COMMERCIAL VIABILITY OF TREE PLANTING IN THE KINABATANGAN FLOODPLAIN

By M.J. Steel (MJS Services), 2000
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Executive Summary

The main objective of this report is to evaluate the commercial viability of planting forest trees as an alternative crop to oil palm in the flood-prone areas of the Kinabatangan Floodplains. The comparative analytical findings based on commercial and environmental considerations, support a strong case for replacing oil palm crops in existing plantation areas subject to intensive recurring floods, with commercial forest trees.

The project study covered a period of three months, and information was obtained from both existing research data as well as from field investigations involving oil palm plantation companies, insurance companies, timber-based corporations and institutions, Sabah and Federal Government Departments and Ministries.

During the 2000 flood, about 15,000 hectares of oil palm plantations were inundated, and an estimated RM45 million in crop losses was reported. The increasing unpredictability and intensity of flooding occurrences are now a major concern to plantation companies as frequent attempts to replant oil palm in the flood prone areas remain highly risky. Flood mitigation methods and flood insurance have proved to be both costly and generally ineffective.

A key constraint in evaluating the commercial viability of planting trees is the lack of research and field tested data on tree species that have commercial value and are suitable for cultivation in a flood prone environment. This information gap had to be supplemented by informal data and expert opinions obtained from field experts. It was felt that notwithstanding these limitations, this project paper is substantive enough to form the basis for the determination of appropriate strategies to persuade the oil palm plantation owners to embark on a tree planting programme.

Six suitable and commercial tree species have been recommended and these have generated keen interest from the plantation companies. All the six recommended tree species appear to be capable of surviving in waterlogged areas, are relatively fast growing, and have good commercial value. A range of possible short term crops has also been analyzed. However none of these crops seem to be suitable as a realistic alternative to forest trees and oil palm.

The plantation companies have four options in deciding on what to do with the repeatedly flooded plantation land:

i) Abandon the flood affected areas
ii) Continue to plant oil palm in the flood affected areas
iii) Diversify into planting short term agricultural crops
iv) Diversify into planting commercial forest tree species

MJS found that planting commercial forest tree species appears to be the most commercially viable option for the plantation companies. A combination of other factors such as the concerns over declining crude oil palm prices, increasing demand for less used commercial timber species, and the need for the oil palm industry to promote an environmentally supportive image, are persuasive arguments for the plantation companies to diversify into tree planting.
The planting of trees with a gestation period of between 15 to 20 years require major investments and long term commitment. Normal bank lending criteria are not applicable for tree plantation as most banks seek positive returns within five to ten years term for projects of this nature. MJS found that most of the plantation companies prefer to have direct control of their land and the tree-planting project. MJS have identified and conducted an evaluation of the various options in undertaking a tree-planting project in the flood prone areas of Kinabatangan Basin. Joint ventures with other organisations such as WWF, Green Sponsors, local timber companies and large diversified Malaysian and International corporations have been evaluated from the perspective of WWF’s objectives.

Plantation companies should be aware that establishing a tree plantation on flood-affected areas also involves a degree of risk, as with oil palm. This is primarily because it is largely still at the experimental stage. Factors that affect the success of a tree-planting project such as tree growth patterns, soil conditions, flooding, wildlife threats, future timber prices should be considered as risk issues in the viability equation.

In the report, the potential for eco-tourism development in relation to tree planting ventures have also been mentioned. MJS found that there is inadequate understanding of eco-tourism potentials and studies could be conducted to address the commercial opportunities available in tandem with the ecological rehabilitation of a forest environment. With regards to wildlife control, plantation companies view pest problems as manageable.

**Summary of Key Results of Report**

1. The continued replanting of oil palm in flood prone areas is a major risk given the increasing unpredictability of flood cycles.

2. Oil palm plantation owners are prepared to consider commercially viable alternatives to planting oil palm.

3. Environmental issues are gaining increasing prominence in oil palm plantations’ corporate policies.

4. Flood insurance covers and flood mitigation measures are inadequate in overcoming the problems of flooding.

5. Oil palm plantation owners have strong commercial orientation, and the tree planting alternative need to have acceptable commercial returns within a gestation period of 15 – 20 years.

6. Subject to specified assumptions, the comparative economics of a oil palm plantation and a tree plantation in the Kinabatangan floodplains indicate that both the Internal Rate of Return and Net Present Value measures for a tree plantation are superior.
7. Existing technical and operational resources of the oil palm plantations are sufficient to support a tree planting programme.

8. Most of the plantations surveyed indicated a strong preference to retain full control in the management of a tree planting programme. Initial pilot projects in collaboration with WWF and/or other Green Sponsors are welcomed.

9. There is limited understanding of the concepts and value of Certified Sustainably Managed Timber and Carbon Trading. Awareness have to be increased.

10. The prospects for eco-tourism are recognised, but knowledge level is minimal.

This report appears timely as the devastating effects of the 2000 flood are still fresh in the minds of the oil palm plantation owners. In the absence of credible alternatives, the oil palm plantations are under strong commercial pressure to replant oil palm, and some have in fact started to do so again. MJS believes that it is opportune for WWF to implement strategies that will both address and support the oil palm plantation owners’ time critical and commercial concerns.

As a first step, a Seminar or Workshop to increase the awareness of the findings of this report should be considered. Following upon which further appropriate commercial options, tailored to the specific operational needs and corporate philosophy of individual plantation companies, can be formulated to raise the levels of both their commitment and participation in the Forest Rehabilitation Programme now being progressed.

MJS believes that the Project findings support the conclusion that a “Win-Win” collaboration between WWF and the Oil Palm plantation community in the Kinabatangan Floodplains can be achieved.
1.0 Introduction to the Project

Massive conversion of forest land to agriculture land has created a range of effects on the ecosystem of the Kinabatangan Wetlands. One of the major consequences of land clearance activities including deforestation is flooding.

Flooding in the Kinabatangan Floodplain is a major concern to oil palm plantations as well as the communities living in the Kinabatangan area. In the recent 2000 flood, many oil palm companies suffered major damages and revenue losses. Some oil palm estates that have been severely affected by floods are considering whether to replant oil palm or other crops in flood prone areas; some have even considered abandoning the flood prone areas as most of their crops have been drowned when these areas have been inundated by recurring floods.

Map 1 shows the entire Kinabatangan Floodplain area and the areas affected by the recent flood, which occurred in year 2000.

Map 1

![Map showing floodplain and flooded areas in the Kinabatangan](image-url)
The areas of oil palm cultivation, the proposed wildlife sanctuaries and existing protected forest reserves are shown on Map 2.

Map 2

Ideally, the proposed areas designated for wildlife sanctuary should be linked to the existing protected forest reserve as this enables the animals to migrate between the proposed wildlife sanctuaries and existing forest reserve to search for food. By restoring the riparian reserve along the Kinabatangan river, WWF believes that the need for wildlife in the Kinabatangan to enter plantations in their search for food would be minimised. In addition, the restoration of riparian forest would reduce soil erosion and indirectly mitigate flooding problems in the Kinabatangan Floodplain.

WWF aims to join hands with major land users to encourage the concept of environmental protection for mutual benefits; WWF and MJS believe that in order for commercial sectors to support forest conservation, economical and social-environmental factors must be carefully considered.
The reforestation of the riparian forest project is aimed at achieving the following objectives:

i) to provide economic benefits to oil palm plantation owners through the reforestation of “good commercial value” trees that can survive in the flood-affected areas

ii) to mitigate flooding problems by reducing soil erosion

iii) to create a corridor for animal migration within the various WWF Wildlife sanctuaries

2.0 MJS’s Project Objectives

- To present a study on the commercial viability of planting forest trees and/or alternative crops to oil palm plantation owners in the Kinabatangan Floodplains.

- To determine the operational and business factors that influence the decision of Plantation Companies located along the lower Kinabatangan River to plant oil palm in flood-prone areas.

- To determine whether it is commercially more profitable for Plantation Companies to plant trees under sustainable forest management practices in the flood-prone areas compared to planting oil palm.

- To determine whether a persuasive proposal can be made to Plantation Companies to join in a tree planting project sponsored by WWF, to re-establish the corridor of riparian forest along lower Kinabatangan River to provide sanctuary for wildlife, irrespective of whether it is more profitable or otherwise to plant trees against planting oil palm.

3.0 Methodology

3.1 Sampling Method

Area sampling and purposive sampling methods have been adopted in this project. Survey participants are oil palm plantations that have been directly affected by the Kinabatangan floods. Other participants include plantation companies who are directly affected by flood but are not located in the Kinabatangan area, e.g. Segama and Labuk.
3.2 Data Collection Methods

The following data collection methods have been employed in MJS’s study:-

3.2.1 Site Visits and Observations

Several site visits and observations have been made to study and observe the severity of flooding problems in the Kinabatangan area. Schedules of MJS’s site visits are available in Appendix A.

3.2.2 Personal Interviews

MJS conducted several personal interviews in Sandakan, Lahad Datu and Kota Kinabalu. Participants include:-

a. Plantation Managers
b. Field Experts
   - Forest Research Institute Malaysia (FRIM)
   - Department of Irrigation and Drainage (DID)
   - Forestry Department, Sabah
   - Natural Forest Research Institute, Sandakan
   - Sabah Agriculture Department, Land Use Section
   - Insurance Companies
   - GTZ German-Malaysian Sustainable Forest Management Project, Sandakan
   - Eco-Tourism Operators

3.2.3 Group Discussions

MJS also held group discussions with various government departments, plantation companies, insurance companies, and foresters to discuss the various issues related to tree planting. Details of schedules of meetings can be viewed in Appendix A. Minutes of meetings are also made available in Appendix B.

3.2.4 Quantitative and Qualitative Survey

MJS sent a general questionnaire to survey participants, accompanied by a covering letter from MJS and a supporting letter from WWF. The general questionnaire has been sent to 17 plantation companies as per the list of stakeholders provided by WWF. Table 1 shows that five (5) out of 17 respondents were not affected by floods and therefore did not participate in the general survey. 11 out of the 12 affected plantations companies completed the questionnaire. The participation rate for the general survey is 91.6 percent. (Responses of participants in the general survey can be viewed in Appendix C2. Summaries of the general survey are also available in Appendix C1).
Table 1: List of plantation companies approached by MJS in the general survey.

<table>
<thead>
<tr>
<th>PLANTATION COMPANY</th>
<th>RESPONDENTS’ STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Malbumi Development Sdn Bhd</td>
<td>Responded</td>
</tr>
<tr>
<td>2. Trushidup Group of Companies</td>
<td>Responded</td>
</tr>
<tr>
<td>3. Asiatic Development Bhd</td>
<td>Responded</td>
</tr>
<tr>
<td>4. Pontian United Plantations Bhd</td>
<td>Responded</td>
</tr>
<tr>
<td>5. IOI (Syarimo Estate)</td>
<td>Responded</td>
</tr>
<tr>
<td>6. Avicess Sdn Bhd</td>
<td>Responded</td>
</tr>
<tr>
<td>7. Abadi Mewah Sdn Bhd</td>
<td>Responded</td>
</tr>
<tr>
<td>8. Pamol Sabah</td>
<td>Responded</td>
</tr>
<tr>
<td>9. Global Enterprise Sdn Bhd</td>
<td>Responded</td>
</tr>
<tr>
<td>10. Lai Fook Kim Corporation</td>
<td>Responded</td>
</tr>
<tr>
<td>11. Sabahmas Plantations Sdn Bhd (Segama)</td>
<td>Responded</td>
</tr>
<tr>
<td>12. IJM Plantations Sdn Bhd</td>
<td>Not Responded</td>
</tr>
<tr>
<td>13. PPB Oil Palms Bhd</td>
<td>Not Affected</td>
</tr>
<tr>
<td>14. Kretam Holding Bhd</td>
<td>Not Affected</td>
</tr>
<tr>
<td>15. SAFODA</td>
<td>Not Affected</td>
</tr>
<tr>
<td>16. Gamore Corporation Bhd</td>
<td>Not Affected</td>
</tr>
<tr>
<td>17. Tung Hup Group</td>
<td>Not Affected</td>
</tr>
</tbody>
</table>
3.3 Research Constraints

3.3.1 Limited Availability of Information

There appears to be a lack of supporting research and field-tested data on tree species indigenous to flood prone areas on:

- Survival rates of tree species on flood-prone areas
- Information on the accessibility of seedlings for specific tree species
- Growth rate and gestation period for Less Used Commercial Timber Species
- Market/commercial value of Less Used Commercial Timber Species
- Planting techniques for tree species on flood-prone areas

3.3.2 Interpretation of Scientific Related Data

MJS will draw on various sources of related technical and scientific data pertinent to the project to support general conclusions on flooding, suitability of alternative crops, and tree planting techniques. MJS’s scope of research would not include detailed technical and scientific findings and would focus on the commercial aspects of tree planting.

3.3.3 Time Constraints

The three (3) months term of the consultancy is a constraint on obtaining information and data where longer lead-time is required.
4.1 Issues on Flooding in the Kinabatangan: Report from Department of Irrigation and Drainage

Flooding is a common occurrence in the Kinabatangan Floodplain area. Based on a study conducted under the Partners for Wetlands Programme, mean annual rainfall within the Kinabatangan catchment area is 3000mm; heavy rainfall occurs between October and March, with frequent storms between November and January (Balamurugam, 1999, p.7).

Severe periods of flooding have been recorded as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Flood Event</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1963</td>
<td>Severe Floods*</td>
<td>Sooryanarayama, 1995</td>
</tr>
<tr>
<td>1964</td>
<td>Severe Floods*</td>
<td>Sooryanarayama, 1995</td>
</tr>
<tr>
<td>1965</td>
<td>Moderately severe floods*</td>
<td>Sooryanarayama, 1995</td>
</tr>
<tr>
<td>1974</td>
<td>Moderately severe floods*</td>
<td>Sooryanarayama, 1995</td>
</tr>
<tr>
<td>1977</td>
<td>Moderately severe floods*</td>
<td>Sooryanarayama, 1995</td>
</tr>
<tr>
<td>1981</td>
<td>Severe Floods*</td>
<td>Sooryanarayama, 1995</td>
</tr>
<tr>
<td>1986</td>
<td>Moderately severe floods*</td>
<td>Sooryanarayama, 1995</td>
</tr>
<tr>
<td>1996</td>
<td>Severe Floods*</td>
<td>Extract from WWFM report</td>
</tr>
<tr>
<td>2000</td>
<td>Severe Floods*</td>
<td>Newspaper</td>
</tr>
</tbody>
</table>

* floods are characterised by Sooryanarayama (1995) according to flood duration and extent of flood damage

(extracted from WWFM article no. 5, Floods in the Kinabatangan, 2000)

MJS was able to obtain information from the Department of Irrigation and Drainage (DID) on water levels, discharge and return period. The information was based on records taken from four water level monitoring stations in the Kinabatangan area in the past 20 years from 1970 to 2000. These stations include Kinabatangan River at Pagar, Kinabatangan River at Balat, Milian River at Tangkulap and Kuamut River at Ulu Kuamut.
Figure 1 shows the location of the water level monitoring stations. (Please refer Appendix D2 for records on water levels, discharge and return periods of the four water level monitoring stations in the Upper Kinabatangan area).

Records on water levels, discharge and return periods provides an indication of water levels of the various rivers in the upper Kinabatangan area. The highest water level recorded was 18.29 metres, recorded in 1971. The record should also provide an indication of water level conditions in the Lower Kinabatangan area.

The difficulty in predicting the frequency and magnitude of flooding poses a problem to plantation companies. Plantation companies have been implementing costly flood mitigation measures such as bunding, platform planting techniques and improving drainage systems to alleviate flooding problems. The success of these flood mitigation methods is inconclusive. With the increased frequency and irregularity of severe flooding, plantation companies are unable to determine the best timing to replant young oil palm seedlings. Most plantation companies replant oil palm after a major flood occurrence in the hope that the crops would be mature and tall enough to withstand the next flood.

One of the plantation companies, Abadi Mewah replanted oil palm crops in the flood-affected area right after the 2000 floods. They anticipated that the crops will be mature enough to withstand high flood water levels in the next flooding. However, Abadi Mewah suffered major losses when the recent 2000 flood destroyed 700 acres of their young oil palm crops (please refer Appendix B14). Another plantation company, Global Enterprise Sdn Bhd reported that 1300 acres were affected by the year 2000 flood. Figure 2 portrays the areas affected by flood in the estate of Global Enterprise Sdn Bhd.
4.1 Magnitude and Frequency of Flooding

A general survey conducted by MJS for WWF revealed that plantation companies are affected by flood on an annual basis. Findings based on MJS’s general survey suggest that ten (10) out of 11 plantation companies are affected by floods for a period of one month in a year. One plantation company is affected by flood for a period of 3 months a year. Plantation companies also reported that during floods, floodwater becomes stagnant and remain in their estate between periods of 20 days to 3 months. Sooryanarayama (1995) reported that “during periods of heavy rains, the Kinabatangan river can rise between 15-20 metres and large areas of the Kinabatangan floodplain are submerge with water...for a period of between 2 to 32 days”.

4.2 Causes and Changes in Flood Cycles

There are many factors that contribute to the increased frequency of flooding in the Kinabatangan. A report based on hydrological research conducted under the Partners for Wetlands Programme suggests that land clearance for agricultural purposes, and logging related activities led to negative effects such as soil compaction and sedimentation. The Kinabatangan is estimated to currently transports more than 6 million tonnes of sediment a year, logging activities in the upper catchment makes up another 4 million tonnes of the sediments (Balamurugam, 1999, p.31). According to Cheng (1999, p.25), the El Nino and La Nina affects weather conditions; La Nina is formed when temperatures are colder than usual in the oceans over the Eastern Equatorial Pacific while El Nino occurs when opposite condition develops. La Nina brings rain while El Nino brings drought.
Increased sedimentation caused by riverbank erosions (as a major effect of deforestation and land clearance activities) makes the riverbed shallower. As a result, flooding occurrences become more severe. Mr Yap Siew Fah, Assistant Senior Director of Department of Irrigation and Drainage (DID) believes that riverbank erosion occurs due to the absence of riparian forests in the Kinabatangan area. DID suggests that riparian reserve, with its vegetation is particularly important to the overall health of the river. A well vegetated riparian is essential for preventing erosion, maintaining habitat, protecting water quality, and for aesthetic and recreation values.

“Almost all research into erosion and hydrology in recent years confirms that forest actually offers the best protection that the land can have on erosion. In undisturbed forest, raindrop impact is greatly reduced by the canopy. Not more than about 5 percent of water reaching the forest floor becomes overland flow, and most runoff at base flow reached the streams through shallow water table”

(Douglas et al in Brookfield, Potter and Byron, 1995).

Logging and forest clearance activities will aggravate flooding in the Kinabatangan as current practices of land clearing lead to substantial soil compaction. The extent of soil compaction would be greater in the plantation sector due to total forest clearance (Balamurugam, 1999, p.17)

Findings on hydrological studies suggest that as a result of soil compaction and reduced infiltration, the frequency of flooding can be expected to increase as plantation and logging activities expand.

Even if logging and land clearance activities in the Kinabatangan catchment were to stop now, the catchment recovery is a slow process; it would take 5 to 10 years for sediments run off to stop (Balamurugam, 1999, p.31).

The raising of riverbeds, coupled with more rapid runoff after heavy rain, is however, more than likely to be responsible for the scale of flooding experienced along the lower courses of many rivers. In formerly forested areas now under agricultural crops, the proportion of annual rainfall becoming runoff is increased from 40-50 to above 60 percent. Numerous accounts of flooding are assertively attributed to land clearance and forest degradation. Intensity and duration of heavy rain have significant impact on the magnitude of flooding (Aiken et al in Brookfield, Potter and Byron, 1995).
4.3 Areas Affected by Flood

The year 2000 flood has affected approximately 15,000 hectares of land area in the Kinabatangan and Labuk and Segama areas. Table 2 provides the size of flood-affected areas within plantation companies; the information is based on findings from MJS’s general survey.

*Table 2 shows the acreage of flood-affected areas.*

<table>
<thead>
<tr>
<th>Plantation Company</th>
<th>Acreage</th>
<th>Flood Affected Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sabahmas Plantations Bhd (located in Segama)</td>
<td>10,991 ha</td>
<td>2,500 ha</td>
</tr>
<tr>
<td>2. Pontian United Plantations Bhd</td>
<td>16,187.60 ha</td>
<td>2,428.14 ha</td>
</tr>
<tr>
<td>3. Pamol Estate</td>
<td>5,260.97 ha</td>
<td>1,618.76 ha</td>
</tr>
<tr>
<td>4. Asiatic Development Bhd</td>
<td>16,996.98 ha</td>
<td>1,600 ha</td>
</tr>
<tr>
<td>5. Lai Fook Kim Corporation (located in Labuk)</td>
<td>2,175 ha</td>
<td>1,500 ha</td>
</tr>
<tr>
<td>6. Trushidup</td>
<td>6,879.73 ha</td>
<td>768.91 ha</td>
</tr>
<tr>
<td>7. Global Enterprise Sdn Bhd</td>
<td>5,100 ha</td>
<td>640 ha</td>
</tr>
<tr>
<td>8. Abadi Mewah Sdn Bhd</td>
<td>5,580.77 ha</td>
<td>283.28 ha</td>
</tr>
<tr>
<td>9. IOI (Syarimo Estate)</td>
<td>2,392.29 ha</td>
<td>250 ha</td>
</tr>
<tr>
<td>10. Avicess Sdn Bhd</td>
<td>2,225.80 ha</td>
<td>80.94 ha</td>
</tr>
<tr>
<td>11. Malbumi Development Bhd</td>
<td>2,832.83 ha</td>
<td>20.23 ha</td>
</tr>
</tbody>
</table>
4.4 Flood Damages and Losses to Plantation Companies

In the recent year 2000 flood, plantation companies suffered an estimated RM 45 million in flood damages. Table 3 provides the amount of losses incurred by plantation companies surveyed within their first five years of establishment.

Table 3 – Flood related damages and losses incurred by plantation companies within their first five years of operation.

<table>
<thead>
<tr>
<th>Plantation Company</th>
<th>Period Of Establishment</th>
<th>Losses incurred (First 5 years of operation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pontian United Plantations Bhd</td>
<td>Above 10 years</td>
<td>RM 10 million</td>
</tr>
<tr>
<td>2. Global Enterprise Bhd</td>
<td>5-9 years</td>
<td>RM 2 million</td>
</tr>
<tr>
<td>3. Abadi Mewah Sdn Bhd</td>
<td>5-9 years</td>
<td>RM 1.5 million</td>
</tr>
<tr>
<td>4. Asiatic Development Bhd</td>
<td>Above 10 years</td>
<td>RM 1 million</td>
</tr>
<tr>
<td>5. Lai Fook Kim Corporation</td>
<td>2-3 years</td>
<td>RM 879,000</td>
</tr>
<tr>
<td>6. IOI (Syarimo Estate)</td>
<td>5-9 years</td>
<td>RM 800,000</td>
</tr>
<tr>
<td>7. Trushidup</td>
<td>Above 10 years</td>
<td>RM 180,000</td>
</tr>
<tr>
<td>8. Avices Sdn Bhd</td>
<td>4-5 Years</td>
<td>RM 100,000</td>
</tr>
<tr>
<td>9. Malbumi Development Bhd</td>
<td>4-5 years</td>
<td>Not Advised</td>
</tr>
<tr>
<td>10. Sabahmas Plantations Bhd</td>
<td>5-9 years</td>
<td>Not Advised</td>
</tr>
<tr>
<td>11. Pamol Estate</td>
<td>Above 10 years</td>
<td>Not Advised</td>
</tr>
</tbody>
</table>
4.5 Prevention Methods adopted by Oil Palm Companies to alleviate Flood Problems

The general survey revealed that oil palm companies have proposed the following methods to mitigate flooding conditions in the Kinabatangan area:-

- Bunding
- Platform Planting Technique
- Straightening the River
- Deepening the River
- Dam Construction
- Drainage Construction

Currently, oil palm plantation companies are adopting bunding, platform planting techniques and intensive drainage systems to mitigate flooding problems in the Kinabatangan Floodplain.

4.6 Evaluation of Success of Flood Prevention Methods

4.6.1 Bunding

Based on MJS’s discussions with the Director of Department of Irrigation and Drainage (DID), bunding is an ineffective way to control floods in the Kinabatangan area and is very costly to implement. Bunding in general has proved to be unsuccessful in floodplains as flood water levels are difficult to predict. Bunding also pushes floodwater away to other plantation areas and as a result, neighbouring plantations become severely affected by the flood (refer Appendix B8, 4.2, p.3)

If bunding is an ineffective way to control floods in the Kinabatangan, why are plantation companies still adopting it? Some views suggest that plantation companies feel that they have no other alternative other than adopting bunding as a flood prevention method. MJS’s general survey reveals that 6 out of 11 plantation companies would adopt bunding as a flood prevention method.

MJS found that Pontian United Plantations Bhd spent RM1.5 million to install a bund to prevent floodwater from entering their oil palm plantation. The bund is approximately 20 feet in width, 7 kms in length, and 10 metres in height. The recent year 2000 flood levels were much higher than the bunds and as a result, approximately 5000 acres of young oil palms were destroyed in the year 2000 flood; floodwater remained stagnant in the plantation area for 24 days. Pontian United Plantations Bhd had to break their bunds to allow floodwater to move out of the plantation back into the river (refer to Appendix B4, 2.2, p.2).
Recent discussions with Pontian United Plantations Bhd revealed that the plantation company is in the process of upgrading their bund. The length of the bund is being extended from 7 kms to 21 kms; Pontian United Plantations Bhd is extending the width of the bund from 20 feet to 40 feet. They are also elevating the height of the bund from 10 metres to 12 metres. While the bunds are being upgraded, Pontian United Plantations are simultaneously replanting oil palm trees in the flooded areas. Upgrading the bund costs an additional RM 3 million.

4.6.2 Mounding / Platform Planting Technique

Many oil palm plantations have implemented Mounding or Platform Planting Technique to enable young oil palm trees to survive in flood conditions. Based on findings from MJS’s general survey, nine (9) out of 11 plantation companies practiced Platform Planting Technique as a flood prevention method. Platform Planting Technique is labour intensive and is partially successful in estates with relatively higher grounds. However, the method proved to be unsuccessful where floodwater levels are very high, that is, above five feet. Based on discussions with oil palm companies, Platform planting technique can be very costly to implement; the cost of implementing Platform planting technique ranges from RM400-RM700 per hectare (refer Appendix B2, 2.7, p.3)

Figure 3 - The implementation of Platform Planting Technique in Asiatic Development Bhd.
4.6.3 Construction of Intensive Drainage System

Some plantation companies have found that an intensive drainage system in flood prone areas can help mitigate flooding effects in the Kinabatangan area. However, this is costly in terms of structural works and loss of land for oil palm planting.

4.7 Other Proposed Flood Prevention Methods

4.7.1 Straightening the Kinabatangan River

Discussions with Department of Irrigation and Drainage (DID) revealed that a trial project in Kota Marudu involved straightening of a river, which proved unsuccessful in mitigating flooding problems in the Kota Marudu area. Therefore, DID believes that in the Kinabatangan Floodplains, straightening the river is unlikely to alleviate flooding problems (refer to Appendix B8, 5.2, p.4). Straightening the river improves efficiency of river flow, which may result in the high likelihood of increased riverbank erosion. In the long term, this may cause river to widen, but becoming shallower due to higher level of soil sedimentation from riverbank erosion. There is a general perception that straightening the river is too costly to undertake. There is a debate on who should bear the cost of straightening the river. MJS believes that this method is unlikely to be implemented as oil palm companies are not willing to pay for the cost of straightening the river. Unless the government is financing the cost of straightening the river, this flood mitigation method will not be implemented.

4.7.2 Deepening the Kinabatangan River

Some oil palm plantations suggest that deepening the Kinabatangan River would alleviate flooding problems in the lower Kinabatangan. Currently, deepening the river has not been practiced by DID to mitigate flooding problems in Sabah. Some planters suggest that DID should undertake the task of deepening the Kinabatangan River and also bear the costs. The problems of disposing of excavated sediments and aggravating offshore marine siltation also have to be addressed.

4.7.3 Dam Construction

In the 1980’s, Japanese International Cooperation Agency (JICA) proposed the construction of two dams in the Kinabatangan Floodplains to control floods and allow for the cultivation of paddy on the fertile land of Kinabatangan. Construction of the two dams would have required USD800 million to complete; however, Federal Economic Planning Unit (EPU) rejected the proposal (refer Appendix B9, 2.1, pp.1-2).
5.0 Flood Insurance

According to Cheng (1999, p.29), “flooding problems in the Kinabatangan is mitigated by flood insurance coverage…” MJS felt that it is vital to explore the importance of flood insurance to oil palm plantations, to determine if flood insurance is an artificial incentive to plantation companies to replant oil palm in flood affected areas instead of implementing other alternatives.

5.1 Oil Palm Companies’ Perspectives

Based on discussions with oil palm estates, MJS found that flood insurance is not an important issue in tree planting. MJS’s general survey reveals that most of the oil palm companies have not obtained flood insurance for their crops. Nine (9) out of 11 plantation companies have no flood insurance coverage. Six (6) out of the nine (9) plantation companies are not insured due to costly insurance premium. The various reasons companies are not insured are the following:-

a) Flood Insurance are too expensive
b) Insurance companies require oil palm plantation companies to implement flood preventive methods for eg. bunding, mounding planting technique etc. Plantation companies believe that these preventive methods are too costly to implement.

c) Oil palm plantation companies who managed to obtain insurance coverage usually have their own insurance agency.

5.2 Insurance Companies’ Perspectives

As a general comment, insurance companies state that they do offer flood insurance to plantation companies. However, plantation companies in the Kinabatangan floodplains who have applied for flood insurance coverage would be considered on a case-by-case basis. Most insurance companies have a knowledge of which areas are affected by the floods in the Kinabatangan Wetlands. If the plantation company is known to be subjected to floods, or have previously claimed under a flood policy, insurance companies will avoid extending flood cover by:-

- directly rejecting the company’s application, especially if there have been no previous business relationships, no potential value or no other valuable ancillary business.
- imposing onerous structural flood mitigation measures as conditions which will significantly add indirectly to the cost of obtaining the insurance cover.
requiring plantation to buy other insurable risks as “add on” to the flood policy for eg. fire policy, accident policy and other policies.

imposing incremental “loading” premiums to normal flood premium to cover additional risks.

Insurance companies will investigate the likelihood of floods before they decide to approve an application for flood insurance coverage. Applicants for flood insurance coverage must also declare if they have previously been affected by floods. In addition to the various precautions taken by insurance companies, the Insurance Companies Association also circulates to all its members the names of companies who have made flood claims; such companies are classified under a “Caution-Avoid” list.

Insurance companies might consider giving flood insurance coverage to applicants under the following circumstances:-

The plantation company belongs to a large group of companies, for e.g. IOI, whereby the insurable risk involves both the applicant and their group of companies. In the interest of the overall dealings and business relationship, insurance companies are obliged to provide flood insurance.

5.3 Insurance Cost and Premiums

Quotations from three insurance companies - Malaysian British Assurance (MBA) Jerneh Insurance and IIB Insurance Brokers Sdn Bhd suggest that oil palm crops are valued at RM2,220 per hectare for one year. In order to obtain flood insurance, oil palm companies need to pay flood premium that is 0.10% of RM2,220 per hectare for one year.

In most cases, additional onerous terms will be imposed such as “excess clause” and “add ons”. For example, for an insurance coverage of RM500,000, a RM50,000 excess clause will be imposed; this means that any claim below RM50,000 will not be paid and will be borne by the plantation. For a claim of RM500,000, only RM450,000 will be paid to plantation companies. Insurance companies also impose other “add ons” insurance coverage such as fire insurance, and animal damage insurance to companies who opt for flood insurance coverage.
Table 4 indicates the insurable value per hectare for Rubber, Oil Palm and Cocoa.

<table>
<thead>
<tr>
<th></th>
<th>Rubber</th>
<th>Oil Palm</th>
<th>Cocoa</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 1 years</td>
<td>2,520</td>
<td>2,220</td>
<td>1,420</td>
</tr>
<tr>
<td>1-2 years</td>
<td>3,590</td>
<td>3,290</td>
<td>4,500</td>
</tr>
<tr>
<td>2-3 years</td>
<td>4,510</td>
<td>4,510</td>
<td>5,700</td>
</tr>
<tr>
<td>3-4 years</td>
<td>5,380</td>
<td>5,255</td>
<td>6,870</td>
</tr>
<tr>
<td>4-5 years</td>
<td>6,150</td>
<td>5,255</td>
<td>6,870</td>
</tr>
<tr>
<td>Over 5 years</td>
<td>6,570</td>
<td>5,255</td>
<td>6,870</td>
</tr>
<tr>
<td>Average no. of</td>
<td>400</td>
<td>140</td>
<td>1,075</td>
</tr>
<tr>
<td>trees per hectare</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

One of the insurance companies, Jerneh Insurance Berhad provided their basic rates for various insurance coverage for Oil Palm:

- Fire and Lightning: 0.45%
- Animal Damage:
  - Plants less than 2 years old: 0.05%
  - Plants over 2 years old: 0.025%
- Flood: 0.10%
- Windstorm: 0.10%
- Riot, Strike, Malicious Damage: 0.03%
- Aircraft Damage: 0.01%

Findings from the general survey suggests that nine (9) out of 11 plantation companies indicated that they have not obtained any flood insurance coverage for their plantation. In fact, six (6) out of nine (9) plantation companies without insurance coverage revealed that they are not insured as insurance premiums are too costly. The remaining five (5) plantation companies who are not insured did not specify any reasons for not obtaining flood insurance coverage.

Malbumi Development Berhad has managed to obtain insurance coverage at a cost of RM28,000 per year. Only one (1) out of the eight (8) plantation companies expressed their interest to obtain flood insurance coverage in future; the company would only obtain insurance coverage if insurance companies are willing to offer reasonable rates.

There is a consensus that plantation companies who have claimed for insurance damages are not likely to obtain flood insurance coverage for the consecutive year.

Having explored the various issues related to flood insurance, MJS found that flood insurance does feature significantly in plantation companies' decision to replant or not to replant oil palm in the flood-affected areas. In fact, most plantation companies' would replant oil palm or other alternative crops regardless of whether they have flood insurance coverage or not.
6.0 Possible Alternatives for Oil Palm Plantation Companies: Planting Forest Tree Species Suitable for Cultivation in Flood Prone Areas

Apart from planting oil palm in flood-affected areas, plantation companies have other alternatives, that is, to plant forest tree species with good commercial value that can withstand severe flooding conditions. In the general survey, three (3) out of 11 plantation companies are very keen to plant commercial timber species in flood-affected areas as an alternative crop to oil palm. Findings from the general survey also revealed that seven (7) out of 11 plantation companies are prepared to invest in a tree crop project with a maximum gestation period of 10 to 15 years. Only two (2) out of 11 respondents stated that they are willing to invest in a tree crop project with a maximum gestation period of 15 to 30 years.

The type of tree species recommended for cultivation on the flood-affected areas in the Kinabatangan is chosen on the following basis:

- Indigenous species to Borneo and Wetlands Environment
- Minimum maintenance requirement
- Fast growing species with a gestation period ranging from 15-20 years
- Seedlings are available
- Good commercial value
- High survival rate and better tolerance towards flooding conditions

6.1 Choosing tree species for cultivation in the Kinabatangan flood prone areas

Mr Robert Ong, the Head of Natural Forest Research Centre (FRC) in Sandakan mentioned the various issues relating to planting specific forest tree species. Perupok is particularly valuable, fetching more than RM2000 per cubic metre in sawn timber form. However, FRC have no experience in planting Perupok. FRC has managed to obtain Perupok seedlings from the wild. The FRC has been able to obtain specific seedlings by employing local villagers to collect them from the Kinabatangan forest.

In the case of the Binuang species, FRC confirmed that planting materials for Binuang could be obtained easily as they fruit virtually every year. FRC also states that vegetative propagation of Binuang species has proven very successful. Experimental planting of the various tree species recommended by FRC is currently being progressed. FRC hopes to establish the timber properties of each recommended species and determine their suitability for cultivation in flood prone areas.
FRC has recommended Binuang, Perupok, Laran and Talisai Paya because the seedlings for these species are available, and the trees are hardy and fast growing with a gestation period of 15 to 20 years. Other species could be marketed once large volumes of a particular species can be made available, such as from a plantation.

The FRC indicated that Sentang and Teak are not suitable for areas where water table is high. Therefore, Sentang and Teak are not suitable for cultivation in flood-affected areas. However, Sentang and Teak could be suitable to be planted on slightly elevated areas in the Kinabatangan where proper drainage system is in place.

FRC views availability of seedlings as a major issue in Tree planting. Plantation companies would experience some difficulty in obtaining seedlings for the recommended tree species if they were to venture into tree planting in the next 12 months. There are no nurseries in Sabah who can provide sufficient planting materials at short notice. In addition, tree seedlings need to be raised in the nursery for a period of six (6) to eight (8) months before they can be planted on site. However, the FRC believes that the problems of obtaining planting materials can be overcome through advance planning and a commitment to venture into tree planting.

It is noted that different species have different fruiting cycles, some cycles can run for 3-4 years. This could mean choice of the tree species might have to conform to this limitation.

Both FRIM and FRC in general agreed that there is minimal research currently available on trees indigenous to a flood prone environment. They caution that data and information available are preliminary and need to be further researched and tested under field conditions. How the trees deemed suitable for flood prone areas will actually perform in a Kinabatangan site is to a large degree conjectural.

6.2 Recommendations on Planting Techniques and Maintenance Systems

Both FRIM and FRC emphasized that the optimal growth of each tree species is dependent on a number of factors. Some species cannot withstand open planting at the initial planting stage and becomes light tolerant as they mature. Trees, which are not tolerant towards sunlight, should therefore be planted in the matrix of secondary vegetation, or planted under fast growing nurse trees which have to be established first. Other species such as Binuang, Perupok and Laran, require a lot of sunlight during growth periods, and therefore can be planted in the open. A suggestion is that block-planting techniques could be adopted and that each forest species could be planted in rows of three or four within the blocks.
FRIM suggests that an alternative is to plant in belts, with tree species most tolerant to floods being planted in the wettest zones and progressing inland with other belts of appropriate species that are less flood tolerant on zones subjected to less serious flooding. FRIM recommends that as many mixes of species are planted as possible to enhance the rate of survival. Much of the symbiotic relationship of the species are not known; how different species will respond to floods, diseases and pests in the Kinabatangan Basin is also indeterminate. If mono-specie tree culture is adopted, and the choice proves inappropriate, the whole tree crop could be destroyed for any one of the mentioned reasons.

The Forest Research Institute of Malaysia (FRIM) suggests that tree seedlings should be kept in a nursery until they reach the height of minimum (one) 1 metre, but preferably (two) 2 metres prior to planting the seedlings on the actual tree planting site.

FRIM was engaged by RISDA to undertake a project in 1998 to determine whether it would be possible to plant flood-resistant trees in a Johor oil palm plantation area which is water logged and subjected to flood levels as high as 9 feet, lasting as long as 20 days. Floods in 2000 destroyed all the new seedlings planted, primarily because the seedlings were only one (1) foot to two (2) feet high, and were completely underwater for a prolonged period. The trial project was abandoned after this failure.

FRIM believes that young seedlings that have reached a height of (two) 2 metres should be mature and tall enough to withstand severe flooding conditions as the trees would not be submerged under floodwater. Therefore the young seedlings would have a better chance of surviving during floods. Obviously, the costs of keeping tree seedlings in a nursery (until they reach the ideal height of two metres) would be high. However, MJS believes that the cost could be reduced if oil palm plantations keep the tree seedlings in their own plantation nursery until the trees reach the ideal height of two metres before transplanting. Transplanting tree seedlings from the plantations' nursery to the actual tree-planting site may cause some damage to the roots and affect the survival rate of the trees.
Figure 4 shows a “Terminalia Sopelandii” tree specie in Asiatic Development Bhd, which survived the year 2000 flood. The height of the flood is approximately five (5) feet, as indicated by MJS staff below.

In relation to maintenance, fast growing trees need only be maintained during its initial planting for two (2) to three (3) years. FRC recommends weeding of three rounds per year, which can cost less than RM30 per round per hectare; and fertilisation would not be necessary for forest tree species. FRIM suggest that if the seedlings are tall enough, weeding can be minimal, and that given the rich alluvial soils of the Kinabatangan Basin, fertilisation may not be necessary.

According to the FRC, plantation companies would in most instances have sufficient technical knowledge in managing tree planting by themselves and therefore, there would be minimal need for external expertise.

6.3 Logging Techniques

The FRC is of the opinion that logging techniques would not be a major issue and suggest that harvesting and extraction can be done during dry season using Reduced Impact Logging (RIL). Another method of harvesting is Cable Yarding, which is especially suitable for extracting plantation logs from clear felling operations.

FRIM has undertaken experiments in implementing sustainable tree harvesting techniques in swampy conditions. FRIM found that by relatively inexpensive adaptations to normal vehicles and equipment, logging operations could be successfully undertaken.
6.4 Comparison of Cost: Dry land tree plantation vs tree plantation in flood-prone area

There should be no significant cost difference when establishing a dry land tree plantation as opposed to establishing a tree plantation in a flood prone area. This is because planting will most likely be carried out when the ground is dry. FRC suggested an establishment cost of RM900 to RM1200 per hectare, including cost of seedlings. However, it is noted that these estimates are subject to some degree of variance depending on terrain, species, planting techniques and maintenance systems.

6.4.1 Planting Patterns, Thinning and Yield

Planting patterns for forest tree species should be similar to oil palm planting patterns; a spacing of 3 metres X 5 metres or 4 metres X 5 metres is recommended by FRC. According to Mr Ong of FRC, plantation companies need approximately 500 to 650 seedlings per hectare. Depending on the tree species, non-commercial thinning may take place at five (5) to six (6) years. Commercial thinning can be conducted at 12 to 15 years.

According to FRC, planters can expect a final crop of approximately 120-150 trees, harvested after 20 years. Assuming a volume of 1.5 to 2 cubic metre per tree, the final harvest can yield up to 300 cubic metre per hectare. FRIM and WWF suggested that in the interest of wildlife and bio-diversity, planters be encouraged to include about 5%-10% of trees that are a source of food for the wildlife.

(Additional information on the various patterns of planting methods can be viewed in Appendix D1).

7.0 Recommendation on Suitable Tree Species for Cultivation in Flood-prone areas of Lower Kinabatangan.

Experts from Natural Forest Research Centre in Sandakan (FRC), Forest Research Institute of Malaysia (FRIM) and World Wide Fund for Nature Malaysia (WWF) have provided a list of tree species recommended for cultivation in Kinabatangan flood-prone areas.
### 7.1 Natural Forest Research Centre’s (FRC’s) Recommendations

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Local Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Cananga Odorata</td>
<td>Cananga</td>
</tr>
<tr>
<td>ii. Lithocarpus gracilis</td>
<td>Mempening</td>
</tr>
<tr>
<td>iii. Litsea garciae</td>
<td>Pengolaban</td>
</tr>
<tr>
<td>iv. Lophopetalum multinervium</td>
<td>Perupok</td>
</tr>
<tr>
<td>v. Mitragyna speciosa</td>
<td>Sepat</td>
</tr>
<tr>
<td>vi. Nauclea subdita</td>
<td>Bongkol</td>
</tr>
<tr>
<td>vii. Neolamarckia cadamba</td>
<td>Laran</td>
</tr>
<tr>
<td>viii. Octomeles Sumatrana</td>
<td>Binuang</td>
</tr>
<tr>
<td>ix. Terminalia copelandii</td>
<td>Talisai Paya</td>
</tr>
</tbody>
</table>

### 7.2 Forest Research Institute of Malaysia’s (FRIM’s) Recommendations

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Local Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Dillenia Excelsa</td>
<td>Simpoh</td>
</tr>
<tr>
<td>ii. Gonostylus Bancanus</td>
<td>Ramin</td>
</tr>
<tr>
<td>iii. Litsea Garciae</td>
<td>Pengolaban</td>
</tr>
<tr>
<td>iv. Lophopetalum multinervium</td>
<td>Perupok</td>
</tr>
<tr>
<td>v. Macarranga</td>
<td>Lingkabung</td>
</tr>
<tr>
<td>vi. Octomeles Sumatrana</td>
<td>Binuang</td>
</tr>
</tbody>
</table>

### 7.3 World Wide Fund for Nature Malaysia’s (WWF’s) Recommendations

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Local Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Cananga Odorata</td>
<td>Cananga</td>
</tr>
<tr>
<td>ii) Dillenia Excelsa</td>
<td>Simpoh</td>
</tr>
<tr>
<td>iii) Duabanga Moluccana</td>
<td>Magas</td>
</tr>
<tr>
<td>iv) Exoeccaria Indica</td>
<td>Gurah</td>
</tr>
<tr>
<td>v) Ficus Racemosa</td>
<td>Ara</td>
</tr>
<tr>
<td>vi) Gonostylus Bancanus</td>
<td>Ramin</td>
</tr>
<tr>
<td>vii) Litsea Garciae</td>
<td>Pengolaban</td>
</tr>
<tr>
<td>viii) Lophopetalum multinervium</td>
<td>Perupok</td>
</tr>
<tr>
<td>ix) Macarranga Specics</td>
<td>Lingkabung</td>
</tr>
<tr>
<td>x) Nauclea Subdita</td>
<td>Bongkol/ Bangkal Kuning</td>
</tr>
<tr>
<td>xi) Neolamarckia Cadamba</td>
<td>Laran</td>
</tr>
<tr>
<td>xii) Octomeles Sumatrana</td>
<td>Binuang</td>
</tr>
<tr>
<td>xiii) Peromena Canescens Jack</td>
<td>Sungkai</td>
</tr>
<tr>
<td>xiv) Pterosperum Stapfianum</td>
<td>Bayur</td>
</tr>
<tr>
<td>xv) Terminalia Sopelandii</td>
<td>Talisai Paya</td>
</tr>
</tbody>
</table>
8.0 Commonly recommended species by WWF, FRIM, and FRC

For the purpose of this paper the commonly recommended species will be referred to as the Selected Tree Species (STS).

8.1 Octomeles Sumatrana (Binuang)

*Octomeles Sumatrana*, also known as *Binuang*, has been highly recommended by the Forest Research Centre due to the following reasons:

- Planting material can be easily obtained
- Yearly flowering patterns
- Vegetation propagation has proved to be very successful

8.1.1 Distribution and Survival Rates in Flood Prone Areas

A pioneer of bare alluvial soil, *Binuang* grows in lowland evergreen rainforest up to 1000 metres altitude. The specie grows well in low-lying areas and where rainfall of about 1500 mm annually is evenly distributed over the year.

8.1.2 Commercial Value and Economic Benefits

*Binuang* has not been a popularly traded timber species. In 1992, total value of export for *Binuang* was US$141 per m³ for sawn timber and US$73 per m³ for round logs (WWF Sandakan, 2000). Wood can be used for purposes where strength is not important; the wood is used in the making of light furniture and joinery, interior finish, mouldings, packing crates, core veneer and pulp paper for manufacture.

8.1.3 Growth Rate

*Binuang* is a fast growing and light demanding specie. Trees can reach a maximum height of between 65-75 metres and a diameter of 250-400 cm. *Binuang* can reach a diameter of 105 cm in 60 years.

For the production of pulpwood, harvesting can start 4-5 years after planting. The normal rotation for sawntimber is expected to be 20-25 years. To reach a diameter of 45 cm, *Binuang* requires a minimum rotation period of between 15-20 years.
8.1.4 Availability of Seedlings

According to the FRC, they are able to provide Binuang seeds during a good fruiting season. Otherwise, seeds/seedling are gathered wild from the forest. Obtaining substantial amount of seeds/seedlings for cultivation is therefore presently still a problem.

8.1.5 Other Comments on Binuang:

The wood of Binuang deteriorates very rapidly, therefore it must be extracted from the forest immediately and handled quickly.

8.2 Lophopetalum Multinervium (Perupok)

8.2.1 Distribution and Survival Rate in Flood Prone Areas

Perupok occurs naturally in peat swamp forests, lowland forests, hills and thrives in peat soil. Perupok is common in floodplains, including the Kinabatangan area. However, Perupok has been known to have difficulty growing during the dry season.

8.2.2 Commercial Value and Economic Benefits

Perupok has been known to fetch a price of over RM2000 per m³ in sawn timber form. Perupok is described as Light Hardwood. Its fine and even texture is suitable for interior finishing, joinery, cabinet making, panelling, partitioning, furniture making, veneer and plywood. On the other hand, locals use the roots and wood of the Perupok tree to make furniture and houses.

8.2.3 Growth Rate

Sabah has no experience in growing Perupok. No field data is therefore available on this specie in Sabah. However, from the Indonesian experience, Perupok is considered a relatively fast growing specie. Perupok can reach a maximum height of 45 metres and a diameter of 80 cm. Usually Perupok is ready for felling once it reaches a minimum diameter of 25–30 cm and it can easily reach this size in 15-20 years.

8.2.4 Availability of Seedling

Currently, there are no nurseries in Sabah that supplies Perupok seedlings. However, according to FRC, the seedlings are relatively easy to acquire. Perupok seedlings can be obtained from the Sabah Forestry Department, which frequently hires local villagers to gather seedlings from the forest floor at a price of RM0.60 to RM1.00 per seedling.
8.2.5 Other Comments on Perupok

Although Perupok is considered a common specie, its growth, flowering and fructifying pattern is yet to be established. The supply of Perupok timber usually comes from that growing wild in the forest.

8.3 Litsae Garciae (Pengolaban)

8.3.1 Distribution and Survival Rate in Flood Prone Areas

Pengolaban is widespread in Sabah and chiefly occurs in moist low-lying areas subject to seasonal flooding, but not permanently swampy. Pengolaban can generally be found up to 1,500 feet elevation however, it also grows naturally in the Kinabatangan Floodplain.

8.3.2 Commercial Value and Economic Benefits

The timber properties of Pengolaban are still being researched therefore, its market value and existing or potential usefulness has not been well established. Locals commonly use it as general utility timber, while its leaves, bark and woodchips are often used as ingredients for traditional medicine. Pengolaban fruits on the other hand, are edible and often sourced both by locals and the wildlife.

8.3.3 Growth Rate

A fast growing specie, Pengolaban is known to reach a diameter of 50 cm in 10 years time, reaching maturity at about 15 years. The FRC is confident that only a minimum rotation period of 10-15 years is required for this specie.

8.3.4 Availability of Seedling

Pengolaban seedlings are also rather easy to obtain. A few individuals from the Tenom Agricultural Park who are reportedly growing Pengolaban seedlings in their orchards could easily supply some seedling. Similarly, Pengolaban quite commonly grow wild on the forest floors.

8.3.5 Other Comments of Pengolaban

Further research and timber tests on Pengolaban are still being carried out by the FRC. Therefore, the availability of data on this specie is very limited. For example, information on its market value is still relatively unknown at this time.
8.4 Gonystylus Bancanus (Ramin)

FRIM considers Ramin to be the most suitable and most commercially viable tree specie to be cultivated in the Kinabatangan Floodplain. Ramin is said to be of better quality than Sentang (Azadirachta Excelsa). Ramin is currently being cultivated as sample specie in FRIM's Research Centre. In- depth study on the properties of Ramin is still on going.

8.4.1 Distribution and Survival Rate in Flood Prone Areas

Ramin is widely found in peat swamp forests, low undulating land and hills. It is endemic in peat and mixed peat swamp environment and is usually found on the West Coast of Borneo.

8.4.2 Commercial Value and Economic Benefits

Ramin is a Light Hardwood and its moderately fine and even texture is highly sought after as decorative cabinet timber and for interior decorative work. Ramin is also considered as one of the popular furniture timber in Malaysia.

8.4.3 Growth Rate

Ramin is also considered a fast growing specie, with a height growth of about 1 metre/year. Although Ramin can reach a maximum diameter of between 90-100 cm, its girth growth is very slow, especially in peat swamp environment. In peat soil, Ramin girth growth is only about 0.3 to 0.4 cm per year. At this rate, it would take about 100 years for Ramin to achieve a diameter of 40 cm. According to Dr Shamsuddin Ibrahim, this may be due to poor nutrients present in peat swamp soil. The higher nutrient content in alluvial soils, such as those found in the Kinabatangan Floodplain, could promote higher girth growth rate of the Ramin specie. On the other hand, according to FRC, the rotation period of Ramin is almost 50 years.

8.4.4 Seedling Availability

According to the FRC, it would be quite difficult to obtain Ramin seedlings in Sabah as 85% of the Ramin swamps in Sabah have been destroyed by recurring fire. Ramin can however, be found in abundance in Peninsula Malaysia. Although the flowering and fruiting patterns of Ramin are yet to be recorded, adequate seedlings supply can be made available through cutting propagation. FRIM gave the assurance that they would be able to supply sufficient seedlings within 6 months-1 year for replanting on 2,000-4,000 hectares of land. Keeping this in mind, should it become necessary, importation of Ramin seedlings from Peninsula Malaysia could be considered.
8.5 Terminalia Copelandii (Talisai Paya)

Planting trials in Sabah suggest that Terminalia Copelandii, locally known as Talisai Paya, grows well in monocultures. A hardy timber tree, Talisai Paya is described as Light Hardwood.

8.5.1 Distribution and Survival Rate in Flood Prone Areas

Talisai Paya is very commonly found in primary rainforest and swamp forest. Research by the Institute of Development Studies shows that Talisai Paya is a prolific grower in the Kinabatangan area (Chuan & Tangau, 1991).

8.5.2 Commercial Value and Economic Benefits

Talisai Paya is widely used as general planking. Other uses include furniture-making, flooring, interior finishing, panelling, moulding, veneer and plywood.

8.5.3 Growth Rate

Talisai Paya is considered a fast growing specie with an estimated annual diameter growth of up to 2 cm/year. Records show that Talisai Paya could reach a maximum height of 40 metres, a maximum diameter of between 80 to 100 cm (31.5 – 39.4 inches) and a rotation period of about 25 years.

8.5.4 Seedling Availability

Talisai Paya is another tree specie that is easily available through similar methods mentioned for Perupok and Pengolaban. Prices of seedlings range from RM0.60 to RM1.00 each.

8.5.5 Other Comments on Talisai Paya

Market value for Talisai Paya sawn timber or logs is presently not available.
8.6 Neolamarckia Cadamba /Anthocephalus Chinensis (Laran)

8.6.1 Distribution and Survival Rate in Flood Prone Areas

Also known locally as Kelempayan in Peninsula Malaysia and Selimpoh in Sarawak, Laran is traded as Light Hardwood.

Although a pioneer specie, Laran is easily identified and is commonly found in the Kinabatangan Floodplain. Laran occurs naturally on riverbanks and in the transitional zone between swampy, permanently flooded areas and in areas, which are periodically flooded.

8.6.2 Commercial Value and Economic Benefits

Laran wood cannot be used in outdoor conditions therefore, Laran is popular where wood strength is not the main consideration. With its moderately fine and even texture, Laran is suitable for light construction, plywood, packing cases, concrete shuttering and for making wooden joinery as well as paneling.

In 1987 the export of Laran round logs from Sabah was 67,000 m$^3$ with a value of US$4.1 million and in 1992, Sabah exports of Laran 9,000 m$^3$ of sawn timber and 32,000 m$^3$ of logs have been reportedly estimated at US$3.9 million (WWF Sandakan, 2000). The 1998 average price of one cubic metre of Laran wood was about US$60.

8.6.3 Growth Rate

Laran grows rapidly with an annual increment in height of up to 3 metre$^3$/year and it could reach a maximum height of 45 metres. The trees are considered mature enough for felling at 10 to 15 years, upon reaching a minimum diameter of 50 cm. A tree of 50 cm diameter yields 2.5-3 m$^3$ wood. A rotation period of 15-20 year is realistic for Laran.

8.6.4 Availability of Seedlings

Laran seedlings are also relatively easy to obtain, usually from freshly germinated seedlings from the wild. However, securing large volumes of this specie would prove to be quite difficult as its flowering and/or fruiting patterns are still unknown. The cost of a Laran seedling is also about RM0.60 to RM1.00 each.

Sabapuri and Kontraktor Malaysia located in Tawau and Lahad Datu respectively are two nurseries suggested by the FRC. Both nurseries are quite willing to supply Laran seeds/seedlings provided advance request is given. The Sabah Forestry Department could also provide seeds during a good fruiting year.
8.6.5 Other Comments on Laran

Laran seeds are dispersed by wind, rain or floods and rivers. Young seedlings do not withstand strong competition of weeds and grasses and they will only develop into trees if not overgrown by surrounding vegetation or strangled by lianas. Therefore, being a shade intolerant specie, the most important condition for the growth of Laran is light.

8.7 Market Value

Figures obtained from the Sabah Timber Association (STIA) state that the year 2000 Average Export Price for Ramin sawn timber is RM1,184 per m$^3$, while the market value for Perupok sawn timber is RM1,630 per m$^3$. On the other hand, Talisai Paya, Pengolaban and Laran have not been commercially introduced into the market. Hence, only average prices for Light Hardwood timber is available. The year 2000 published sawn timber prices obtained from the Malaysian Timber Board (MTIB) for Light Hardwood is RM330 per m$^3$.

8.8 Planting Techniques/Patterns Relative to Binuang, Perupok, Pengolaban, Ramin, Talisai Paya and Laran.

All of the selected tree species are tolerant to light and do not require shade. Open planting techniques are therefore suitable for all six species.

The Block Planting System, as suggested by Mr Robert Ong of FRC is clearly ideal. Adequate spacing between trees when planting in a mono-culture or when using the Hedge Planting System is necessary to avoid problems when the canopy of some tree species closes, hence depriving other tree species of sunlight, which for species like Laran, is vital for its growth development. Another suitable technique is Perimeter or Border Planting, which involves planting trees along rivers or along borders of agricultural crop plantations. (Please refer Appendix D1).

FRIM suggests planting in rows or single specie planting to ease maintenance and facilitate harvesting. Planting a few different species together or in a group will be cost inefficient as different species would probably have different needs, maintenance and grow at a different pace.
8.9 Other Suggested Species

- *Peromena Canescens* Jack (*Sungkai*)
- *Mitragyna Speciosa* (Sepat)
- *Excoecaria indica* (Apid-Apid)
- *Nauclea subdita* (Bongkol)

8.9.1 *Peromena Canescens* Jack (*Sungkai*)

8.9.1.1 Distribution and Survival Rate in Flood Prone Areas

*Sungkai* is native or indigenous to Peninsular Malaysia, Sumatra, Java and Borneo. It is commonly found in secondary forest, river banks and occurs naturally in logged over forest from sea-level up to 600 metres altitude. *Sungkai* grows best in moist and wet sites, even in a seasonally flooded area. It is an ideal species for cultivation due to its ability to grow on very poor soils.

8.9.1.2 Commercial Value and Economic Benefits

*Sungkai* timber can secure attractive market value and demand in future. Some views suggest that *sungkai* can be harvested after 5 years for making high quality photo frames. *Sungkai* is classified as a luxurious timber in Indonesia; the price for *Sungkai* is as follows:

<table>
<thead>
<tr>
<th>Material</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sungkai Sawn Timber:</td>
<td>US$1,100 per m³</td>
</tr>
<tr>
<td>Sungkai Flooring:</td>
<td></td>
</tr>
<tr>
<td>Unfinished</td>
<td>US$1,450 per m³</td>
</tr>
<tr>
<td>Finished</td>
<td>US$1,675 per m³</td>
</tr>
<tr>
<td>Sungkai Plywood:</td>
<td>US$12.00 per piece</td>
</tr>
</tbody>
</table>

*Sungkai* timber is described as a “Fancy Wood” due to its light, hard, elastic and attractive linear figure characteristics. *Sungkai* can be used to make furniture and cabinets, good quality plywood, decorative veneer, interior contraction and fancy wood production.
8.9.1.3 Growth Rate

*Sungkai* grows rapidly and is usually straight and tall prior to reaching 6-7 years old. It is reported that the mean annual increment (MAI) of *Sungkai* can achieve 10 metre³/ha/yr. The MAI of its diameter is 1.61 cm/yr and height of 1.27 metre/yr.

8.9.1.4 Availability of Seedlings

Seedlings for *Sungkai* can be obtained from Sabapuri nursery in Tawau at the following costs:

(Minimum order $\rightarrow$ 3,000 seedlings)

<table>
<thead>
<tr>
<th>Seedling quantity</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10,000</td>
<td>RM1.50</td>
</tr>
<tr>
<td>10,000-30,000</td>
<td>RM1.30</td>
</tr>
<tr>
<td>30,000-100,000</td>
<td>RM1.20</td>
</tr>
<tr>
<td>More than 100,000</td>
<td>Negotiable</td>
</tr>
</tbody>
</table>

8.9.1.5 Other comments on Sungkai

*Sungkai* is suitable for “Open Planting” and Mixed Planting in “Perimeter” Planting pattern where sufficient sunlight is available. *Sungkai* is not a suitable species for enrichment planting as it is a strong light demander. Competition of sunlight will affect its fast growth rate when the trees are young.

(Information on Sungkai has been extracted from the brochure of Sabapuri Nursery Sdn Bhd, Tawau)

8.9.2 *Mitragyna Speciosa* (Sepat), *Excoecaria indica* (Apid-Apid), and *Nauclea subdita* (Bongkol)

Very little studies have been made on these three (3) species, both in terms of their properties and commercial values. Sepat and Bongkol are considered to be fast growing species and its seeds are easy to acquire. Mr Robert Ong of FRC commented that a minimum rotation period of 15-20 years is expected for Sepat and Bongkol.

MJS is unable to comment further on the above three (3) species. More field research is needed to determine their suitability and commercial viability in this project.
8.10 Other Related Issues

- **The Colour of Wood**

  The wood colour of each tree species is one of the factors that determine its commercial attractiveness in the market. Wood that has fair or white shades is better preferred, as they are easier to stain. All of the selected tree species except the Talisai Paya are of this colouring.

- **Potential Markets**

  Although Talisai Paya, Sepat, Pengolaban and Bongkol are relatively unknown species, illegal loggers frequently harvest these species and then market them as Other Timber (OT). Looking at this from another perspective, perhaps this could be a good indication that these species do have existing markets. With adequate and reliable marketing as well as consistent supply, a demand for these species can be created.

- **Pests and Diseases**

  There are no diseases that are known to seriously affect any of the six (6) selected tree species. As for pests, Mr Robert Ong of FRC feels that it is unlikely to be a problem. Although wildlife such as elephants, deers and wild boars, which eat the shoots and crowns of tree seedlings, are quite common in the Kinabatangan area, they are also prevalent in plantations. On the other hand, elephants and wild boars are known to like young oil palms as well. This being said, oil palm plantation managers express that the wildlife problem is manageable, and control of wildlife and other pests can be similarly managed for tree plantations.

9.0 Other Possible Alternative Crops

Based on MJS’s general survey, seven (7) out 11 plantation companies are keen to plant other crops other than oil palm while three (3) out of 11 plantation companies are undecided on whether they would plant other crops as an alternative to oil palm. Mr Deratil Boaklan, Head of Research in the Land Use Section of Sabah Agriculture Department provided MJS with a list of possible alternative crops. He commented that cocoa and rubber are not suitable for cultivation in the Kinabatangan flood prone areas.

9.1 Perennial Crops

- **Cocoa**

  Cocoa shows signs of intolerance towards very wet climate in Kinabatangan Floodplain, and to wet soil. Dry bean yields varies from 400-600kgs per hectare per year.
• **Rubber**

Rubber may not tolerate the wet conditions because of risks of fungus attack and root problems.

9.2 **Lowland Vegetables**

- Crucifas
- Brinjal
- Capsicum
- Sayur Manis
- Lady's Fingers
- Tomato
- Radish
- Long Bean

9.3 **Root Crops**

- Tapioca
- Sweet Potato
- Taro

9.4 **Pulses**

- Mung bean
- Soya bean
- Ground nut

9.5 **Maize, Sorghum, Tobacco and Sweet Corn**

10.0 **Alternative Cash Crops for Cultivation in the Kinabatangan Flood Prone Areas**

The Land Use Section of Agriculture Department provided MJS with some information on the suitability of crops for specific areas within the Kinabatangan Floodplain. In the general survey, respondents showed some interest in planting other alternative crops such as paddy, maize, sago as an alternative to oil palm in the flood-affected areas. This section provides relevant information on their suitability for cultivation on flood-prone areas. Please refer Appendix D3 for further information on soil profile and suitability of crops.
10.1 Paddy

Paddy is a labour intensive crop suitable for cultivation in well-irrigated plantation area. Four (4) types of paddy species are currently cultivated in Malaysia. They include Malinja, Mahsuri, Bahagia and Ria. Maturity period for paddy species can range from 120 days to 230 days, depending on the type of species (Abdullah, 1991, pp. 7-8).

When choosing paddy species for cultivation in floodplains, the species should have the following characteristics:

i) Can produce a large volume of paddy per hectare
ii) Have higher resistance towards diseases and pests
iii) Can be harvested within a short gestation period
iv) Can produce good quality of rice

(Abdullah, 1991, pp.20)

In the general survey, two (2) out of 11 participants stated their interest in planting paddy as an alternative crop.

Paddy requires sufficient water supply in its early stages of growth, and grows well in Floodplains along the riverbanks. However, proper dam and drainage is needed to mitigate flooding and drought problems. The Japanese Government sponsored research team (JICA) concluded that a broad based paddy cultivation scheme requires the construction of two massive dams in the Kinabatangan. The Malaysian Federal Economic Planning Unit (EPU) did not deem this proposal viable. “Paddy cultivation involves vast land area and infrastructure. With just one yield per year/or an area of 2000 to 3000 hectare, it is just not economically feasible to plant paddy” (Boaklan, 2000, Appendix B9, 2.6, p.2).

Paddy cultivation consumes time and effort for land preparation such as ploughing and raising soil. Soil needs to be raised to a height of four (4) inches and width of approximately 1.5 meters. In a Floodplain area such as Kinabatangan, it is possible for planters to produce one crop a year. However, planters will need to reconsider planting paddy as floods destroys the basic infrastructure and therefore, planters will incur high costs in the redeveloping planting infrastructure for paddy after flooding.
Data from Agricultural Department suggest that the production costs of Kampung paddy (planted in a traditional manner) is approximately RM2,044.77 per hectare (refer Appendix D). Seedling costs and the harvesting methods used can have an effect on production costs. Return on investment for paddy cultivation for “Kampung Paddy” is negative RM553.77 per hectare (information obtained Ms Julie Sulaiman of Agriculture Department, Economics Section). Paddy crops are also known to attract pest such as rats to the plantation.

10.2 Maize

Maize can be cultivated in a tropical climate area with temperatures ranging from 18 to 30 degrees Celsius. Maize crops need plenty of rain and would grow well in a relatively flat plantation area receiving over 800 mm of rainfall annually (Zaharah, 1992, p.15). It’s high sensitivity towards sunlight and water affects the gestation period of maize. Tropical maize species requires 100 to 140 days to mature and therefore, would be an ideal cash crop cultivated between flooding periods. In the Kinabatangan, plantation companies have expressed their interest to plant maize as an alternative crop to oil palm in flood prone areas.

In early stages of growth, maize crops required proper drainage, as they cannot tolerate too much water. Flood poses a great threat to maize crops especially in its early growth stages. Excess water tends to stunt the growth of maize crops and affect the production levels of maize (Zaharah, 1992, p.29).

Maize can be cultivated for animal feed as well as for staple food such as baby corn or sweet corn. The costs of investment for corn cultivation can range from RM2,000 to RM2,600 per hectare. Planters of sweet corn can expect a total revenue of RM2,650 per hectare per season (120 days). Maize cultivated for baby corn and sweet corn has better revenue prospects (Zaharah, 1992, pp.56-68).

10.3 Bamboo

Bamboo is one of the fastest growing plant on earth, typically about 76-406mm per day. It grows three times faster than most eucalyptus species and can be harvested four times as often (commercially important species usually mature in 4 - 5 years). Its lightness and high elasticity make bamboo an ideal material for housing areas prone to natural calamities, such as hurricanes and earthquakes. One (1) out of 11 plantation companies considered planting bamboo in flood-affected areas as an alternative crop to oil palm.
**Bamboo** displays a remarkable adaptability to surroundings. It tolerates a wide range of soils from perennially poor to perpetually rich, and soil moisture conditions, from drought to drowning. This characteristic has proved very useful in rehabilitating degraded lands. However, elephants are a great threat to bamboo crops, as they are known to be a favourite food for elephants and other wildlife.

### 10.3.1 Environmental Benefits of Bamboo

*Bamboo*’s potential for checking soil erosion and for road embankment stabilization are now becoming known. It is equally important for providing fast vegetative cover to deforested area.

### 10.3.2 Commercial Value of Bamboo

The global trade in *bamboo* is estimated at US4.5 billion. *Bamboo* furniture is an expanding business. In the Philippines exports rose from US625,000 in 1985 to 1.2 million in 1994.

*Bamboo* shoots industry has become a major money-spinner today. Mainland China earns US130 million annually from shoot exports. In India, modern paper industry has expanded to such an extent that 2.2 million tones of *bamboo* are used for paper production.

*(source: International Network for Bamboo and Rattan (Inbar), http://www.inbar.cn.org/wbamboo.asp )*

### 10.4 Rattan

Like bamboo, *rattan* can withstand a wide range of variety of soils. Indonesia, is currently the world’s largest *rattan* producer.

#### 10.4.1 Environmental Benefits of Rattan

Ecologically, *rattan* grows in degraded forests in marginal soils. It can also be introduced artificially in natural forests without distributing the existing structure and balance, and in felled areas.

*Rattan* is an extremely environmental friendly plant in that it “hugs” the trees and saves it from the loggers axe by providing equal or more benefit than the companion tree without disturbing the natural habitat.

*Rattan* species such as Callamus minutus have subterranean stems that could be effective soil binders. Some *rattans* such as Callamus caesium and Callamus manna have widely radiating, horizontally growing roots, up to 8 metres from the plant base; such roots are bound to have significant role in preventing soil displacement.
10.4.2  Rattan: Nutritional Value and Commercial Uses

Rattan is a favourite food for elephants and wildlife. Both shoots and roots of rattan are edible. Mohd et al. (1999, p.6) state that in Sabah, "rattan planting on Sungang Estate...experienced setback due to attack by monkeys."

Based on MJS's general survey, one (1) out of 11 plantation companies are keen to plant rattan in flood-prone areas as an alternative crop to oil palm. Rattan has an average rotation period of (eight) 8 years and is increasingly popular because it is easy to work with, light in weight and as strong as medium density wood.

Rattan roots and, fruits and leaves are used in folk medicine. Leaves of some species, such as Calamus andamanicus and Daemonorops kurzii can be used as roof thatch. The fruit scales of some rattan species yield a substance called “dragon's blood”, which is used as a dye or varnish material.

Undoubtedly, furniture is the most popular rattan product. In 1994, the Philippines exported rattan furniture worth US$123 million while China exported US$329 million worth of bamboo and rattan. In 1994, trade in raw rattan worldwide was approximately US$50 million and by the time the finished product reaches the consumer the value has increased to US$1.2 billion.


10.4.3  Other Comments on Rattan

Malaysian Palm Oil Board (MPOB) and FRIM have conducted a joint study in integrating rattan manau in mature palm oil plantation; the study revealed that “…rattan manau is not suitable for planting on deep peat and low lying areas which are prone to flooding…(Rattan) cane was not matured enough to be harvested for commercial purpose [at the age of 7 years]" (Mohd. Tayeb, 2000, p.2). Some views also suggest that rattans are difficult to harvest; there are no known harvesting methods for rattan in forested area.

10.5  Sago

Sago is one of the many crops that have been proposed for cultivation in the flood prone areas of Kinabatangan. Cowardin et. Al (1979) states that "sago grows in estuarine, riverine, lacustrine and palustrine wetlands system." St John (1916) described sago habitat as brackish, alkaline or freshwaters.
Sago is an extremely hardy plant, thriving in swampy, acidic peat soils where few other crops survive. The palm is immune to floods, drought, fire and strong winds. Two (2) out of 11 plantation companies expressed their interest to plant sago in flood affected areas as an alternative crop to oil palm.

According to the State Agriculture Department, Sago can grow well in the Kinabatangan Floodplains; however, the water levels must be maintained. The Agriculture Department also reported that there has been experimental planting of sago under Kimanis Bridge. However, the experimental planting was unsuccessful; it revealed that sago plants cannot survive in brackish water containing sulphuric acid (refer to Appendix B9, 6.4, p.3).

Sago palms can be felled in about 10 to 15 years after planting, depending on the fertility of the terrain. The Agriculture Department does not view sago as a good cash crop due to long gestation period and low value for its produce.

10.6 Fruit Trees

Findings based on MJS’s general survey revealed that none of the respondents showed interest in planting fruit trees. Agricultural Department do not recommend fruit trees as an alternative crop for flood prone areas as they believe that the rate of survival for fruit trees in flood affected areas is not known. Furthermore, fruit trees require high maintenance as they are commonly infested with diseases and pests. The gestation period for fruit trees is approximately 10 to 15 years, which make them unpopular as commercial or cash crops. Fruit trees are likely to both attract and promote a more than natural rate of growth in wildlife population, which could pose a threat to oil palm crops.

11.0 Land Use Options for Plantation Companies in the Kinabatangan

11.1 Continue to Plant Oil Palm

Based on discussions with the various oil palm companies, MJS found that there are some plantations who are prepared to replant oil palm on flood-affected areas; these companies are replanting oil palm because their Head Office in Peninsular Malaysia have specifically instructed them to replant in flood affected areas, in the absence of any known viable alternative.

There are also some companies who are replanting oil palm because plantation managers cannot allow the flood-affected areas to remain fallow; this being a matter of company policy.
Based on MJS’s general survey, six (6) out of 11 plantation companies will be replanting oil palm in the flood-affected areas. Some plantation companies are replanting oil palm because they are not aware of other alternative crops that can be cultivated in the flood prone areas. Most companies replant in the hope that the seedlings can grow to a mature age and height to withstand high flood levels.

Through MJS’s discussions with plantation companies, MJS found that the high costs incurred in replanting oil palm in flood affected areas, and loss of revenue due to floods, do not deter plantation companies from replanting oil palm in the flood-prone areas. Plantation companies are willing to take the risks by replanting oil palm regardless of whether they have flood insurance or not.

The difficulty in predicting flooding occurrences poses a great problem for plantation companies in determining the best timing to replant. Some companies replant right after a flooding incident in the hope that the crops would grow to a mature age and height to withstand the next flood. Nevertheless, plantation companies who have replanted have suffered major losses. Flooding in the Kinabatangan area has become an annual event. Asiatic Development Berhad has attempted to replant three times but unfortunately all their efforts failed as most of their young oil palm crops have been destroyed in the recent 2000 flood. The unanticipated degree of flooding in the year 2000 has created a keen interest among plantation companies to identify suitable alternative crops to oil palm for cultivation in flood-affected areas.

### 11.2 Abandon Land

Land abandonment is the least preferred option for oil palm companies as it is considered a loss of resources. Most plantation companies opt for land maximization and therefore, would continue to plant crops even if the area continues to be affected by floods. In the Kinabatangan area, small plantation companies do abandon flood-affected areas after several attempts to replant have failed. These companies realize that it is more expensive for them to replant especially if several attempts to replant have failed due to the effects of floods. Most would be glad if alternative crops, including fast growing cash crops or forest tree crops can be identified for suitable cultivation in flood-affected areas. Those plantation companies who have decided to abandon the flood-affected areas will allow the flood-affected areas to return to natural reforestation.

However, based on discussions with plantation companies, MJS found that large plantation companies would continue to replant oil palm in the flood-affected areas rather than abandon the flood-affected areas. Pontian United Plantations have upgraded their bunds and spent an additional RM 3 million in the hope that the bunds could prevent floods from destroying young oil palm seedlings. MJS found that Pontian United Plantations Berhad is currently upgrading their bund while simultaneously replanting oil palm in flood-affected areas.
Findings from MJS’s general survey revealed that four (4) out of 11 plantation companies agreed to let repeatedly flooded areas to lie fallow until an economically acceptable alternative is available.

11.3 Diversification

MJS’s discussions with plantation companies revealed that most plantations have started to diversify due to the following reasons:-

i) land maximisation  
ii) competition from neighbouring countries  
iii) longer term decline in crude palm oil (CPO) prices.

Most plantation companies are engaged in diversification for land use maximization. Based on personal interviews with oil palm estate managers, most hilly areas have been planted with teak as these areas are too steep for oil palm cultivation. Forest on some hilly areas has been preserved for potential eco-tourism projects.

Some plantation companies view Indonesia as a strong future competitor for palm oil supply as Indonesia has massive land resources and cheap labour costs. Plantation companies are aware that they are not able to compete in terms of production costs and therefore are diversifying to pre-empt economic threats to their future commercial security. In addition, crude palm oil price has dropped tremendously from RM2228 per tonne in December 1998 to RM1199 per tonne in December 1999 (Statistics of Malaysian Palm Oil, Feb 2000). The drop in price may also instigate many companies to diversify and / or adopt a multi-crop policy.

11.4 Plant Forest Tree Species

Some oil palm plantation companies have integrated forest tree planting in their oil palm plantation. Teak is commonly planted in hilly areas unsuitable for planting oil palm. Some experiments on intercropping Sentang and Sungkai have been undertaken. There is inadequate evidence to prove the commercial viability of planting trees as a second crop. While some oil palm plantation companies are very keen in reforestation for eco-tourism purposes, other plantations are keen in planting high commercial value timber for future investment. Some plantation companies are planting timber for internal use and therefore are not particularly concerned on the future commercial value of timber tree species.

Plantation Forest Tree Species such as Acacia Mangium, Tectona Grandis (Teak) and Azadirachta excelsa (Sentang) cannot tolerate flooding conditions therefore are not suitable for cultivation in the repeatedly flooded areas of the Kinabatangan Floodplain.
Mohd Noor et al (1999, p. 3) stated that in their research, “Sentang trees planted at the bottom of the hill where there was occasional flooding during rainy season begin to die. Some trees which survived, has stunted growth as compared to those trees planted on higher grounds.”

When planting forest tree species, it would be advisable to plant a mix of tree species rather than a monocrop. Due to lack of research on the survival rate of specific tree species grown in flood-prone areas, experimental planting of mixed species would eventually determine which of the various tree species could survive in flood-prone areas.

11.4.1 Benefits of Tree Planting

Plantation companies could gain many benefits by venturing into a tree-planting or reforestation project.

11.4.1.1 Tree Planting is Not Labour Intensive

Planting forest tree species require minimum maintenance compared to other agricultural crops such as oil palm, paddy or maize. As mentioned earlier, planters need to maintain trees in the first three years after planting. All of the plantation companies suggest that labour shortage is a major problem in plantations. The low maintenance nature of tree planting enables plantation companies to diversify without having to extend its labour resources. Plantation companies are very dependent on foreign labour; approximately, 90 percent of their labour is of foreign origin. Consideration of the political, legal and costs implications of managing this group of labour force has to be taken into account.

11.4.1.2 Ground Technical Experience Useful for Diversification

Plantation companies have had many years of experience in managing oil palm plantations. As the companies are moving towards diversification, the reforestation project could be used as a learning curve in managing a second crop.

11.4.1.3 Establishing Green Image

Plantation companies have been labeled as “non environment friendly” organisations. There is a move by NGOs to label oil palm as a “Forest Destructive Crop.” Aquatic life has been severely degraded by pollution originating from oil palm plantation caused by fertilizer and mill effluence. Through the reforestation project, plantation companies can begin to build a “green” image.
This is a goodwill investment for plantation companies to counter and pre-empt environment based opposition to oil palm in the future.

11.4.1.4 Mitigate Flood Problems

The reforestation of riparian reserve would minimise run-off and reduce bank erosion, which can mitigate flooding problems in the Kinabatangan area. Further siltation of Kinabatangan River will lead to even more frequent and severe floods, and perhaps inundate areas of planting currently not affected.

11.4.2 Disadvantages of Tree Planting

There is a perception by some planters that reforestation would increase pest population and aggravate pest problems in the Kinabatangan basin. On the other hand, some others believe that the incidence of pest intrusion into plantations would not increase. In fact, the reforestation project could create a larger acreage of habitation for wildlife sustenance by adding to existing wildlife sanctuaries and forest reserves.
12.0 Financial Cost of Planting Oil Palm Compared to Planting Trees based on current available data on recommended tree species

12.1 Economics Of Oil Palm Plantation In The Kinabatangan Floodplains

The rapid expansion of oil palm plantations in Sabah, and in particular in the Kinabatangan River Basin is indicative of the strong economics underlying the investment in this agricultural crop. The profitability and returns on investment from oil palm will be examined in the context of a “Standard Case” and a “Risk Adjusted Case”. This will facilitate an analysis that will address the problems relating to recurring flooding of large areas of oil palm plantations.

Two key measures of returns on investment will be used, namely:

- **Internal Rate of Return**

  There is a particular rate of interest which will make the total of the present values of future cash flows just equal to the initial capital cost of the investment. The IRR is then compared with the cost of capital. If the cost of capital is higher than the IRR, then the project should not be taken up. If two alternative projects are compared, the one with the highest IRR would be selected for investment, assuming that it was above the cost of capital.

- **Net present value of all future cash flows**

  By this method, the initial investment is netted off against the sum of the present values of the future cash flows. If the net present value is positive, then the project is acceptable at the rate of interest allowed for in calculating the present values. If the net present value is negative then the project has not achieved the rate of interest used in calculating the present values of the future cash flows.


12.1.1 Standard Case Investment in Oil Palm Plantations

The key assumptions in this scenario are:

- No bank borrowings
- Project life span is 26 years
- Plantation size is 5,000 hectares
- Suitable soil and terrain
- CPO Price is RM1,400 and remains constant throughout life of project
- No extreme weather conditions
- Trees requires 4 years to mature
- The discount rate is 10%
### Table 5

**SENSITIVITY ANALYSIS: STANDARD CASE**

**CPO PRICE CHANGES IMPACT ON PROFITABILITY, NPV AND IRR**

<table>
<thead>
<tr>
<th>CPO PRICE (RM/per tonne)</th>
<th>PEAK OPERATING PROFIT (RM/ha)</th>
<th>NPV @ 10% (RM million)</th>
<th>IRR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1600</td>
<td>5027</td>
<td>25.9</td>
<td>13.6</td>
</tr>
<tr>
<td>1500</td>
<td>4505</td>
<td>15.8</td>
<td>12.3</td>
</tr>
<tr>
<td>1400</td>
<td>3984</td>
<td>5.8</td>
<td>10.9</td>
</tr>
<tr>
<td>1300</td>
<td>3463</td>
<td>- 4.3</td>
<td>9.3</td>
</tr>
<tr>
<td>1200</td>
<td>2942</td>
<td>- 14.4</td>
<td>7.5</td>
</tr>
<tr>
<td>1100</td>
<td>2421</td>
<td>- 24.4</td>
<td>5.4</td>
</tr>
<tr>
<td>1000</td>
<td>1900</td>
<td>- 34.5</td>
<td>2.7</td>
</tr>
<tr>
<td>900</td>
<td>1379</td>
<td>- 44.6</td>
<td>&lt; 0</td>
</tr>
</tbody>
</table>

Based on the financial model with the above assumptions, the findings are:

- The total fixed capital requirement covering land cost, dwellings, vehicles, farm equipment, furniture and office equipment amounted to RM34.79 million or **RM6,958 per hectare**
- Total field expenditure amounted to RM27.0 million or **RM5,401 per hectare**.
- Positive cash flow commences from the 7th year and continues to the 26th year.
- The Net Present Value of the plantation is RM5.8 million or **RM1,160 per hectare**
- The Internal Rate of Return is 10.9%

The analysis indicates the following:

- RM900 / tonne is the approximate break-even price for oil palm plantations
- To achieve a positive NPV at 10%, CPO prices should be between RM1,300 / tonne and RM1,400 / tonne
- The IRR becomes negative when CPO price is below RM900 / tonne
- Given the heavy initial costs, a plantation venture is viable only if the average CPO price is above RM1,300 / tonne over the 26 years project life.
12.2 Economics Of Selected Tree Species Forest Plantation In The Kinabatangan Flood Plains

The evaluation of the economics of a Forest Plantation in the Kinabatangan Floodplains is constrained by a number of factors:

- The trees selected have to be suitable for a flood prone riparian zone, subjected to recurring severe flooding.
- Currently little research and field data are available on the tree species deemed suitable for such adverse planting conditions.
- The commercial demand and market values of the subject selected tree species are in the main indeterminate as the market for the harvested timber is not quite established due to both the low volume harvested and insufficient knowledge of timber quality.

In discussions with FRIM, Sabah Forestry Department and other forestry experts, MJS was advised that currently no research has been undertaken on both the growth pattern and financial viability of planting the six riparian tree species included in the *Selected Tree Species* group.

There is apparently a market for the timber of the selected species, as evidenced by the fact that quite a few of species are subject to illegal logging activities. The consensus of forestry experts is that in the absence of proper field studies, and established data on the growth pattern of the selected species, a substantive analysis of the commercial viability of establishing a forest plantation using the selected species of trees will not be possible. The results of a financial evaluation in this context is at best a “guestimate”, and should be used on the strict understanding that the financial data derived are helpful indicators and are not definitive in nature.

Added to these constraints, are the yet indeterminate critical factors of the effects of recurring floods on growth rate, planting densities, seedlings survivability rate, cost of establishment, gestation period and value of the logs 15 to 20 years from time of planting.
12.2.1 Best-fit Financial Model for Selected Tree Species

Given the limitations mentioned above, MJS evaluated several financial models based on data derived from “dry land” tree species where proper field researches have been undertaken. It was considered that the financial model based on the “Sentang” tree is the best fit for the Selected Tree Species for the following reasons:

- This model appears to have general acceptance given its frequent reference in various forestry related forums.

- The gestation period of 15 to 20 years of Sentang approximates the average gestation period of the Selected Tree Species.

- The establishment and maintenance costs are generally regarded as applicable to that of establishing a forest plantation in the Kinabatangan floodplains.

It is noted that various parties have differing financial profitability results for Sentang due to use of different assumptions, which unfortunately cannot be ascertained or verified. As an example the Internal Rate of Return (IRR) for a Sentang tree plantation was variously stated as follows by:

- Ernst & Young (1996) 12.32 %
- Murray R Barber (1998) 14.3 %
- Forest Research Institute of Malaysia (1998) 16.4 %

(Extracted from Chan, Kho and Lee, 1998)

For the purpose of this paper, the financial model as set out in FRIM’s “Viability of Planting Teak and Sentang in Malaysia” will be used as it has the most detailed financial data available, thus making the model most amenable for adaptation for use in the comparative evaluation of the planting of Oil Palm as compared to planting of the Selected Tree Species.
12.2.2 Key Assumptions and Caveats relating to the Financial Model for a Selected Tree Species Forest Plantation

1. As critical data pertaining to the trees listed within the Selected Tree Species are indeterminate, no specific tree will be named for the financial model. Instead the financial model is taken to be representative of all the Selected Tree Species as a Group.

2. The growth pattern for Sentang, and the gestation period of 15 to 20 years are deemed to be applicable to the Selected Tree Species.

3. The establishment and maintenance costs for Sentang are taken to be applicable to that for the Selected Tree Species.

4. The log volume estimated for Sentang at 0.5 m³ and 0.6 m³ on a 19 year rotation also applies.

5. An initial planting density of 833 trees is assumed, with first non-commercial thinning at year 6 of about 30% of the trees. A second commercial thinning is assumed at year 11, after which there will be a final crop of approximately 300 trees / ha for the final harvest commencing at year 16.

6. The Cost, Revenue and Net Cash-flow of the project are based on a 2,000 ha plantation.

7. It is further assumed that the wood quality and commercial demand for the logs of the Selected Tree Species match those classified as “Mixed Light Hardwood” and reported in MASKAYU’s monthly bulletin on “Average Domestic Prices”

   Two threshold prices for logs will be used as the baseline for two financial models to allow for greater flexibility in making appropriate sensitivity analysis in the event it is deemed that the range of timber prices of specific species cannot be accommodated within just one financial model.

   The first financial model is based on average log price of RM225 / m³. The second financial model is based on log price of RM330 / m³.

8. Constant inflation is assumed and that any cost increases can be recovered by higher prices received for harvested timber.

9. The growth performance of each specie is very site dependent and the figures tabled are not applicable to any or every site. A site specific model should be developed to accommodate sub-optimal characteristics that could lead to reduced proportion of plantable trees and diminished growth rates.
10. The volume harvested, wood quality and price received are subject to variance for any number of reasons and sensitivity analysis is recommended prior to embarking on any forest plantation project.

11. Land cost is taken to be sunk cost.

12. The applicable discount rate is taken as 10% as an approximation to the cost of borrowing in Malaysia.

12.2.3 Log Prices Trend For Period 1990 – 2000

The timbers from the Selected Tree Species are taken for the purpose of this exercise to fall within the “Mixed Light Hardwood” category, otherwise locally known as “Other Timbers” or “OT”. It is noted that the price for these logs have increased from RM136/m$^3$ in 1990 to RM330/m$^3$ in February 2000. This reflects both the increasing scarcity of logs in general, and rising acceptability of mixed light hardwoods as marketable timber. Table 6 and Table 7 provide some indication of the price trend for logs. It is expected that in the period ahead, log prices will maintain the upward trend.

For the purpose of analysis, two financial models, one based on the 1996 price for Mixed Light Hardwood at RM225/m$^3$ to reflect a "Worse Case Scenario", and the other based on the February 2000 log price of RM330/m$^3$ to reflect a "Current Scenario".
Table 6: Average Domestic Prices of Logs in Peninsular Malaysia

<table>
<thead>
<tr>
<th>Species</th>
<th>Logs Prices (RM per cubic metre)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mar-90</td>
</tr>
<tr>
<td><strong>HEAVY HARDWOOD</strong></td>
<td></td>
</tr>
<tr>
<td>Chengal</td>
<td>422.00</td>
</tr>
<tr>
<td>Balau</td>
<td>295.00</td>
</tr>
<tr>
<td>Red Balau</td>
<td>275.00</td>
</tr>
<tr>
<td>Merbau</td>
<td>334.00</td>
</tr>
<tr>
<td>Mixed Heavy Hardwood</td>
<td>108.00</td>
</tr>
<tr>
<td><strong>MEDIUM HARDWOOD</strong></td>
<td></td>
</tr>
<tr>
<td>Keruing</td>
<td>235.00</td>
</tr>
<tr>
<td>Kempas</td>
<td>154.00</td>
</tr>
<tr>
<td>Kapur</td>
<td>223.00</td>
</tr>
<tr>
<td>Mengkulang</td>
<td>313.00</td>
</tr>
<tr>
<td>Tualang</td>
<td>N / A</td>
</tr>
<tr>
<td>Mixed Medium Hardwood</td>
<td>132.00</td>
</tr>
<tr>
<td><strong>LIGHT HARDWOOD</strong></td>
<td></td>
</tr>
<tr>
<td>Dark Red Meranti</td>
<td>421.00</td>
</tr>
<tr>
<td>Light Red Meranti</td>
<td>393.00</td>
</tr>
<tr>
<td>Red Meranti</td>
<td>275.00</td>
</tr>
<tr>
<td>Yellow Meranti</td>
<td>224.00</td>
</tr>
<tr>
<td>White Meranti</td>
<td>245.00</td>
</tr>
<tr>
<td>Mersawa</td>
<td>265.00</td>
</tr>
<tr>
<td>Nyatoh</td>
<td>233.00</td>
</tr>
<tr>
<td>Sepetir</td>
<td>151.00</td>
</tr>
<tr>
<td>Jelutong</td>
<td>250.00</td>
</tr>
<tr>
<td>Mixed Light Hardwood</td>
<td>136.00</td>
</tr>
</tbody>
</table>

Source: MASKAYU
12.2.4 “Worse Case Scenario” Financial Model With Base Line Average Log Price For Selected Tree Species Set At RM225 Per M³

The RM225 / m³ price level approximates the price of “Mixed Light Hardwood” quoted by MASKAYU as at March 1996. This price level is deemed to be the bottom end of logs price range obtainable for the Selected Tree Species, factoring in discounts for the currently indeterminate growth performance, wood quality and commercial demand – and in that respect this model is to be regarded as a “worse case scenario” model.

An analysis of the Internal Rate of Return and Net Present Value based on this model will provide indicators on the financial viability of planting Selected Tree Species if log prices are set at RM225/m³.

Table 8 provides a financial model for a selected tree species forest plantation based on 2000 hectares.
### 1.2.5 Analysis Of Internal Rate Of Return

#### Table 9

**“WORSE CASE SCENARIO” SENSITIVITY ANALYSIS OF ESTABLISHING SELECTED TREE SPECIES PLANTATION (2,000 HA WITH 19-YEAR ROTATION & LOG PRICE @RM225/M³)**

<table>
<thead>
<tr>
<th>Changes in Log Price(%)</th>
<th>Changes in cost(%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-30</td>
<td>-20</td>
</tr>
<tr>
<td></td>
<td>11.23%</td>
<td>9.99%</td>
</tr>
<tr>
<td>+30</td>
<td>10.48%</td>
<td>9.24%</td>
</tr>
<tr>
<td>+20</td>
<td>9.67%</td>
<td>8.41%</td>
</tr>
<tr>
<td>+10</td>
<td>8.77%</td>
<td>7.50%</td>
</tr>
<tr>
<td>0</td>
<td>7.77%</td>
<td>6.48%</td>
</tr>
<tr>
<td>-10</td>
<td>6.63%</td>
<td>5.32%</td>
</tr>
<tr>
<td>-20</td>
<td>5.32%</td>
<td>3.97%</td>
</tr>
<tr>
<td>-30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*(Baseline log price is RM225 per cubic meter)*

With log prices averaging RM225 / m³, it is noted that the IRR is 5.32%, below the minimal IRR of 10% generally required by oil palm plantations. However if log prices increase by 30% to an average of RM293 / m³, and cost is reduced by 20%, an IRR of 9.99% is obtainable.

### Evaluation of analysis

At the time of writing (June 2000), the price for Other Timber (OT) or Mixed Light Hardwoods is fluctuating around RM300 / m³. This equates to the 20% increase in log prices required to make the investment in tree plantation viable on current basis. The increasing scarcity of timber in the future, and in particular timber from certified sustainable forests, suggests that OT logs prices will at least be maintained at current prices, if not higher.
From the cost perspective, on the assumption that the tree plantation will be planted on existing cleared, infrastructure-ready plantation land that previously had oil palm trees planted on it, the establishment costs as set out in the FRIM model can be materially discounted. This is because the FRIM model assumes a cost regime pertaining to establishing a stand-alone plantation on unprepared land, under natural forest vegetation.

On the premise that by establishing a tree plantation in an existing oil palm plantation, the benefits of economies of scale, shared operational, administrative and labour facilities and resources will accrue. These benefits will not be available to new a plantation start up. The following reductions in costs are estimated.

<table>
<thead>
<tr>
<th>ITEMS</th>
<th>FRIM’S COSTS (RM ‘000)</th>
<th>DISCOUNT %</th>
<th>COST SAVINGS (RM’000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bldg. &amp; Infrastructure</td>
<td>1,250</td>
<td>50 %</td>
<td>625</td>
</tr>
<tr>
<td>Vehicle &amp; Machinery</td>
<td>1,220</td>
<td>50 %</td>
<td>610</td>
</tr>
<tr>
<td>Administration Cost</td>
<td>4,181</td>
<td>50%</td>
<td>2,091</td>
</tr>
<tr>
<td>Quit Rent</td>
<td>1,900</td>
<td>(see note)*</td>
<td>1,431</td>
</tr>
<tr>
<td><strong>Total Savings</strong></td>
<td><strong>RM4,757</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 10 – Estimated Cost Adjustments to Tree Plantation Establishment Expenditure.*
*(Note: FRIM costed quit rent at RM100,000 per annum, whilst the average quit rent imputed for the oil palm plantations is RM24,700 per annum).*

The estimated savings of RM4.76 million against a total cost of RM39.08 million represent a cost reduction of 12.17%. The foregoing is an example of possible cost savings available to plantation owners, leveraging on facilities and resources synergies of their present operations. A 20% cost savings appear reasonable and with Mixed Light Hardwood prices currently around RM330/ m³, the commercial viability of a tree plantation looks positive.

Similar adaptations can be used to factor in lower cost of weeding and manuring, if seedlings planted are of 2 or 3 meters height. The richer alluvial soils could also mean less fertilization is required. Conversely higher costs for felling in swampy conditions can in a like manner be imputed.

1.2.6 “Current Case Scenario” Financial Model For A Selected Tree Species Forest Plantation (2000 HAs)

This financial model is based on current price levels for Mixed Light Hardwoods or OT. The log price is set at RM330 / m³ and reference is made to Table 11. It is evident that with the higher price, the financials are significantly improved.
### Table 12

**“CURRENT CASE SCENARIO” SENSITIVITY ANALYSIS OF ESTABLISHING SELECTED TREE SPECIES PLANTATION**

*(2,000 HA WITH 19-YEAR ROTATION & LOG PRICE @ RM330 / M³)*

*(Internal Rate of Return (IRR))*

<table>
<thead>
<tr>
<th>Changes in Log Price(%)</th>
<th>Changes in cost(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-30</td>
</tr>
<tr>
<td>+30</td>
<td>17.77%</td>
</tr>
<tr>
<td>+20</td>
<td>17.02%</td>
</tr>
<tr>
<td>+10</td>
<td>16.21%</td>
</tr>
<tr>
<td>0</td>
<td>15.33%</td>
</tr>
<tr>
<td>-10</td>
<td>14.34%</td>
</tr>
<tr>
<td>-20</td>
<td>13.24%</td>
</tr>
<tr>
<td>-30</td>
<td>11.97%</td>
</tr>
</tbody>
</table>

(Baseline log price is RM330 per cubic meter)

The log price of RM330 / m³ is the average domestic price for Mixed Light Hardwoods for the period of Feb 2000 (MASKAYU Bulletin for March 2000). At this price, the IRR is enhanced at 11.97 %, better than the 10.9 % for oil palm. If the similar 10% costs reduction for the previous analysis is factored in, the IRR will strengthen to 12.97 %.
12.2.7 Analysis Of Net Present Value

The Net Present Value analysis will provide another measure on the commercial viability or otherwise of venturing into planting of Selected Tree Species. The cost and price matrix based on log prices of RM225 / m³, as set out in Table 13 below offers useful indicators.

Table 13

"WORSE CASE SCENARIO" SENSITIVITY ANALYSIS OF ESTABLISHING SELECTED TREE SPECIES PLANTATION
(2,000 HA WITH 19-YEAR ROTATION & LOG PRICE @225/ M³ WITH DISCOUNT RATE OF 10%)
(NET PRESENT VALUE (NPV))

<table>
<thead>
<tr>
<th>Changes in Log Price(%)</th>
<th>Changes in cost (%)</th>
<th>(RM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-30</td>
<td>(23,631)</td>
</tr>
<tr>
<td></td>
<td>-20</td>
<td>(1,993,691)</td>
</tr>
<tr>
<td></td>
<td>-10</td>
<td>(3,963,752)</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>(5,933,812)</td>
</tr>
<tr>
<td></td>
<td>+10</td>
<td>(7,903,872)</td>
</tr>
<tr>
<td></td>
<td>+20</td>
<td>(9,873,932)</td>
</tr>
<tr>
<td></td>
<td>+30</td>
<td>(1,946,429)</td>
</tr>
<tr>
<td>+30</td>
<td></td>
<td>(1,993,691)</td>
</tr>
<tr>
<td>+20</td>
<td></td>
<td>(3,204,218)</td>
</tr>
<tr>
<td>+10</td>
<td></td>
<td>(5,174,279)</td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>(7,144,339)</td>
</tr>
<tr>
<td>-10</td>
<td></td>
<td>(9,114,399)</td>
</tr>
<tr>
<td>-20</td>
<td></td>
<td>(11,084,459)</td>
</tr>
<tr>
<td>-30</td>
<td></td>
<td>(1,685,152)</td>
</tr>
</tbody>
</table>
| (Baseline log price is RM225 per cubic meter)

In a "worse case" scenario, a negative NPV of RM7.6 million is registered. However if log price is increased by 30%, and cost can be reduced by 20%, the negative NPV at RM23,631 is only a marginal shortfall. The variations in costs considered in the analysis of the IRR can be similarly adapted to provide for specific known circumstances.
Table 14

“CURRENT CASE SCENARIO” SENSITIVITY ANALYSIS OF ESTABLISHING SELECTED TREE SPECIES PLANTATION (2,000 HA WITH 19-YEAR ROTATION WITH DISCOUNT RATE OF 10%) (NET PRESENT VALUE (NPV))

<table>
<thead>
<tr>
<th>Changes in Log Price(%)</th>
<th>Changes in cost (%) (RM)</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-30</td>
<td>17,692,954</td>
<td>15,722,893</td>
<td>13,752,833</td>
<td>11,782,773</td>
<td>9,812,713</td>
<td>7,842,652</td>
</tr>
<tr>
<td></td>
<td>-20</td>
<td>15,271,155</td>
<td>13,301,095</td>
<td>11,331,035</td>
<td>9,360,975</td>
<td>7,390,915</td>
<td>5,420,854</td>
</tr>
<tr>
<td></td>
<td>-10</td>
<td>12,849,357</td>
<td>10,879,297</td>
<td>8,909,237</td>
<td>6,939,177</td>
<td>4,969,116</td>
<td>2,999,056</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>10,427,559</td>
<td>8,457,499</td>
<td>6,487,439</td>
<td>4,517,379</td>
<td>2,547,318</td>
<td>577,258</td>
</tr>
<tr>
<td></td>
<td>+10</td>
<td>8,005,761</td>
<td>6,035,701</td>
<td>4,065,641</td>
<td>2,095,581</td>
<td>125,520</td>
<td>(1,844,540)</td>
</tr>
<tr>
<td></td>
<td>+20</td>
<td>5,583,963</td>
<td>3,613,903</td>
<td>1,643,843</td>
<td>(326,218)</td>
<td>(2,296,278)</td>
<td>(4,266,338)</td>
</tr>
<tr>
<td></td>
<td>+30</td>
<td>3,162,165</td>
<td>1,192,105</td>
<td>(777,955)</td>
<td>(2,748,016)</td>
<td>(4,718,076)</td>
<td>(6,688,136)</td>
</tr>
</tbody>
</table>

(Baseline log price is RM 330 per cubic meter)

In a more optimistic scenario, assuming that OT log prices are around prevailing price level of RM330 / m³, the NPV is strong at RM4.52 million. Even if log prices fall by 10% or costs increase by 20% the project remains viable. The commercial viability of establishing a Selected Tree Species plantation at prevailing log prices and costs appears to be robust.

Financial Conclusions
The following section will consider the inferences of the various financial analyses undertaken and how they should be applied in evaluating the commercial viability of planting trees in place of oil palm in areas subject to intensive recurring floods.
12.2.8 A Comparison between the Profitability and Returns of planting Oil Palm and planting Selected Tree Species

For a feel of the comparative economics of planting oil palm and planting Selected Tree Species, the pertinent financial data have been adapted to a comparable format. This is set out in Table No.15 below:

Table 15

<table>
<thead>
<tr>
<th>COST, REVENUE, INTERNAL RATE OF RETURN, AND NET PRESENT VALUE</th>
<th>COMPARATIVE TABLE FOR OIL PALM PLANTATION AND SELECTED TREE SPECIES PLANTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CROP</td>
<td>STANDARD CASE</td>
</tr>
<tr>
<td>Gestation Period (yrs)</td>
<td>4</td>
</tr>
<tr>
<td>Net Revenue per Hectare (RM)</td>
<td>3,984</td>
</tr>
<tr>
<td>Establishment cost/ha (RM)</td>
<td>5,401</td>
</tr>
<tr>
<td>IRR % before tax/ha</td>
<td>10.9%</td>
</tr>
<tr>
<td>NPV @ 10% before tax/ha (RM)</td>
<td>1,160</td>
</tr>
</tbody>
</table>

The financial data provided have to be evaluated in the context of the substantial difference in gestation period, 4 years for oil palm and about 19 years for the Selected Tree Species. Notwithstanding the qualification, the data allow for a broad brush comparison of the relative economics of the two crops.
Evaluation of Analysis:

i) Net Revenue per hectare for oil palm is RM3,984 against RM22,836 per hectare (log price RM225/m³) and RM42,611 per hectare (log price RM330/m³) for planting trees.

ii) The establishment cost for trees are more than twice that of oil palm, but if the cost of maintaining the oil palm trees for another 11 years is factored in, the differential is likely to be minimal.

iii) The IRR for oil palm at 10.9% is higher than the 5.32% for the trees if log price is RM225/m³. However if log price is RM330/m³, the IRR for trees is higher at 11.97%.

iv) If CPO price is RM1,400/tonne, the oil palm plantation’s NPV per hectare of RM1,160 is better than the tree plantation’s negative RM3,798 (if log price is RM225/m³) but below RM2,259 (if log price is RM330/m³).

It is noted that CPO prices have been declining and are currently fluctuating around the RM1,100/tonne for the 1H 2000, and at this price range, the relative IRR is only 5.4% and the NPV is a negative RM4,880 / ha. To quote Haron Siraj, Secretary-General of the Ministry of Primary Industries, “Of course the prices are worrying us. A fair price should be between RM1,400 to RM1,500 per tonne” He further indicated that Malaysia’s palm oil production is projected to reach 10.5 million tonnes this year, with Indonesia adding another estimated 7 million tonnes. This growth in production will have a great adverse impact on international palm oil prices. (Daily Express 9 June, 2000).

12.2 Other Factors that will affect the Financial Analysis of Oil Palm and Selected Tree Species Plantations

The evaluation of the comparative financials of Oil Palm and Selected Tree Species accords a general feel for the economics involved. However it is noted that special factors have to be taken into cognizant when applying the financial models earlier used. The planting of oil palm and the planting of Selected Tree Species in the flood prone areas of the Kinabatangan floodplains are associated with problems not normally encountered in dry land environments.

12.3 Planting of Oil Palm in Flood Prone areas: A RISK ADJUSTED CASE

The previous financial model for oil palm is based on a “Standard Case” where normal parameters apply, and there are no extreme weather conditions. The adverse weather conditions in the Kinabatangan floodplains require a model that takes into account the consequential negative effects. In particular the effects of floods which occurs about every 5 years have to be factored in.
A “Risk Adjusted Case” financial model incorporating a 25% decline in FFB yield for each 5th year of floods, shows less robust profitability and returns in comparison to those of a “Standard Case”. In the “Risk Adjusted Case” it is assumed that the oil palm trees have matured, and are able to survive the Kinabatangan flood conditions (Cheng, 1999).

Table 16

<table>
<thead>
<tr>
<th>CPO PRICE (RM / tonne)</th>
<th>NPV @ 10% (RM million)</th>
<th>IRR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1600</td>
<td>19.8</td>
<td>12.9</td>
</tr>
<tr>
<td>1500</td>
<td>10.2</td>
<td>11.5</td>
</tr>
<tr>
<td>1400</td>
<td>0.7</td>
<td>10.1</td>
</tr>
<tr>
<td>1300</td>
<td>-8.9</td>
<td>8.5</td>
</tr>
<tr>
<td>1200</td>
<td>-18.4</td>
<td>6.7</td>
</tr>
<tr>
<td>1100</td>
<td>-27.7</td>
<td>4.6</td>
</tr>
<tr>
<td>1000</td>
<td>-37.5</td>
<td>1.7</td>
</tr>
<tr>
<td>900</td>
<td>-47.1</td>
<td>&lt;0</td>
</tr>
</tbody>
</table>

The above chart shows that, in a risk adjusted environment, an oil palm plantation is only viable with CPO prices at or above RM1,400 / tonne over the life of the project. The IRR at this price level is 10.1%.

One of the critical assumptions appears invalid in severely flooded areas, viz that the trees are mature and can survive floods. The financial scenario is even weaker if the fact that vast tracts of 1 – 3 years old young palms are periodically destroyed by floods is factored into the model. In the 1996 floods, Asiatic Development Bhd suffered the loss of 1,900 hectares of young palms in low-lying areas. A loss of RM4.4 million in new planting expenditure was incurred. In January 2000 an estimated 15,000 hectares of young palm was inundated by floods, and a conservative estimate of the loss is RM45.0 million. This works out to an estimated loss of RM2,923 / ha in planting expenditure written off. Further, the gestation period for oil palm has to be lengthened by another 3 – 4 years to account for the replanting that has to be undertaken.
In addition to the above, it is estimated that field establishment costs in flood prone areas can be as high as 50% more because of poor soil structure, poor drainage and implementation of flood mitigation measures.

If these adverse factors are appropriately discounted for in the financial computations, the planting of oil palm in areas subject to recurring severe flooding will in all likelihood, not be financially viable.

12.3.1 Planting of Selected Tree Species in Flood Prone Areas

The positive inferences of the financial data obtained from the financial model for the tree plantation have however to be tempered by a number of factors, the main of which is related to the fact that there are no established field data on the suitability, growth pattern, survival rate, gestation period, and commercial demand for the trees listed in the Selected Tree Species. Whilst the selected trees are known to be indigenous to wetlands environment, little is known about how they will fare if planted in areas subject to recurring severe flooding. The trees could suffer stunting, a proportion could be destroyed at early planting stage, species matching could be wrong and the gestation period could be significantly longer than the projected 15 – 20 years as a consequence of a combination of the aforesaid limitations. Whilst commercial demand and the future prices for the harvested timber are less of a concern, there could be a wide range in prices between the different species. Any variation of the above mentioned factors will have a material impact, both positive and negative, on the commercial viability of the tree plantation project.

Another constraint pertains to managing and operating a tree plantation in the wet and swampy conditions of flood prone areas. Information and ground experiences relating to availability of seedlings, planting and maintenance procedures, sustainable harvesting systems and tree felling systems, specific to wetland conditions are in the main limited. Oil palm plantation management will largely be experimenting and this will impact on the costs side of the financial equation.

A key factor that will add significantly to the commercial viability of a tree plantation is the revenue from the implementation of a Carbon Trading Programme. Whilst this programme is still a green field activity, there are sufficient and growing numbers of implemented projects to support the belief that Carbon Trading Programme will become a reality in the near future. In February 2000, Tokyo Power Electric Company of Japan signed a “Carbon Credit” deal worth AUD130 million (RM305 million) with an Australian State Company, to plant 40,000 hectares of new forest.
12.4 Caveats on use of Financial Models for planting of Selected Tree Species

It will be incumbent on those intending to use the financial models, to use it judiciously, and to factor into the models appropriate input to accommodate specific risks and data they are either privy to or wish to make provision for. It will not be possible within the scope of this paper to provide details and to address all and every issue that impinge on the comparative financial viability of planting oil palm and Selected Tree Species.

The following chart will be useful in providing some guidance on what factors and issues have to be addressed in arriving at a “best – fit” financial model applicable to a particular situation.

Table 17

A Forest Plantation Model showing the Factors that Impacts on Costs and Revenues

![Diagram of a forest plantation model showing the factors that impact costs and revenues.](image-url)
13.0 Options in Operating a Tree Planting Project

13.1 Fully-Managed Tree Planting Project

13.1.1 Advantages:-

- **Direct control**

  Direct control is the main reason for plantation companies' preference to self-manage their tree-planting project. According to MJS's general survey, seven (7) out of 11 plantation companies stated their preferred policy to retain complete and direct control over the start up planting and maintenance operations and subsequent logging activities. This will give them a free hand to determine the future course of the project and/or to terminate it for technical, legal, commercial or unforeseen reasons.

- **Available resources**

  Most plantation companies have all the necessary resources (such as land, labour, technical knowledge, finance and organisational structure) required to venture into a tree-planting project. Plantation management generally feel that the existing in-house experience and technical skills derived from planting oil palm can be easily adapted for the successful planting of forest trees.

- **Acreage for reforestation is too small**

  As the tree planting project is still in the infancy stage, there are not many success stories on tree planting within flood-affected areas in the Kinabatangan Basin. Due to the absence of success stories on tree planting in flood-affected areas, most oil palm companies are not confident in taking the first steps to venture into tree planting. Some are only willing to conduct experimental planting on a small acreage of land, which has been abandoned or known to be unsuitable for oil palm cultivation. Others are only willing to reforest a small area along the riparian of the Kinabatangan river. The small size of tree-planting operation does not justify companies hiring external consultants to manage their tree-planting projects and therefore, plantation companies prefer to self manage their tree-planting projects.
- **No need to deal with legal and profit sharing issues**

Some plantation companies view that self-managing is a less troublesome and a more effective option than joint venturing with other organisations. Self-managing allows the company to avoid dealing with complicated legal issues, profit sharing arrangements and other related complex matters. Plantation companies are aware that dealing with foregoing problems and arriving at a consensus with the JV partners on management control will take considerable time and effort, and will distract management from their prime focus of oil palm cultivation. The self-management option assures them of direct control of the tree-planting project. Furthermore, the complication of going into joint venture with one or more partners for a relatively minor part of their plantation is deemed not worth the while.

- **Valuable learning experience in preparation for crop diversification plans**

MJS’s general survey revealed that four (4) out of 11 plantation companies are confident that they have sufficient in-house expertise to operate and manage a tree-planting project. Although five (5) out of 11 plantation companies revealed that they do not have sufficient in-house expertise to run and manage a tree-planting project, MJS believes that these companies can easily acquire the skills with the employment of minimal external expertise. MJS believes that the tree-planting project would be a valuable learning experience for plantation companies, especially if they are planning to diversify into intercropping with trees in future.

### 13.2 Joint Venture with Green Sponsors

Energy and utility companies have been major sponsors of reforestation projects around the world. These “green sponsors” view reforestation investments as a goodwill investment. The priority is to establish a “green” image with commercial returns ranking as a secondary objective.

#### 13.2.1 Advantages:-

- **Reduced Risks**

Establishing a tree-planting project on the basis of a joint venture with green sponsors would benefit plantation companies in terms of reduced risks and costs sharing. With reduced risks and shared costs, plantation companies would be more confident in venturing into tree planting.
Pressure for Plantation Companies to Establish Green Image

Plantation companies have been increasingly labeled as “non-environmental friendly” organisations. Recent moves from green organisations to project oil palm as a forest destructive crop are putting more pressure on plantation companies to be more environmentally friendly. The tree planting project would be ideal for plantation companies who are concerned over possible moves by international organisations to boycott consumption of palm oil on grounds that the industry is “not environmentally friendly.”

13.2.2 Disadvantages:

- **Green Sponsorship must Offer Recognition to Sponsors**
  
  International corporations who are offering green sponsorships require public and proper recognition. Without recognition, it would be difficult to obtain sponsorship from these green investors.

- **Size of the tree planting project must be large enough**
  
  International green investors usually sponsor large-scale tree planting projects. Therefore, it is unlikely for individual plantation companies to obtain sponsorship from international green investors if the acreage for tree planting project is too small. However, MJS believes that plantation companies could attract international green investors if they are willing to amalgamate separately owned flood-affected areas into one reforestation deal. The complications of having to deal with several plantations will put off many green investors.

13.3 Collaboration with WWF

Most of the plantation companies have expressed their interest to work with WWF in a trial reforestation project. The oil palm companies are keen if the project proves that alternative tree crops have a better survival rate in flooding conditions compared to oil palm. Based on MJS’s general survey, eight (8) out of 11 plantation companies are prepared to consider participating in a reforestation programme to rehabilitate the flood-prone riparian reserve of the Kinabatangan River. Two (2) participants were undecided on whether they would consider participating in a reforestation project.

The collaboration with plantation companies is to encourage plantation companies to take the first step into tree planting. WWF hopes that the collaboration could instill sufficient confidence in plantation companies to persuade them to venture into larger scale tree planting once the experimental tree-planting project proved successful.
13.3.1 Advantages:-

- **Technical Support on Tree Planting**

  In the trial reforestation project, plantation companies' main contribution is to provide a land area to WWF to establish the tree-planting activity. There are no specifications of land acreage required by WWF and therefore plantation companies could freely contribute any land size area. Usually, plantation companies would allocate an abandoned area, or an area unsuitable for oil palm cultivation. Once a specific land area has been allocated to WWF for reforestation, WWF could provide technical support and tree species information, and seedlings at cost; Plantation companies should provide labour to maintain the trees for the first tree (3) years after planting. As forest trees require minimum maintenance, the plantation companies should have no problems in managing their existing available labour resources for tree maintenance.

13.4 **Intercropping oil palm with agricultural crop**

13.4.1 Advantages:-

13.4.1.1 **Provide intermediate revenue**

  Plantation companies could maximize land use by intercropping oil palm with agricultural crops. Intercropping would provide plantation companies with intermediate revenues and make full use of land resources unsuitable for oil palm cultivation. However, the success of planting a second crop depends on the planters understanding of growth requirement of crops, growth habits of crops, growth duration in terms of period to harvesting, planting techniques and soil suitability. The practice of intercropping agricultural crops on a large scale has recently been introduced and there is insufficient research on how a second agricultural crop could affect oil palm crops and vice versa.

13.4.1.2 **Annual Flooding and Short Term Crops**

  Although oil palm companies have reported that flooding is an annual event, between the flooding periods, an annual or short-term crop could be cultivated in flood-prone areas for land use maximisation.
13.4.1.3  Crops for Internal Consumption

Labour shortage is a problem in oil palm plantations. Some plantation companies have abandoned flood-affected areas after their repeated attempts to replant oil palm have failed. Some plantation companies feel that they could allocate the areas unsuitable for oil palm to plantation workers to plant food crops such as vegetables for internal consumption. This may help to retain labour within oil palm plantations.

13.4.2  Disadvantages:-

13.4.2.1  Labour and Maintenance Intensive

Agricultural crops require intensive labour, fertilizer and pesticide. Therefore, introducing agricultural crops as a second crop in oil palm plantation may strain the plantations’ labour resources.

13.4.2.2  Need Proper Marketing and Logistics Support

Plantation companies who are planning to introduce a second crop on a commercial scale need to consider setting up proper marketing and logistics. These incremental costs need to be factored into the evaluation of this alternative.

13.5  Joint Venture with Local Timber Companies

13.5.1  Plantation companies could also form a joint venture with local timber companies especially those companies who are unable to obtain a forest management unit (FMU) and are looking for assurance of long-term timber supply.

The JV collaboration can be in two forms:

i)  To inject separately owned flood-affected lands into a specially Designated Company as equity equivalent, and to have the Designated Company act as the Agency to manage the tree plantation project on all the flood-affected lands as a single business entity. The timber companies will also be subscribing shareholders in the Designated Company.
The separate ownership situation remains, but a timber company is appointed as the Common Contractor to plant the trees, maintain them and ultimately harvest the trees.

Plantation companies must however address profit sharing and management issues, which are likely to be complicated and involved.

**13.5.1.1 Advantages:**

- **Secured Buyer**

  Plantation companies who establish a joint venture with a local timber company would have the benefit of a secured buyer. Downstream timber processing projects as a rule have much better margins than pure tree planting projects. The integration of these two project phases will enhance the commercial returns of the joint venture, and in particular the returns to the plantation owner.

**13.5.1.2 Disadvantages:**

- **Short business life span of timber processing companies**

  On average, the life span of a pure timber processing company is relatively short as they are particularly vulnerable to the vagaries of the timber trade. Due to this short life span, MJS believes it would be difficult to find interested joint venture partners who would be prepared to invest in a tree-planting project with a gestation period of 15-20 years. However, possibilities of a joint venture may be feasible with an international or local public listed corporation with longer-term corporate lifespan. These large corporates as a rule will have diverse business interest, from which income will be derived to support the long gestation period required for a tree plantation venture. However, given the strength of these corporations, negotiating power will lie with them to the detriment of plantation companies.

**13.6 Injecting Land As Equity into Third Party Corporation**

13.6.1 Based on MJS’s discussion with oil palm companies, MJS found that plantation companies are not willing to give up their land ownership and therefore are not willing to sell their land to a third party corporation. Injecting land as equity into a Third Party Corporation is the least preferred option for plantation companies.
14.0 Other issues on Tree Planting

14.1 Wildlife Control

In MJS’s discussions with oil palm plantations, some degree of concern was expressed by oil palm plantations on the growth of pest population especially elephants. MJS’s general survey reveals that 6 of the 11 plantation companies stated that their current elephant deterrent systems are acceptable and that the deterrent systems are within existing cost and/or savings constraints. Report from WWF revealed that plantations that are adjacent to forest reserve have less intrusion from elephants; this may be due to ample space for elephant movement and sufficient food sources.

Elephant tracks beside Asiatic Development’s Plantation

The following wildlife controls are currently being implemented by oil palm plantation companies in the Kinabatangan area:

14.1.1 Electric Fence

Many plantation companies have erected electric fences to protect their plantations from wildlife such as elephants. There is some debate on the success of this elephant deterrent method; some expressed that elephants destroy the fence post with their tusks. One solution to prevent elephants from destroying the fence post with their tusks is to hot wire the down post. Sometimes, larger elephants push younger elephants through the fence to test for electricity. Elephants also destroy the electric fences by pushing trees down on the fence.
14.1.2 Elephant Trench

Discussions with plantation companies revealed that elephant trench or ditch has been employed to keep elephants out of the plantations. However, the cost incurred in constructing and maintaining the ditch is very high. Lack of maintenance caused some parts of the elephant trench to be filled with water. This allows elephants to swim across and get into the plantations.

14.1.3 Poison

Oil palm plantation companies poison rats and porcupines to control pest problems.

14.1.4 Shoot

Plantation companies also eradicate pests such as wild boar by hunting or shooting. This method is not practiced by Muslim villagers in the Kinabatangan area.

14.1.5 Wildlife Department

The Wildlife Department is assisting plantation companies by reallocating wildlife to other areas. However, reallocation of large animals such as elephants can be very costly. Earlier this year, elephants have been reallocated to Tabin at a cost of RM6,000, which had to be borne by a plantation company.

14.1.6 Intervention by Plantation Personnel

Most plantation companies employ plantation personnel to protect the plantation from pests. These plantation personnel use fireworks and burning tyres to drive away elephants and other pests. Plantation personnel would be on guard during day and night, and therefore plantation companies have to pay overtime wages.
14.2 Legal Issues

14.2.1 Riparian Buffer Zone Requirement: Sabah Water Resources Enactment 1998

In Clause 40 of the Sabah Water Resources Enactment (1998), it has been clearly stated that land owners must establish a riparian reserve of 20 metres. Section 3 of clause 40 also states that river reserves are established for the purpose of protecting the volume or flow of water bodies and preventing the degradation of the quality of water resources and damage to the aquatic environment. Clause 41 states that within a river reserve, it is an offence to undertake any of the following activity without approval from the Director of DID:

a) the removal of natural vegetation or the removal or deposition of material:-

b) the erection of a structure or building; or

c) the carrying out of a commercial or agricultural activity

Despite the introduction of the Sabah Water Resources Enactment 1998, MJS found that most of the plantation companies have ignored the regulation by not maintaining a 20 metre riparian reserve. Some plantation companies have cleared the riparian reserve so that they can extend more land for agriculture. Others believe that they need to clear the riparian reserve for pest prevention. However, experts have claimed that natural predators would naturally reside in these riparian reserves and therefore help to control pest infestations in the estate.

14.2.2 License for Planting Trees

According to FRC, there is no need to apply for a license to plant trees in Oil Palm estates. DID said that there is no need to apply for a licence to plant trees along the banks of the Kinabatangan River. However, it was recommended that the planters write to the Director of Water Resources to seek his approval to plant trees and also express the intention of harvesting them in future. According to Clause 41 of the Sabah Water Resources Enactment 1998, any activity, which involves the removal of natural vegetation or carrying out of a commercial or agricultural activity, has to be undertaken with the approval of the Director of the Water Resources.
14.2.3 License for Harvesting Trees

FRC said that harvesting licenses are easily obtainable for trees planted in estates; it is just a matter of complying with routine administrative procedures. DID commented that harvesting of trees on riparian reserves could be allowed as long as it does not degrade the condition of the reserves but they would recommend the planters to engage a consultant to do a proper study to manage it.

14.2.4 Land Title for Oil Palm Estates

According to the Agricultural department, the land titles of oil palm estates are normally of 99 years lease.

14.3 Forest Plantation Incentives

The high entry costs and long gestation periods associated with forest plantations diminish the attractiveness of these investments. Provision of incentives to mitigate these perceived negative aspects of the investment is an effective tool to promote plantation development.

The common types of financial incentives that the government can introduce to promote plantation development are direct subsidies, tax deductions and subsidized loans. The type and method of implementation of the incentive program are dependent on each country’s combination of local growing conditions, land tenure, government policy and the investment environment.

14.3.1 Direct Subsidies

Direct subsidies are funds provided directly to the forest growers to cover costs associated with plantation establishment and sometimes, the early stages of maintenance.

The benefit of this type of incentive is that it provides the government with a means of monitoring the success of plantation establishment. Forest growers in Chile were only reimbursed in the second year of operation upon meeting the performance criteria which is, to attain a certificate that planting was undertaken and that survival rates exceed minimum standard (70%).

The drawbacks of this incentive is high administrative costs associated with monitoring the forest planting programme and the need for the private sector to provide the initial capital, thus, discouraging smaller growers.
14.3.2 Tax Deductions

Tax deduction enable forest growers to offset the cost of establishing plantations against the amount of tax paid to the government. It is also another form of indirect subsidy whereby investors directly provide funds to establish forest plantation, rather than the government collecting taxes then reallocating them as subsidies.

There are many types of tax deductions. In Uruguay, the government not only introduced income tax deduction for forest growers, but also implemented other forms of tax deductions like waiver of land tax, import duty on equipment used in plantation establishment, management and processing.

The disadvantage of this incentive scheme is that the government will have little control over plantation development. Some growers establish plantations with the short-term goal of reducing their income tax and have no incentive to undertake on-going maintenance.

14.3.3 Subsidised Loans

Loan scheme implemented by the government to provide investors with funds at very low or zero rates of interest benefits long-term investors committed to seeing their plantation reach maturity and achieving returns from harvesting. Loans can be a successful measure where funding permits on-going management rather than simply covering establishment, and where repayment schedules are structures to reflect the nature of returns from forestry investments.

Subsidies loans are often offered in combination with direct subsidies and loans as in Indonesia and Uruguay.
In countries where forest plantation incentive schemes were introduced, investments in forest plantation have shown to increased quite significantly. Please refer to the graph below.

Table 18 - Impact Of Incentives

However, the success of the incentive schemes depends on other factors in the market as well. For example, direct subsidies were provided by New Zealand government in 1970's but inequitable tax laws and increasing inflation affected the success of the scheme.

14.3.4 Latest Developments On Tax Incentives In Sabah And Sarawak

The increasing interest in commercial tree planting, fuelled by the implementation of the Forest Management Units (FMU) Concept in Sabah, has brought about a concerted effort by the Sabah Forestry Department, the Forest Management Unit License Holders Grouping (FMULH), the Timber Associations, and the Timber Industries Associations in pushing for appropriate tax incentives for commercial tree planting. If granted, the prospects for commercial tree plantations will be significantly enhanced.
14.4 World Forests In Perspective

Forests and trees play vital roles in natural systems, as well as in economic development. With growing interest in eco-tourism, countries with intact natural forests may be able to generate new source of foreign currency. Forests areas are also important to developing countries as a source of new lands for conversion to agricultural or other uses. Properly utilized forests lands can serve to increase food and energy supplies for rapidly growing population in developing countries.

The world’s forest area has been declining steadily. During the past few hundred years, about one third of the forests have been lost. The rate of deforestation in developed countries has stabilized and in some cases, their forest areas have increased. However, rapid population growth, agricultural expansion, and accelerated economic development have increased the pace of deforestation in the developing countries.

By the year 2025, demand for wood products may increase 50 percent. This demand could be met from sustainable management of some natural forests for wood production and increased tree planting. If these measures are not taken, there could be a shortfall of wood, particularly in developing countries, and this shortfall could speed the degradation of the environment as the remaining forest resources are depleted.
According to Malaysia’s Primary Industries Minister, Dr. Lim Keng Yaik in the Business Times, the demand for Malaysian timber are likely to increase in the next few years. The key markets such as China, Japan and Europe have increase their housing construction, a good indicator of wood consumption in most countries, which would result in an increase in demand for timber products. Dr Lim commented that despite this increase in demand, the timber industry in Malaysia may not be able to capitalize on this trend due to the dwindling supplies from the natural forests. Log production in Malaysia has dropped from 40 million cubic metres in 1990 to 21.7 million cubic metres in 1998. Dr. Lim believes that the only measures to reduce this demand-supply gap are sustainable forest management and active participation of forest plantation by the private sector.

The forests in Sabah are depleting rapidly because of logging and forest conversion to agriculture land, especially oil palm plantations. The total crop area has rose from 263 338 hectares in 1970s to 390 356 hectares in 1980s. By 1990, it has doubled to 734 189 hectares. With the remaining protected forests shrinking in size and becoming fragmented, the various wildlife species are becoming endangered and the biodiversity of Sabah is severely threatened.

14.5 Forestry Certification

When sawmills, factories, warehouses, shops and consumers purchase wood and wood products with the Forest Stewardship Council (FSC) logo, they can be sure that their purchase are from a well-managed forest.

FSC is a non-governmental, non-profit organization with a diverse membership representing environmental, business, and social interests globally. FSC, as an independent body, set the standards for well-managed forestry worldwide, award accreditation to independent certifiers and regulate the use of its name and logo on product labels.
More and more forest growers, primary and secondary manufacturers have opted to certify their operations because of the economic rewards, some of which include:

1. Higher returns as certified timber has a higher price in the market than equivalent uncertified timber.

2. Positive response from customers, employees and media, thus, improving their image and reputation.

3. Forest productivity increases.


5. The long term supplies of quality timber are ensued since forest are managed so that harvesting do not exceed the growth rate of the trees.

6. Maintain access to forest resources, as some countries do not allow companies to extend their operations into forestry and wood processing facilities unless they have certification to prove that they will manage their operations in the most environmentally sound manner.

When more and more consumer demand for certifies forest products, there is a market-based incentive for forest owners to mange their land in a sustainable manner.

Malaysia has set up its own forestry certification body, the National Timber Certification Council, who are in the process of agreeing with FSC for Malaysia to gain international forestry certification standards.

14.6 Carbon Trading: Carbon Sequestration Potential of the Reforestation activities in Kinabatangan

Activities that sequester carbon dioxide are gaining recognition around the world as having a value. Investors in projects and companies want to find out the future carbon benefits when making a fully appraised investment decision. Carbon benefits add value to shareholders and make the investment more competitive. Carbon Trading may be able to provide alternative source of capital to reforestation in the Kinabatangan River.

EcoSecurities Ltd, a leading expert and proponent of carbon trading based in United Kingdom and Brazil, would be able to assess and develop the carbon sequestration aspects of tree planting activities in the Kinabatangan and provide WWF with the potential carbon credit value of its operation and eligibility in a future trading regime. EcoSecurities would ensure that proposed activities are acceptable under the terms of the Kyoto Protocol's mechanisms, in particular the Clean Development Mechanism (CDM).
The work undertaken by EcoSecurities would be as follows:

1. Quantification of carbon pools and fluxes generated by the project.

2. Policy analysis of conditions and the requirements imposed by the Malaysian government in relation to carbon sequestration activities and to gather Malaysian’s requirements and regulations in relation to Joint Implementation projects, with the objective to gauge country-level acceptance of the project.

3. Make recommendations to the project’s internal monitoring programme, to allow it to fulfill the likely requirement of greenhouse gases (GHG) bodies and independent certifiers.

15.0 Conclusion

There is a strong commercial as well as environmental case for oil palm companies to consider planting forest trees in place of oil palm trees in existing plantation areas in the Kinabatangan floodplains, that are subject to recurring intensive flooding.

The growing scarcity of timber and the concerns of a possible long term decline in CPO prices, suggest that the comparative economic advantages of tree plantations over oil palm plantations, will further skew toward tree plantations in the period ahead.

In addition to commercial benefits, the plantation companies would gain from being seen as environmentally supportive. This would be a prudent pre-emptive move to counter growing anti-palm oil lobbyists.

The restoration of the forest cover of the wildlife corridor along the Kinabatangan River can only be a “win-win” situation for both WWF and the oil palm plantation companies.
References

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