interviews. Of 12.5 million hectares of land, some 52.5 percent (6.5 million hectares) are for purposes other than timber production. Nearly 1.0 million hectares of this proposed land use is for Totally Protective Areas (TPA) - essentially to remain as virgin forests.

Of lands available for timber and non-timber uses (5.9 million hectares), Table 4.1.1 provides information on the status and slope of these lands. Logging on steep slopes (slope > 60%) worsens environmental problems and harvesting practices used on lowlands are not appropriate to the forests on steep slopes. Within the 5.9 million hectares available for timber production on PFE and state lands are the disputed indigenous peoples land claims. While not precisely known, these claims are estimated to be about 500,000 hectares.

Table 4.1.1
Available Forest Land in Sarawak¹

	Hill Forests		Peatswamp	Mangrove	Total
	Slope < 60%	Slope > 60%			
Primary Forest					
PFE	1721	614	150	22	2507
State	824	588	195	84	1691
Harvested Forest					
PFE	729	68	529	15	1341
State			242	2	244
Deforested Land					
PFE	90	1	24	1	116
State				31	31
Totals					
PFE	2540	683	703	38	3964
State	824	588	437	117	1956
Total Available	3364	1271	1140	155	5930

Source: ITTO, 1990 (Tables 5.1 and 5.2).

¹ Original Forests for all uses in Sarawak minus alternate uses (agriculture, urban, total protective areas) is 12,460 - 6530 = 5930 hectares (000's).

Estimates of sustainable timber production by the Sarawak Mission is provided in Table 4.1.2. This assumes a rotation of 35 years, cutting of trees greater than 45 cm (dbh) of species type 1-3. Liberation thinning involves removal of vines and small trees to permit more rapid growth of remaining species. No cost estimates were provided for this practice. Clearly, there is a return for this silviculture treatment in terms of timber yield as Table 4.1.2 implies.

Table 4.1.2
ITTO Sustainability Estimates for Sarawak
(000's)

Forest Lands Available	Area (hectares)	Sustainable Yield Untreated (cubic meters)	Liberation
PFE < 60% slope	3,135	4,100	6,300
Add State < 60% slope	4,513	6,300	9,200
Add PFE > 60% slope	5,198	7,000	10,500
Add State > 60% slope	5,783	7,700	11,000

Source: ITTO, 1990.

Regardless of the costs of liberation thinning, the ITTO Mission found itself in a dilemma. Actual logging in 1987-1988 was about 13.5 million cubic meters per annum. As Table 4.1.2 indicates, sustainable annual yield (SAY) on PFE < 60% slope is 4.1-6.3 million cubic meters per year. Thus the mission report states, "a precipitate reduction in the rate of harvest to this level, because of its social and economic impacts, would be neither recommendable nor realistic. Accordingly, other options were explored for sustaining a higher yield." (ITTO, 1990, p. 34).

Unfortunately, these options included adding state lands to the permanent forest estate (difficult and time-consuming), the assumption of liberation thinning (costly), or adding PFE and state land with slopes greater than 60% to the production area (large environmental damages). In addition, indigenous land claims (reducing harvests) were ignored.

The ITTO Mission recommendation regarding sustainability was 9.2 million cubic meters per year, representing the assumptions implicit in row two of Table 4.1.2. The timber is assumed to be cut on a 35 year cycle at girths of 45 cm dbh of wood quality 1-3. If harvests were limited to trees of 60 cm dbh or more and to wood quality or species No. 1, longer cutting cycles (about 45 years) would be necessary to yield first cut volumes at 38 m³ per hectare. The use of 45 cm dbh of species 1-3 assumes that future markets can be found for these smaller logs of more diverse species. The predicted harvest volume of the smaller, more diverse cut would be 68.9 m³ per hectare. Utilising the sustainable annual yield (SAY) formula of section 2.0 and the land area from Table 4.1.1, gives the ITTO estimate for annual yield:

$$\text{SAY} = A \times (B \div C) = 4.655 \times (68.9 \div 35) = 9.163 \text{ MCM.}$$

This figure, while 70 percent of the actual annual cut in Sarawak for the years 1987-88, was criticised widely by environmental groups and indigenous peoples as being excessive and unsustainable.

Environmental groups, relying on the basic data in Table 4.1.1, provided their own estimate of SAY for Sarawak (Castelleja, 1990). The assumptions are as follows: land available is only PFE less than 60% slope; no liberation thinning occurs; a 50 year cycle is harvested of trees 60 cm dbh or more of species No. 1. The estimated first cut volume is 38 m³ per hectare resulting in a sustained annual yield $SAY = 3.835 \times (38 \div 50) = 2.92$ million cubic meters per year. Accounting for indigenous lands of approximately 500,000 hectares and deducting this land area from timber harvesting $(2.92 - (.5 \times .76))$ results in a sustainable annual yield of 2.54 million cubic meters in Sarawak. This is one-fifth the current annual cut in Sarawak.

These exercises indicate the sensitivity of SAY to maintained assumptions. Estimates of SAY are particularly sensitive to assumptions about liberation thinning, minimum cut size (cm of dbh) and species quality (see Appendix A). All affect predicted harvest volume in a straightforward fashion. Each assumption is under management discretion with well-defined costs and benefits. Table 4.1.3 re-estimates the SAY, incorporating the conservative baseline assumptions of the environmental group with the liberal assumptions of the ITTO mission. For each case, the impact of indigenous peoples' land claims have been incorporated by deducting timber harvests estimates from lands on the PFE and state lands in a pro rata fashion. The upper portion of Table 4.1.3 calculates SAY for the PFE land area (less indigenous land); the lower calculates SAY for PFE and state forest lands. There is no guarantee in practice that state lands will continue in forest production.

Sustainable yields vary considerably. For a 35 year cycle, they range from a low of 2.37 million CM per annum based on no silviculture treatment, on trees 60 cm or greater dbh of species quality No. 1, to a high of 8.18 million cm per annum. The former estimates incorporate the assumptions of the environmentalists, the latter that of the ITTO mission. For each estimate, 500,000 hectares of indigenous lands and corresponding timber production were deducted.

Two major observations derive from this exercise and the figures in Table 4.1.3. First, sustainability is a pliant concept even within the biological concept of timber harvesting alone. Second, column one estimates, the most conservative, come closest to the current market for sawn logs - large logs of good quality represent the export characteristics desired. Much of timber processing waste is of the poor quality and undersized logs. For sustainability estimates close to the ITTO figures to emerge, a market for these timber products will have to emerge.

Table 4.1.3
Alternative Sustainability Estimates in Sarawak
(000's)

Permanent Forest Estimates (PFE)				
	Species	60 cm	45 cm	
	1	1-3	1	1-3
35 year cycle				
Untreated	1.68	2.12	2.70	3.58
Liberation	2.38	3.01	4.50	5.80
50 year cycle				
Untreated	2.18	2.80	2.89	3.69
Liberation	2.54	3.27	5.00	6.44
Total Sarawak (PFE and State)				
35 year cycle				
Untreated	2.37	2.98	3.81	5.04
Liberation	3.35	4.24	6.03	8.18
50 year cycle				
Untreated	3.07	3.95	4.07	5.20
Liberation	3.58	4.61	7.04	9.08
PFE = 2.95 million hectares (net of slope > 60% and Indian lands)				
State = 1.21 million hectares (net of slope > 60% and Indian lands)				

Source: Table 4.1.1 and Appendix A.

4.2 Sustainable Employment in Malaysia's Forestry Sector

The sustainability exercise for Sarawak could be repeated for Sabah and Peninsular Malaysia as well. Instead, estimates for sustainable yield from the Permanent Forest Estate for Sabah and Peninsular Malaysia will be used to derive sustainable employment implications in the timber and wood-based products industry in Malaysia. Information previously discussed (see Tables 3.2.2 to 3.2.4) will be utilised for this derivation.

The information in Table 4.2.1 examines current production of raw logs in the three major producing areas and the associated logging and wood-based products employment. Column 4 of Table 4.2.1 represents "employment units" supported in logging by the annual coupe in each region and for Malaysia as a whole. In general for Malaysia, each one

thousand cubic meters cut supports 1.73 logging employment units. The figures for PM, Sabah and Sarawak reveal a very similar relationship between annual harvest and logging employment.

Column 5 represents employment units supported in the entire wood-based products industry, including semifinished and finished products. The figure for the whole of Malaysia, 3.77 employment units per thousand cubic meters of annual cut, hides considerable regional disparity. For PM, the development of the wood-based products industry has proceeded further into semifinished and finished product lines than has the industry in Sabah and especially Sarawak. The result is greater employment supported by volume of logs cut in PM than Sabah or Sarawak.

Table 4.2.1
Current Annual Harvests and Employment

	Total Harvest (MCM)	Total Employment	Logging Employment	Employment Units Logging	(L/Q) Total
Peninsular	12.4	79,930	21,000	1.69	6.44
Sabah	9.0	30,283	16,462	1.83	3.36
Sarawak	18.4	39,939	31,520	1.71	2.17
Malaysia	39.8	150,152	68,982	1.73	3.77

Source: See Tables 3.2.2, 3.2.3 and 3.2.4.

To link sustainable harvests of timber to sustainable employment, the following assumptions are maintained:

- (1) Malaysia relies only on its own timber resources for raw materials. Malaysia does not become a net importer of logs.
- (2) Existing technology is maintained and the apparent productivity implicit in the employment unit concept (L/Q) is maintained.
- (3) No further downstream processing of wood products occurs beyond the level exhibited currently by PM.
- (4) Sustainable yields of timber are from the Permanent Forest Estate only.

Table 4.2.2 provides some benchmark estimates of sustainable employment. Column 1 provides the total and regional distribution of the Permanent Forest Estate (PFE), while column 2 represents estimates of sustainable annual yield from the PFE. The total annual coupe for Malaysia is 14.8 MCM from the PFE. This contrasts with the actual coupe of 39.8 MCM in 1990 from all sources; PFE, state lands and plantations.

The next column provides estimates of logging employment given the sustainable yield

figures. Logging employment will fall from nearly 69,000 persons in 1990 to 25,600 persons under sustainable yield conditions. Sarawak alone will lose 21,000 logging jobs.

The last two columns of Table 4.2.2 estimate total timber and wood-based products employment. Column 4 relies on the employment unit information from Table 4.2.1 specific to each region. Column 5 estimates employment as if each region further processes its wood products to the extent currently practised in PM. PM continues at the same degree of processing as it currently practices.

Table 4.2.2
Sustainable Annual Harvests and Employment

	PFE (000's)	Sustainable Yield (MCM)	Employment Logging ¹	Total I ²	Total II ³
Peninsular	4,750	4.9	8,325	31,556	31,556
Sabah	3,350	3.9	7,200	13,104	25,116
Sarawak	4,640	6.0	10,345	13,020	38,640
Malaysia	12,740	14.8	25,604	57,680	95,312 ⁴

Source: PFE in Tables 3.2.1 and 3.2.2. Sustainable Yield in Table 3.3.1 (for PM), Table 4.1.3 (for Sarawak). Sabah estimates by author from PM and Sarawak. SAY = 4,900 + 6,000 = 1.16. Sabah is 1.16 x 3,350 = 3,900. PFE 4,750 + 4,640.

¹ Employment in Logging is Logging Employment Unit (L/Q) times Yield.

² Total Employment I is Total Employment Unit (L/Q) times Yield.

³ Total Employment II is PM Total Employment Unit (L/Q) times yield.

⁴ Ignores PM plantation yields and associated employment (3.2 MCM per year x 6.44 = 20,600 employees).

The figures in column 4 reveal Malaysia's forest and wood products employment to be approximately one-third the current levels under sustainable yield conditions and with the current structure and extent of processing of wood products. All regions suffer in the downturn. Total employment is reduced from 150,000 to less than 58,000.

The impact of downstream processing is immediately apparent in column 5, where the assumption is that processing on Sabah and Sarawak proceeds only to the point where PM is at present. Sustainable employment increases from 57,000 to 95,000. Although this is a significant improvement, it still represents a loss of one-third of industry employment from current levels.

While the sustainable employment estimates were based upon conservative assumptions, in the short term these assumptions appear realistic. Adoption and diffusion of new

technology, investment in downstream processing facilities, and introduction of new commercial species, are not easy commitments that bring immediate returns. It is further noted that Peninsular Malaysia has made an effort to develop and harvest plantation forests (oil palm, rubber) for wood products. Official estimates place this additional source of timber at 3.2 MCM per year. In the context of Table 4.2.2, this translates into perhaps 20,000 additional wood-based industry jobs.

In sum, sustainable yields from PFE alone in Malaysia are approximately 14.8 MCM versus current yields of 39.8 MCM from all sources. Sustainable employment, based on current productivity and the structure of the industry, may be only 58,000, including 25,000 logging jobs. Current employment is 150,000, with 69,000 in logging positions. Total employment opportunities would be maintained if downstream processing activities were increased and new sources of supply (oil palm and rubber) were included. Even with these developments, employment losses of 35,000-55,000 could be anticipated.

Clearly, there will be significant transitional costs of any movement towards sustainable yields in Malaysia and such a policy change will require transitional assistance to displaced workers. However, since current annual coupes are not sustainable in the long run in any event, the downturn in logging employment and associated wood-based products employment will occur either with or without an explicit policy decision toward sustainable yield. Conceivably, an unplanned downturn may prove more abrupt than a gradual policy directed towards downsizing of the sector to levels that are sustainable.

4.3 Monitoring and Principal-Agent Concerns

One of the noncontroversial recommendations of the ITTO was the need to comprehensively strengthen the staff of the State Forest Department, which has been frozen in size since 1982. While forestry staff levels were frozen, annual harvests increased by 50 percent. The result is that most of personnel time is spent on revenue collection and administration.

Under current conditions in timber harvesting, the State Forestry Department acts as the principal; the concessionaires are their agents. The familiar problem is how do principals ensure that agents act in a manner consistent with the principal's objectives. The mechanisms are: (1) monitoring of forest harvest practices; (2) the control of terms and conditions of licenses including time limits, fees/royalties; and (3) the imposition of penalties for noncompliance or inappropriate behaviour.

The size of the State Forestry Department relative to concession areas open for logging (340,000 hectares in 1990) would suggest that monitoring practices, pre-harvest inventories, post-harvest inspection and rehabilitation efforts are weak at best. As a result, in addition to inadvertent environmental consequences due to lack of State supervision, there are increased reports of illegal reentry into once cut PFE and state lands, game poaching, and illegal timber harvesting in national parks and wildlife areas, like Taman Negara in Peninsular Malaysia (New Straits Times, February, 1991).

In addition to strengthening the State Forest Departments through increasing staffing, the license/concession practices are coming under increased criticism. The terms of the concessions vary from several years to 25 years. Renewals are not guaranteed. Suggestions have been made to increase the term of the concession so that they match the cutting cycles (at least 35 years) with conditional renewals possible after post-harvest inspections. Policy changes along these lines would attempt to bring concessionaire (as agent) behaviour more in line with State (as principal) objectives.

Finally, penalties for noncompliance or inappropriate behaviour need to be strengthened. Violations are often not enforced, in part due to insufficient monitoring activity. When they are enforced, violations result in small penalties which, in practice, can easily be absorbed by concessionaires interested in short-term profit seeking behaviour.

Major violations, as in a failure to cease operations due to reported infractions, results in a M\$ 5000 fine (about US\$ 2000). Continuing fines are M\$ 300 per day (US\$ 120). For large or even small operations, this is unlikely to be a significant deterrent to undesirable activities.

4.4 Reduced Demand for Log Export Product

A number of policies have been recommended both within and outside Malaysia to reduce the demand for tropical log exports and thus presumably get closer to sustainability in timber harvesting practices.

Increased Production of Finished Products

A policy option supported by the Malaysian government is to encourage downstream activities in the wood-based industries. Mentioned in the National Forest Policy Act of 1978, and various Five Year plans, the wood-based product industry was the subject of extensive study by the Malaysian Industrial Development Authority (Malaysia, Volume II, Part 4, 1985).

While the potential to move into higher valued products in the wood-based industry exists, the problems facing Malaysia are significant in spite of attendant employment gains. Firms are small (87 percent have less than 50 employees), productivity is low and product quality is variable (Malaysia, Volume II, 1985) with low log recovery rates. Further, the overwhelming bulk of sawmill and wood manufacturing capacity is on West Malaysia. In fact, West Malaysia processes most of its own timber harvest. Log exports are perceived problems on Sarawak and Sabah, which have no serious wood-based industry. The development of a wood-based industry will require closer coordination between Peninsular Malaysia, Sabah and Sarawak. The latter states have resisted cooperation, arguing for a need for wood-based industries in their own states. But this strategy would be complicated by a lack of skilled labour, small domestic markets and poor transportation facilities.

Aggravating the situation are import policies of Malaysia's major customers: Japan, South Korea and Taiwan. Logs imported from Malaysia bear low tariffs while finished wood-based products are discouraged by much higher trade barriers (FAO, 1988). The

ability to expand Malaysia's wood-based industry depends on some factors beyond Malaysia's control, including consumer country trade policies and existing and new trade competitors like Indonesia.

The states of Malaysia are proceeding with efforts to encourage local processing. Sarawak provides a rebate of 80 percent on the royalty rate of logs processed (within the state only). Log exports to other countries or to other Malay states bear the full royalty rate. In 1988, the revenue foregone by Sarawak was estimated at M\$ 20 million on 1.4 million cubic meters of locally processed logs. Total timber harvests were approximately 13 million cubic meters in 1988, 18 million cubic meters in 1989 and 1990.

Increased Royalties, Cess Charges, Fines

A familiar Pigovian response to externalities would be to internalise the externalities through tax levies. As indicated in Section 2.0, this would increase the rotation period. To the extent log product prices were also increased, some reduction in quantity demanded would also occur. Alternatively, at constant export prices, concessionaire profits would be reduced.

In 1988, Sarawak derived 480 million ringgit from the forestry sector revenues, including premiums, royalties, cess and fines. This was 53 percent of state revenues. As noted previously, fines are low and not an effective deterrent to undesirable behaviour. More meaningful penalties, perhaps on a sliding scale for continuing violations would improve compliance and perhaps enhance revenue collections as well.

Timber Export Quotas

Timber export quotas have been proposed or adopted by a number of tropical timber countries, including the Philippines and Thailand. Recognition of non-sustainable timber practices is in part responsible, but efforts to encourage downstream wood-based industry production also contributes to these policies. For example, Sarawak and Sabah are making efforts to curb log exports to stimulate domestic downstream activities. They also offer royalty rebates on timber domestically processed.

Export quotas can accomplish what sustainable yield calculations and practices did not accomplish: the limiting of annual harvesting and export of tropical timber. An additional benefit is that the reduced export supplies by a number of countries might raise market prices, so industry and Government revenues would not fall much.

The downside is that export agreements by countries to raise prices have generally been unsuccessful as individual country goals, resources, population pressures all differ. Furthermore, smuggling of contraband tropical timber is not uncommon in the region.

Consumer Boycott of Tropical Timber

It has been recommended by a number of environmental groups that a boycott of tropical timber by consumers would reduce demand and unsustainable harvests. However, there are difficulties attached to this proposal.

First, like export quotas among countries, a consumer boycott would rely on joint cooperation to be effective. But timber processing capacities built up in Far Eastern countries rely heavily on foreign imports of timber. These processing interests are unlikely to be found willing to operate against their own self interest.

Second, concern need not abate if a boycott were successful. If tropical forests lost their timber value due to the boycott, it may encourage more rapid clear cutting and conversion to non-timber uses that would accordingly become more attractive.

Third, a consumer boycott requires "labelling" or identification of sustainable from non-sustainable sources of timber. Past efforts to reliably convey such information do not give one confidence.

4.5 Property Rights Allocation

The allocation of property rights to resolve some of the forestry issues in Sarawak has surfaced in several contexts. These include indigenous peoples land claims, gazetting more state lands into PFE and moves to privatise forest lands or their management.

The Sarawak Land Code recognises native customary land rights. Section 5(2) recognises rights created prior to 1958 by a number of methods involving evidence of habitation and use. It does not require formal filing of applications, deeds, etc. In practice, the definition of customary land is disputed while logging continues. The State recognises the right to native dwellings (longhouses) and immediately adjacent area, but not the adjacent forests.

Maps of customary lands do exist, but not officially. Periodically, xerox copies have appeared to resolve one legal dispute or another, but they disappear shortly after (U.S. House Study, 1989; Jonish, 1991). A preliminary step to resolving the issue is to introduce formal maps of customary lands into the official record or to develop a map of customary lands. Unofficial estimates have put claims at about 500,000 hectares; presumably affecting both PFE and State lands. Resolving indigenous land claims would go a long way toward defusing the socio-economic debate over forestry management.

In addition to land, indigenous peoples might be given property rights in the production of timber and amenity values. Greater training and employment opportunities would also enable these people to receive more of the direct benefits of timber production and processing activities. Furthermore, employment in parks, reserves and as forest department personnel would involve them in amenity management.

Land can be converted to PFE use from State land use and vice versa under the National Forestry Policy and Act. Allocation of more lands to PFE or to totally protective areas (TPA) would provide greater assurances of long term sustainability of forests for timber and non-timber uses. But the gazetting process to PFE is lengthy and exploitation and conversion proceed while the legal process continues.

Privatisation has been recommended as an alternative to State owned and controlled forests. It is argued that the interests in maximising net returns over all time periods by private owners would ensure sustainability of timber harvests. However, it ignores amenity and social values in the forest which are not captured by the private owners and it ignores the shortness of the private time horizon as governed by the interest rate. Thus, public monitoring and control would remain necessary with private forest management. The most practical mechanism for privatisation of forest lands would be the lengthening of the license/concession period. Currently, this varies from several years to 25 years, too short to interest concessionaires in the maintenance and regeneration of the forest resources.

4.6 Increased Yields and Alternate Products

Research, testing and commercialisation of new ideas point to directions Malaysia might take to increase yields on PFE and State lands. Liberation thinning can increase harvest volume by 40-60 percent on a 35-year cycle; and 16-50 percent on a 50-year cycle (see Appendix A). While liberation thinning is costly and labour intensive, yield increases are large enough to suggest such practices to be cost-effective. The employment gains would offer an additional social benefit.

Even on clear-cut state lands, subsequent timber production and amenity values are non-zero. Much of the converted agricultural land is in plantation agriculture, oil palm and rubber. Although at reduced levels, these plantations provide timber, water catchment and soil protection. In recent years, aging rubberwood has been utilised in Peninsular Malaysia as a timber product. In 1988-1990, rubber plantations provided about 1.5 million cubic meters per year of log supply to Peninsular Malaysia's total of 9.8 million cubic meters per year (Ministry of Primary Industries, n.d.).

Other yield-increasing efforts include the establishment of fast growth plantations of tropical varieties like *Acacia mangium*. To the extent that these practices on State lands increase annual harvest yields and provide employment, this may help reduce pressures on native rain forests.

Another strategy of promise is the development of new commercial products within Malaysia's forests. Rubberwood and *Acacia mangium* mentioned above are two illustrations. Similarly, the ITTO estimates of sustainability for Sarawak implicitly assume a commercial market for smaller logs of a poorer quality can be developed.

Potential of new products is sometimes considered enormous, particularly for non-timber forest products (NTFP). A number of products have been identified for commercial feasibility (Dixon, 1988). These include products for the cosmetics and perfume industry, spices, herbal teas, mushrooms, honey and natural foods. Many of the proposed products require little capital for entry and processing involves known technology. The feasibility study argues that there is a growing "green" customer base for these products.

Finally, as indicated earlier, another way to increase net yield is to improve harvest, transport and sawmill practices so that waste is reduced. This involves appropriate training and supervision within the timber harvesting production process. Even waste byproducts

(inferior quality logs, wood waste, sawdust) have product uses in pulp/paper and wood chip industries. Malaysia imported M\$ 1.25 billion of pulp, paper and allied products in 1989. Currently, there is one pulp/paper processing facility in Malaysia (on Sabah).

4.7 Small Scale "Swidden" Agriculture

Swidden agriculture is slash and burn agriculture, a traditional farming method practised by transitory subsistence populations. In areas with high population densities, the wide scale practise of this farming method can be destructive. In Sarawak, low population and abundant land make it less of a problem. Nevertheless, swidden agriculture remains a problem.

State and Federal government sources view swidden or shifting cultivation as mainly responsible for Sarawak's deforestation (U.S. House, 1989). In recent publications, Government sources put the impact of swidden agriculture at 2.25-3.3 million hectares in Sarawak and 1.1 million hectares in Sabah (Ministry of Primary Industries, 1989; Profiles, 1990). If correct, swidden agriculture is an important contributor to deforestation in Malaysia.

Others view logging practices as primarily responsible for deforestation. Even the same data is used to support opposing views. According to a State Forestry official in 1979 (Lau, 1979): "with an average family of 6 persons, the number of households practising shifting cultivation would be 36,000. Estimates of forested area cleared annually per family unit vary widely, but a conservative average of 7 acres has been estimated. This puts the annual area of forests cut for cultivation at 250,000 acres (100,800 hectares). The percentage of mature high forest cut is around 60 percent." The author concludes that the shifting cultivation system is a disaster to sustained forest management.

Eleven years later, a U.S. study group found: "an estimated 36,000 families in Sarawak are swiddeners. Studies have shown that swidden households with an average of six people rarely exceed 6.2 acres (2.5 hectares) of land, which represents a total of 180,000 acres (73,000 hectares). Less than half of swidden land is cultivated in primary forest. The amount of primary forest used is not even 15% of the 270,000 hectares logged by the timber industry in Sarawak during 1985." The authors conclude that it is difficult to blame shifting cultivation for deforestation.

Both views hold elements of truth, although the U.S. study group's arithmetic is wrong. Shifting cultivation contributes to deforestation (42,000-60,000 hectares per year) but not as much as claimed by the government. Timber harvesting contributes to deforestation if sustainable practices are not followed, which they are not. In 1989, 340,000 hectares were logged in Sarawak. With a larger population and a smaller land area, shifting cultivation with movement every 2-3 years can become a serious problem contributing to deforestation. At the present time in Sarawak, logging practices appear to be a much more important contributor to deforestation.

Nonetheless, there are proposals to reduce the impact of shifting cultivation. Permanent settlements with alternative employment including plantation agriculture have been

recommended. Improved soil rehabilitation, fertilisers, etc. are also argued to reduce swidden agricultural practices by maintaining productivity on current settlements.

Such proposals are strongly resisted by activists within the various Indian tribes in Malaysia and particularly Sarawak (ITTO, 1990 Appendices). Various nongovernmental organisations (NGOs), both within and outside of Malaysia, have come to their assistance in providing political, legal and research advice in resolving their problems. As a first major step, the recognition and resolution of indigenous peoples' land claims (estimated at 500,000 hectares) would provide a basis for the solution to their predicament.

4.8 National, International Revenue Sharing

It has been argued that the heavy reliance of the States of Sarawak and Sabah on revenues generated from forest harvesting has accelerated unsustainable harvest practices. In Sarawak, timber royalties represent 53 percent of government revenues. The problem is exacerbated by the fact that forest lands and policy are the domain of the individual states. Each state has its own forest department and coordination among states is voluntary. This suggests two strategies; national and international revenue sharing.

National Revenue Sharing

While each state has its own forest department, policies and practices, this is not the case for all natural resources and their exploitation. Oil and gas is under control of the Federal government, not individual states. The reason is perhaps that most if not all of major oil and non-associated gas fields are off-shore. Royalties, export taxes and other oil and gas levies provide the Federal Government with 30 to 35 percent of its revenues each year. The net surplus from international trade in oil and gas was M\$ 8.245 billion (US\$ 3.0 billion) in 1989 (U.S. Embassy, 1990).

Oil and gas fields exist offshore of Peninsular Malaysia, Sarawak and Sabah. A federal-state revenue sharing scheme offers Malaysia two possibilities: (1) to reduce pressures on states like Sarawak and Sabah to rely on timber royalties for the bulk of their revenues, and (2) leverage by the Federal government over state governments to bring timber annual harvests and practices into line with the National Policy.

International Revenue Sharing

There has been considerable attention paid to Malaysia's forestry practices by the worldwide media and environmental groups. Concerns about deforestation, indigenous peoples and global warming have led to significant pressures and a threat of a tropical timber boycott if forest harvesting practices and policies in Malaysia, and particularly Sarawak, are not altered.

Such pressures, however well intentioned, offend nationalistic feelings adversely. It is equally appropriate for countries like Malaysia to argue that the energy consumption policies of developed countries are responsible for international environmental degradation including global warming. Both policies, one to reduce pollution from hydrocarbon sources

and the other to improve sustainability of forest management, are required. The economic solution would evaluate incremental costs and benefits of each strategy and equalise these choices at the margin.

But participant countries differ in total wealth, income per capita and economic development policies. "Debt-for-conservation" swaps have been recommended to encourage debtor nations to engage in more environmentally sound, conservation oriented practices. Internationally-owned debts are in part forgiven or used to purchase lands for parks, reserves or conservation enhancing practices. This reduces the country's international repayment obligations while enhancing environmentally sound practices. Malaysia's international debt in 1988 was US\$ 25 billion. In the same year, the U.S. international debt was US\$ 400 billion.

In Malaysia's context, such debt-for-nature swaps might be used to increase the size of the PFE, to purchase for reservation purposes the indigenous land claims, as well as to reduce annual harvests through revenue supplements to states like Sabah and Sarawak.

A possible concern with such a policy, regardless of which country is under consideration, is environmental blackmail. Debt ridden countries could argue that certain unsound environmental practices will be undertaken unless debt reduction concessions are provided. How to assess genuine environmental needs versus premeditated environmental threats may not be trivial in many instances.

5. Conclusions

5.1 Land Use and Sustainable Forestry

While 20.5 million hectares (62.4 percent) of Malaysia remains forested, government policy incorporated in the creation of the PFE and parks and wildlife areas have dedicated 14.1 m hectares (42.9 percent) to continued forest use. The remaining 6.4 million hectares of state forest lands (including 4.6 m on Sarawak) are available for land use conversion to plantation agriculture and related.

Estimates of employment in Malaysia's agricultural sector are 1,714,000 people versus 150,152 persons in forestry and the wood-based products industry (see Appendix B). It is argued that such land use conversion has generated significant employment opportunities in plantation agriculture, although at least two-thirds of Malaysia's agricultural acreage is in small family holdings which rely on family employment, often unpaid. Sabah and Sarawak have very limited populations so land use conversion pressures should be minimal. In recent years, with Malaysia's rapid industrialisation, labour vacancies in the plantation and timber based sectors have arisen, leading to the immigration of Indonesian and Philippine labour contracted for plantation work. Rural to urban migration should reduce pressures for land use conversion in PM. Accordingly, it would appear that the justification of conversion of forest lands to plantation agriculture is not warranted on the ground of employment creation

given the short-term labour market reality in Malaysia.

Forest management practices are not sustainable. Annual log production is approaching 40 MCM in Malaysia, with Sarawak representing 18 MCM per year. Sabah's log production is already declining, PM production will fall dramatically after 1994 and PM will become an importer of natural logs after 1996 if it is to maintain its current sawmill and plywood/veneer capacities. Sarawak's log production rate suggests a complete harvesting of state and PFE forests (under 60 degree slope) in 12-14 years. Reentry and initiation of a new cutting cycle will depend on areas originally cut in the 1970's. Without an adequate source of quality logs, the wood-based products industry and its associated employment is at risk in PM.

If current harvesting practices do not meet sustainability criteria for long term timber supplies and the wood-based products industries, it is difficult to see how amenity values are maintained except in the totally protected forests and national parks/wildlife refuges. Unresolved indigenous land claims further exacerbate the situation.

Rough estimates in this paper put Sarawak's annual sustainable yield from PFE alone at 4.5-5.8 MCM and the combined state and PFE sustainable yield at 6.00-8.2 MCM, based upon liberation thinning, a 35 year cycle incorporating harvesting of trees 45 cm or more of species 1 (low estimate) or species 1-3 (high estimate). This is roughly one-third of current annual harvests. For Malaysia as a whole, estimates of annual sustainable yields are approximately 14.8 MCM per year, as compared to recent annual coupes of 39.8 MCM.

The employment implications of a sustainable yield of 37 percent of current yield are dramatic. Logging employment would fall to 25,000 from current levels of 69,000 and the total timber and wood-based products industry employment would decline to 57,000 from current levels of 150,000. Movement into downstream production and the use of supplemental sources of wood supplies (plantation forests) would reduce the employment impact, but 35,000-55,000 jobs would potentially still be at risk in the near term future.

5.2 Concluding Comments: Policy Options

The review of proposed policy options for Malaysia (and particularly Sarawak) reveal a number of strategies to alleviate non-sustainable timber harvesting practices and associated issues. These include the following:

- (1) The State Forest departments must be strengthened. With primary responsibility for monitoring the harvest practices of concessionaires and of determining sustainable yield, an increase in the quantity and quality of such personnel is necessary. An increase in employment of indigenous peoples would be welcomed.
- (2) Resolution of indigenous peoples land claims and the official acceptance of a map delineating such lands (or the preparation of a new map) seems imperative to moderate this socio-economic issue in Malaysia's forestry management.
- (3) There is a need to increase rehabilitation efforts on state lands and PFE to increase sustainability volume on once cut land. Rapid growing species in plantation forestry, use of aging rubberwood to supplement traditional forestry supplies and liberation thinning are all technologies available which would augment traditional first cut

volumes per hectare. Rehabilitation would reduce pressures on further overcutting of PFE.

- (4) Preliminary research suggests that non-timber products (NTP) of forests may have significant economic potential. A comprehensive study by the Malaysia Industrial Development Authority is warranted as such NTP would also reduce pressures on the forest products of PFE. Most of the NTP identified appear to require small capital resources for entry and are relatively labour intensive.
- (5) Several policies to reduce the demand for raw export product were examined. Timber export quotas or consumer boycotts were considered to be ineffectual in improving sustainability practices. Malaysia's own efforts are to encourage downstream production of wood-based products. This effort is being pursued vigorously but several problems exist. These include external concerns; trade barriers by consuming nations and competitive position in world markets. Also domestic issues play a part. Prominent are the competition between Peninsular Malaysia, Sarawak and Sabah for the location of the downstream industry and the generally inefficient size of firms and variable quality of the finished product.
- (6) To reduce state government reliance on timber revenues from unsustainable exploitation rates, federal revenue sharing - providing funds but insisting on improved practices, or international debt-for-nature swaps, would alleviate the pressures to keep up unsustainable rates in the short term.
- (7) Small scale swidden agriculture has been viewed as "good" (and sustainable) or "bad" (and leading to deforestation) by different researchers. Within the present context in Sarawak it is a lesser source of deforestation than timber harvesting practices because of the limited number of swidden agriculturalists and the low population density. However, these conditions will not necessarily be maintained.
- (8) An official determination of annual sustainable yields needs to be determined *a priori* and agreed upon in Sarawak and Sabah. Current determinations are advisory at best or record-keeping exercises of past cuts. Under reasonable assumptions about size and species (45 cm of species 1), liberation thinning and the allocation of lands to indigenous peoples, annual sustainable yield (SAY) in all of Sarawak (state lands and PFE) is approximately 6.0-8.0 million cubic meters on a 35 year cycle. On PFE lands only, the figure is 4.5-6.0 million CM. Current annual harvests in Sarawak are 18 million CM. For all Malaysia, sustainable yields on PFE alone appear to be approximately 14.8 MCM.
- (9) Finally, a reevaluation of the policy of land use conversion from forest lands to agriculture for employment generation purposes seems warranted. Following recent industrialisation efforts, the plantation and logging/timber industry throughout Malaysia has experienced labour shortages, leading to the influx of immigrant labour, often illegal, from nearby nations. While agriculture remains a dominant employer at 1,700,000 persons, more than two-thirds of its acreage is in small family holdings. Much employment in this sector is family labour, often unpaid.

Appendix A

Prospective Timber Yield - Cut over Hill Mixed Forest (Harvesting to the Minimum Indicated DBH)

Diameter Classes	60+ cm		45+ cm		30+ cm	
Wood Quality Group	1	1-3	1	1-3	1	1-3
Average Residual Crop						
Number/ha	0.9	1.0	6.7	8.3	13.1	17.0
m ³ /ha	3.4	3.8	15.4	18.8	22.0	27.8
Predicted Harvestable Volume (m ³ /ha, by cutting cycles)						
25 Years						
Untreated	8.6	10.1	27.4	34.8	41.3	45.6
Liberated	18.5	22.6	32.6	41.9	54.2	69.9
30 Years						
Untreated	14.3	17.6	29.3	37.4	45.2	49.1
Liberated	23.4	29.2	43.0	55.4	60.7	78.3
35 Years						
Untreated	20.0	25.1	32.0	42.5		
Liberated	28.3	35.8	53.4	68.9		
40 Years					Growth	
Untreated	25.7	32.6	37.7	47.6		
Liberated	33.2	42.4	63.8	82.4		
45 Years					data	
Untreated	31.4	40.1	43.4	55.1		
Liberated	38.1	49.0	74.2	95.9		
50 Years					incomplete	
Untreated	37.0	47.6	49.0	62.6		
Liberated	43.0	55.4	84.3	109.2		

Source: ITTO (1990) taken from Sarawak Forest Department.

Appendix B**Agriculture, Forestry, Fisheries Employment: 1989**

Total Employment	1,957,900
Minus	
Forestry and Wood-Based Products	150,152
Minus	
Fisheries	93,500
Equals	
Implied Plantation/Small Farms	1,714,248

Source: Fisheries Department, Malaysia, Sabah and Sarawak; Table 3.2.2 and Department of Statistics, Yearbook of Statistics.

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