JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

No. 2

ECONOMIC PLANNING UNIT
PRIME MINISTER'S DEPARTMENT
MALAYSIA

THE FEASIBILITY STUDY ON THE FORESTRY DEVELOPMENT PROJECT IN MARAK PARAK, NORTHERN SABAH, MALAYSIA

September 1997

Japan Overseas Forestry Consultants Association (JOFCA)

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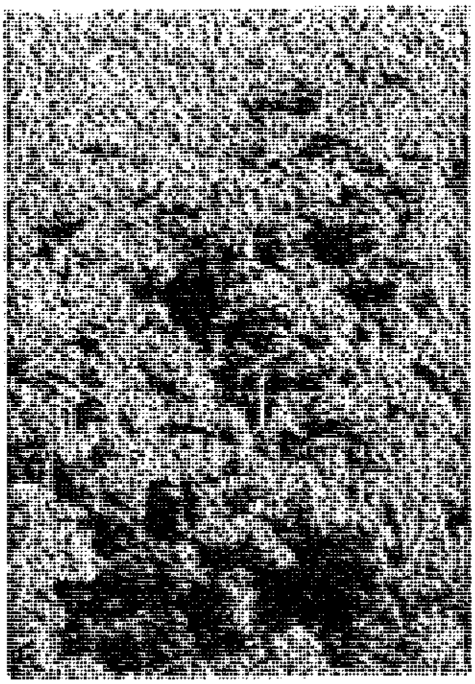
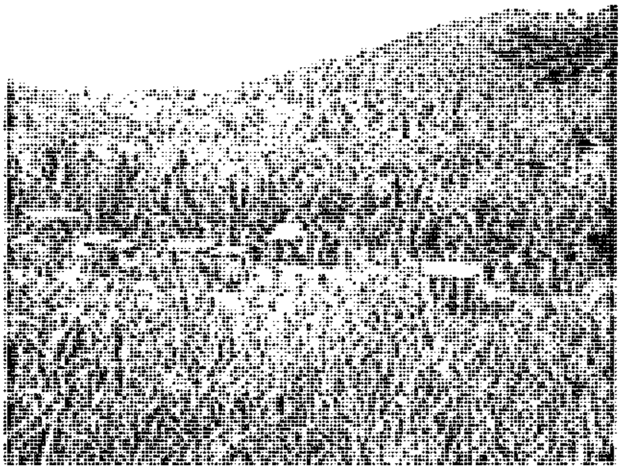
Kinarom basin around Kg. Marak Parak

Landslide at degraded forest after fire

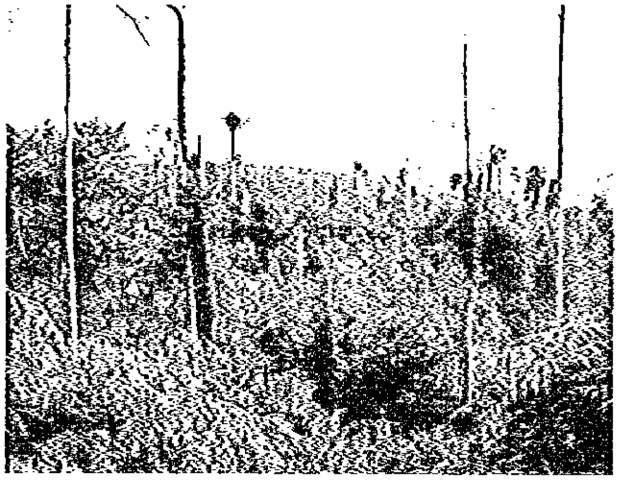


Secondary high forest

Soil survey at tree plantation (*A. mangium*)

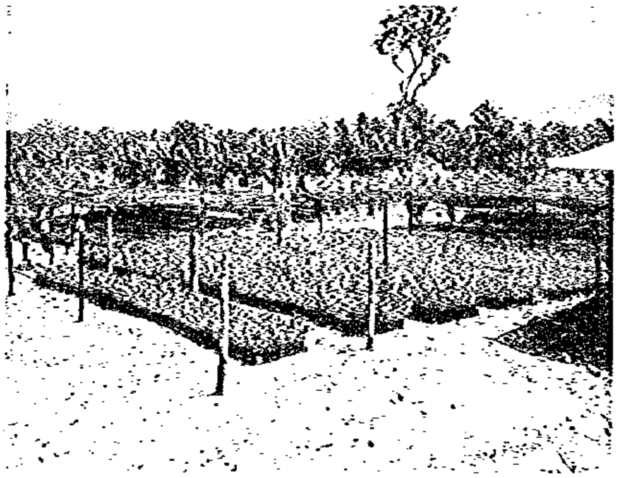


Village in the Study Area



Degraded forest after fire

Turbid stream (Kinarom river)



Private nursery

Field survey by JICA Advisory Team

Workshop with villagers

PREFACE

In response to the request from the Government of Malaysia, the Government of Japan decided to conduct the Feasibility Study on the Forestry Development Project in Marak Parak, Northern Sabah, Malaysia and entrusted the study to Japan International Cooperation Agency (JICA).

JICA sent to Malaysia a study team headed by Mr. Tsutomu HANDA, Japan Overseas Forestry Consultants Association four times during the period from April 1996 to August 1997.

The team held discussions with the officials concerned of the Government of Malaysia, and conducted field studies at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between two countries.

I wish to express my sincere appreciation to the officials concerned of Malaysia for their close cooperation extended to the team.

September, 1997

Kimio Fujita

Kimio Fujita
President
Japan International Cooperation Agency

September, 1997

Mr.Kimio Fujita
President
Japan International Cooperation Agency
Tokyo, Japan

Dear Mr.Fujita

Letter of Transmittal

We are pleased to submit the report on the Feasibility Study on the Forestry Development Project in Marak Parak, Northern Sabah, Malaysia.

This study was conducted by Japan Overseas Forestry Consultants Association and Kokusai Kogyo Co.,Ltd., based on a contract with JICA, during March 1996 and October 1997. In this study, we formulated the implementation plan permitting sustainable production management in the Marak Parak area (consolidation) which was defined in the Master Plan for forest plantation development in Northern Sabah prepared by JICA in 1994.

We would like to take this opportunity to express our gratitude to the relevant officials of JICA, the Ministry of Foreign Affairs, and the Ministry of Agriculture, Forestry and Fisheries in Japan. We are also greatly indebted to the concerned officials of Prime Minister's Department, Sabah Forestry Development Authority, and the Embassy of Japan in Malaysia for their close cooperation and assistance extended to the study team during the preparation of the report.

Your faithfully,

Tsutomu Handa
Team Leader
The Feasibility Study on the
Forestry Development Project
in Marak Parak, Northern Sabah,
Malaysia

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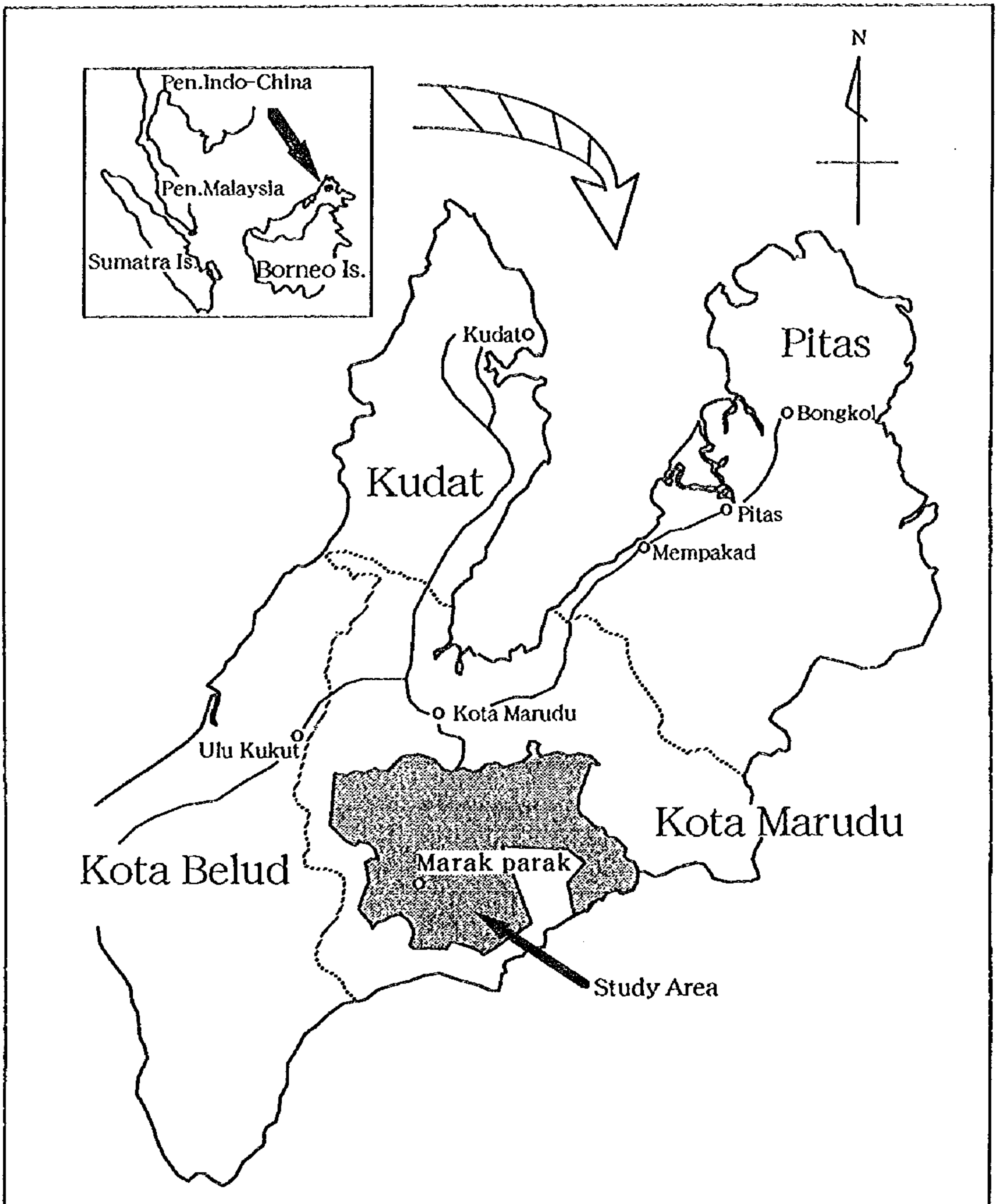
Abbreviation

ACLA	Assistant Collector of Land Revenue
BDT	Born Dry Ton
CDO	Community Development Officer
DO	District Officer
EIA	Environmental Impact Assessment
FELCRA	Federal Land Consolidation and Rehabilitation Authority
F/S	Feasibility Study
ha	Hectare
IRR	Internal Rate of Return
JICA	Japan International Cooperation Agency
JKKK	Jawatankusasa Kemajuan Keselamatan Kampung
JKR	Jabatan Kerja Raya
Km	Kilometer
KPD	Koperasi Pembanguan Desa
LA	Land Under Application
LUC	Land Utilization Committee
m	Meter
m^3	Cubic Meter
m.t.	Metric Ton
MAI	Mean Annual Increment
MDF	Medium Density Fiberboard
M/P	Master Plan
NBT	North Borneo Timbers Bhd.
NPV	Net Production Value
PTF	Private Tree Farming
PRA	Participatory Rural Appraisal
RM	Malaysia Ringgit
SAFODA	Sabah Forestry Development Authority
SFI	Sabah Forest Industries Sdn. Bhd.
SRFB	Sabah Rubber Fund Board
SSSB	Sabah Softwood Sdn. Bhd.
S/W	Scope of Work
WWF	World Wildlife Fund for Nature



Location of Study Area

This is a final report on the feasibility study of the Forestry Development Project in Marak Parak in Northern Sabah, Malaysia.

This study was conducted over eighteen months in accordance with the Scope of Work(S/W) by the Japan International Cooperation Agency (JICA) and the government of Malaysia signed on December 15, 1995 and began with a field survey in April 1996. Four field surveys were completed in July this year. These surveys produced necessary data and material for developing an implementation plan. Based on their results, a forestry development plan was formulated, and financial and environmental assessments of this project were carried out.

This report summarizes the results of the surveys and assessments.

Summary of the Study

At the request of the Malaysian government, the Japan International Cooperation Agency (JICA) prepared a master plan (M/P) for forestation[1] in Northern Sabah, Malaysia, for the purpose of developing the region through forestry. The plan which was submitted to the Malaysian government in November 1994, covers an area of 323,000 hectares (ha), of which 236,000 ha will be subjected to forest practices. For large-scale forestation, the four consolidations (aggregated forest areas) of Langkon, Tandek, Sonsogon and Marak Parak were selected and a forestation plan was prepared for them. Subsequently, the Malaysian government requested that a forestation feasibility study in Marak Parak, one of the larger consolidation be carried out. It was decided that this study would be conducted by the JICA office through the Japan Overseas Forestry Consultants Association (JOFCA).

The study area is located in the southernmost part of Kota Marudu, Sabah, an area occupying 50,523 ha.

The basic structure of this study is as follows:

(1) Preparation of a topographical map
(2) Preparation of an implementation plan
(3) Economic evaluation
(4) Environmental impact assessment

This study took place over a period of eighteen months and was divided into four stages (corresponding four field surveys). The fourth field survey was completed in July 1997. The first of 3 prior surveys had been started in April 1996.

Chapter I Basic Study of Marak Parak

Natural Environment

Forests in Sabah are classified into forest reserves which are intended to be used only as forests and other forests which can be converted to any other use. The study area falls under other forest area. This area is surrounded by steep mountains and degraded forests except, on some lowlands. Most of the remaining forests are low-quality secondary ones resulting from cutting and shifting cultivation. They border forest reserves and military lands, except in the northern part of the area. Some sections of the southern part border the national park, with Mt. Kinabalu at the center. The study area (50,523 ha) accounts for about 26 percent of the total area of the Kota Marudu district.

The study area is classified as a tropical rainforest climate zone and under the influence of monsoons. Mean annual precipitation ranges from 2,400 to 2,600 mm. The rainy season lasts from October to January. Maximum rainfall takes place from October to December. According to data obtained in Kudat, the temperature range is very small throughout the year. The difference between high and low temperature is as little as 6℃ or 7℃ on average. However, the temperature range is greater in the portion of the study area located in the inland mountainous district. The diurnal range is also expected to be larger in this area. There is a short dry season which is not severe.

The study area is topographically located in the transition zone from the plain which adjoins Marudu Bay to the mountains. Mountains altitude range from 500 to 600 meters (m) on average. Mountains have been considerably dissected and are generally steep. The study area is divided into five basins. Four streams flow down the Marudu Plain northerly and northeasterly into Marudu Bay. The Bengkoka River in the easternmost part of the study area flows easterly down to the Bengkoka Peninsula and into Marudu Bay near Pitas. In geological terms, the study area is comprised of marine sedimentary rocks originating in the Eocene and Oligocene period. These rocks are comprised of sandstone, shale and siltstone. The layers of these rocks contain tuff and breccia. Acrisols, cambisols, luvisols and fluvisols generally seen in tropical monsoon zones are distributed in the study area.

Since the study area is located in the mountainous district, it is generally surrounded by both good and bad-quality forests. In terms of land use, this area is occupied by forests, cultivated land, grasslands, land under shifting cultivation, and villages. No virgin forests remain in this area, where forests are all secondary. The quality of these forests has been degraded by repeated cutting and subsequent shifting cultivation. High forests (tree height of 30 m or higher) account for 1 %. There are many medium and low trees occupying about 60 % of the total. Shrubs account for 33 %. Mountainous rainforests, including Quercus spp. are found in mountains over 600 m above sea-level. Since there are no cutting restrictions in place, the forests in this area may be used for other purpose and have been repeatedly felled and degraded into low forests and shrubs by subsequent shifting cultivation.

Socioeconomic Environment

In order to identify the socioeconomic aspects of the communities affected by this project, a dual-phase survey was conducted. The first phase concentrated on the general socioeconomic conditions of these communities and the second phase focused on more specific elements. The survey covered 23 out of all 32 villages located in the Marak Parak consolidation. They were chosen because of their location in grassy, shrub and low forest districts which tend to become sites for forestation. General conditions were surveyed by interviewing key informants and asking questions of the villagers concerned.

The villages surveyed are topographically classified into eight on the basins and fifteen in the mountainous district. A total of about 5,600 people live in these villages. They belong to the Dusun ethnic. The populations of most villages range from 100 to 200 except for two larger ones which exceed 600 persons. The majority of the population is under fifty years of age with the highest proportion of people being in their thirties. The number of people in their teens and twenties is relatively small owing to the migration of young people seeking for employment opportunities in urban areas.

People mainly live on hill rice which is self-supplied by means of shifting cultivation. The fallow period ranges from one to six years. Some farmers have settled in a certain area for the purpose of planting and cultivating mainly trees. Trees are planted not only on land but also around their houses. Main tree species planted include fruits, rubber, coco palm, and *Acacia mangium*. Farmers select certain species based on whether they can be used for multiple purposes and whether they can bring in cash. Surrounding forests are an integral part of the rural economy. In accordance with customary rules, villagers collect a variety of forest products necessary for daily life, including foods such as fruits, honey, and meat, as well as firewood, medicine, household items, and building materials.

A major source of income in most cases, is the sale of surpluses which remain after self-consumption. An exception of this is farms in certain villages which cultivate cash crops with the support of extension agencies. Their incomes are generally low and unstable. Villagers, including cash crop farmers live in extreme poverty (under RM300 for a family of five members on a monthly average) in Sabah.

Moreover, this area has been left behind in the development of its social infrastructure, and very few including roads and schools exist. More specifically, the only access to villages in the mountainous area is a forest road (for timber transportation). The road is in bad condition and becomes impassable to vehicles in the rainy season. This situation inhibits the sale of farm crops and extension activities by government agencies, creating a great obstacle to community development.

A survey which focused on "land tenure/use" and "villagers and projects" was carried out by interviewing people from relevant agencies and by examining five villages selected on the basis of the results of the general survey. The main points brought out by the results of the survey are indicated bellow.

(1) Land Tenure/Right to Use: Land in this area is owned and used in different forms in accordance with customary and modern laws. According to customary laws, land fundamentally belongs to the community. In recent years, however, land has tended to be distributed to individuals in the form of private farmland by following customary procedures. On the other hand, the modern law, while respecting land tenure/use under customary laws, gives legal land rights to those who satisfy certain requirements and allows for issuance of Native Title (a deed to natives) to said land. Many villagers apply for Native Title to ensure legal tenure in order to protect their own land assets acquired in accordance with customary laws. However, it takes seven to ten years on average to receive Native Title, due to the delay in administrative procedures. Very few applicants have successfully received such a title. The majority of applications have not been reviewed or are pending. Villagers regard such land under application (LA) as providing them with the same rights as Native Title.

(2) Land Use by Communities: Land within the boundary of a village is divided by the community itself for several purposes, such as living, cultivation and common use. Thus, people make an attempt to plan land use. There is little land in the area covered by this study whose use is undetermined, except in one village in the mountainous district. Looking at this project from a community's perspective, there is no vacant land which can be expropriated for large-scale forestation.

(3) Land Tenure/Use by Farms: Generally, villagers own several farmlands for which they have followed procedures to obtain Native Title. These farmlands are used for multiple purposes. Shifting cultivation is carried out in a certain area exclusively used for this purpose, while small holding planting of trees and vegetables is common in other small private areas. However, idle land also exists owing to shortages of labor and funds. The delay in procedures for Native Title is another obstacle to rural development, since farmers need a title to farmland in order to receive agricultural extension services and loans.

(4) Villagers and Projects: Villagers are concerned that they will not be allowed to use their own farmlands after expropriation if a large-scale forestation project is implemented. They insist that when selecting sites for forestation, land with Native Title as well as LA, should be excluded from the coverage of this project with respect to land use. On the other hand, some replied that if they were given the right to land, including LA, they would support the project since it would improve infrastructure and create employment opportunities. With regard to small-scale forestation project on private farmlands, villagers give priority to such tree species as fruits and rubber but have little interest in *Acacia mangium*.

The results of the survey showed that the present state of land ownership was about to be variable due to existence of many land applications (LA) waiting administrative procedures. Therefore, it was in the situation that a general plan for forestry development, which was a main subject of this study, could not be easily developed by dividing clearly watershed areas into state and alienated lands. The issue of land ownership affecting the basis of the study was discussed with the Malaysian side. As a result of discussion, the fundamental framework of the study was reviewed and it was determined as a policy that a development plan would be formulated by setting Model Area (for state and alienated land). In this connection, the social survey (participation/consideration of people) was also replanned within this framework and it was conducted in Phase 2 to develop an approach to the participation of people in the forestry development plan.

Model Area comprises the model zone of state land and that of alienated land. The villages involved include two villages in mukim Sinpangan and some of four villages in mukim Marak Parak. The three villages of Sunsui, Kotud and Polipikan gave cooperation for this study. These are average villages in the Marak Parak Consolidation. On the whole, their socioeconomic infrastructure are minimum or less. They have interest in improving access to highways, the bridge (the Kinaromu River), clinics, etc.

In both of these model zones, the most part of land available in villages has already been distributed to individual villagers except for commons (residential areas, graveyards and grazing lands). People have applied for a native title. According to them, there is no empty land available for large-scale forestation in this area, and the large-scale forestation plan is not fundamentally supported by them. They are concerned that their applications may be rejected owing to the plan. That is why some villages take quite a hard line. On the other hand, some people who have interest in infrastructure which may be improved and opportunities for employment which may be created following industrial forestation support large-scale forestation as far as a native title is granted to them. It is proposed that the project should be implemented through communities so that the local people will be employed before others when the project is implemented.

Every village has a sizable areas of unutilized/under-utilized lands. However, they have a specific land use plan for themselves, such as rubber and oil palm plantations. As an extension agency, the SRFB has been most active. Rubber is a very important source of income for the local people. Rubber plantations draw much attention from them as an effective form of land use (alienated land). Industrial forestation is an alternative to rubber plantations in some unsuitable land for rubber. However, people take a negative attitude toward the planting of *A. mangium* from the experience in the PTF program (SAFODA). Their enthusiasm for such forestation will not be elicited unless they regain confidence in it.

Although re-afforestation is inevitably limited to *A. mangium* under local soil conditions, it should be designed to improve the incomes of the local people. In this respect, the two approaches of sales profit and land rent are here taken into consideration in developing a forestry plan. To facilitate the implementation of this project, a system of communication with local communities/people needs to be established. It is proposed how the system should be established at the levels of district, community and project.

A key industry in this area is agriculture. As only a few flats are available, paddy rice is cultivated in a limited area. Yams, cassavas, sweet potatoes, fruits and vegetables are cultivated around houses. In addition to these, hill rice and maize are cultivated as staples by means of shifting cultivation. These crops are mainly self-consumed, except in some areas, where peanuts, fruits and vegetables are cultivated as cash crops. Stock farming has not been well developed.

Forestation in Sabah has been carried out on a commercial scale since the 1970s. It is mainly undertaken by three entities, namely Sabah Softwood Company (SSSB), Sabah Forestry

Development Authority (SAFODA), and Sabah Forest Industry (SFI). An area of 113,194 ha was actually forested by December 1995. Eighty percent of species for forestation were fast-growing ones. Only SAFODA undertakes large-scale afforestation in Kudat District (mainly Bengkoka) in Northern Sabah, to which the study area belongs. However, it has not carried out afforestation in the Marak Parak Consolidation. In this area, the local people plant trees by themselves under SAFODA's PTF programme. This is one of incentives for afforestation by supplying seedlings to the local people free of charge. After the commencement in 1988, participants in this programme increased but began to fail in 1992 or 1993. Such stagnation is attributable to a low possibility of selling planted trees (*A. mangium*) as well as limited land for granting a native title as a condition for the PTF. Log production in Sabah State is faced with a decrease in natural wood and an increase in man-made wood. The share of plantation in log production significantly rose from 2% in 1992 to 5% in 1995.

While *P. falcateria, E. deglupta and G. arborea* are sold on a commercial scale, *A. mangium* is still tentatively sold and sawn. Some of man-made wood is exported in the form of logs, while other is used as sawn wood or pulp chips. The overseas market for man-made logs is still small and not expected to grow. The greatest obstacle to the development of commercial afforestation is the absence of markets for man-made wood. It is another problem that SAFODA has no source of income on its own. Sustainable forestry seems to be impossible in Northern Sabah unless a market for man-made wood is discovered or developed by itself.

Forestry Survey

The study area includes Kg. Marak Parak at the center and the mountains on the outskirts. Rivers, which flow almost from south to northeast, are divided by watershed ridges into five basins. These are the basins of the Bandau, Pangapuyan, Kinaromu, Menuradiang and Bengkoka. The Bandau and Pangapuyan basins were formed by the downward erosion of steep mountains. Since they are important water source areas down the rivers (for drinking and irrigation), much care should be taken to use forest as means of water conservation and soil erosion control. The Manuradiang Basin is so steep that rains flow out in a short time. Judging from the slope of the stream bed, the basin has a high potential for sediment transportation. The Kinaromu Basin is the largest among these basins and is the most developed and most deforested owing to its accessibility to people living in the flat areas. The Kinaromu River flows in the center of the basin and the valley extends along the river. While the left bank is steeply mountainous, the right one is a basin from which a hilly area extends and a mountainous area extends further. Rains on this basin, which flow from tributary catchments altogether into the main stream, are likely to raise the peak rate of flow. Generally, however, the flow is constant since it winds down the long and gentle main stream. The Bengkoka Basin (near Gana) is a flat area at the head of the Bengkoka River, and has an altitude of 700 m or more. The basin is surrounded by mountains. As topographical conditions are not severe, cutting has degraded forests to poor secondary quality. However, difficult access prevents people from reaching this basin.

This study involves the survey of soil and forestland productivity in order to select sites and tree species for forestation. In the soil survey, a pit survey is conducted on the basis of topographical and vegetational characteristics and a soil map is prepared on the basis of the results. In the productivity survey, topographical conditions, vegetation, and soil types obtained from a mesh analysis are evaluated in terms of the growth of planted trees as an external criterion. Scores recorded in the evaluation are aggregated and a land productivity index is prepared. A preliminary study is also under way for an environmental impact assessment planned for the third survey of this study.

Forest Infrastructure

Hauling roads have been constructed here and there, as a result of past and present forest cutting. The density of such roads is 9.8 m/ha on the Kinarom Basin, which is expected to be the center of forestry activity in connection with this study. The density is as high as 16.3 m/ha on the Bengkoka Basin. When formulating a forestry plan, these roads should be effectively used and new construction should be avoided to the utmost. Many of the bridges, which were constructed for hauling logs are simple but are damaged and in need of repair.

Chapter II Basic Ideas of Forestry Development Plan

The study covers the upper reaches of rivers in Kota Marudu District. Proper watershed management is important, including private land use in order to secure water resources, control floods and prevent earth and sand from flowing into the lower reaches. Many people live in this area. The conservation and development/use of watersheds should be kept in balance in land use. Therefore, in consideration of respective characteristics of basins within the study area, the Bandau and Pangapuyan basins used as water resources for Kota Marudu, the steep Manuradiang basin and the area adjacent to the park of the Kinarom basin will be treated as protection forests (felling prohibited). In these areas, the State Water Department is now formulating the water conservation program, aside from this study. As for other basins, it is a policy that highlands will be conserved while lowlands will be used and developed.

Forest practices will be carried out at the proposed sites for management to facilitate the functions of forests based on watershed characteristics with respect to the significance of forests in watershed conservation and their use. It is planned that forest practices will include natural regeneration (selective cutting), artificial regeneration (selective cutting) and re-afforestation (clear cutting). Re-afforestation will cover shrubs and grasslands, while artificial regeneration will cover open low forests comprising relatively low stand density and enrichment planting will be applied as operation. Other forest types will be subject to natural forest management.

Chapter III Forestry Development Plan

Preconditions for Formulating the Plan

In view of ownership in land, the study area consists of state-owned and privately owned lands (alienated land). A native title to state land is granted to a person who has applied for it based on a customary right given to natives. There are lots of applications for such a title (called LA). Many of them are still pending due to the delayed procedures for examination. Although it is unpredictable how they will develop in the future, no doubt, state land will be gradually alienated. The status of land ownership is quite variable.

In this study, a general plan for forestry development cannot be easily developed by dividing clearly watershed areas into state and alienated lands under the above-mentioned circumstances. Accordingly, a Model Area was selected according to the form of land ownership, and the following two cases are taken up in considering the forestry development plan. Forest practices treated here are re-afforestation and artificial regeneration (enrichment planting).

Case A: This is a plan based on the demarcation of state and alienated lands (the standard sheet prepared by the Land and Survey Department) at the time of the Stage 2 field survey (October 1995). The plan involves the large-scale forestation of state land and the small-scale forestation of alienated land. Although state land may be gradually alienated, the possibility of a system for carrying out large-scale forestation is examined.

Case B: This is a plan based on the results of the socio-economic survey. The local people are not aware of state land and believe that any patch of land belongs to some village. Every village has its own plan for land use. Forestry development is planned with respect to public aspects of watershed conservation on the basis of communities' plans for land use.

The above cases show two opposite extremes. No one knows how the state of land ownership will be developed. However, after land problem is settled in future, the forestry development plant will be suggested in between these two extremes.

Forestry Development Plan - A

As previously stated, Cases A (Forestry Development Plan A) and B (Forestry Development Plan B) are proposed for planning forestry development.

Forestry Development Plan A is prepared by setting model zones for state and alienated lands. As for state land, large-scale forestation in the Model Area is under consideration. An overall plan for the study area is also considered on the basis of state land model zone. As for alienated land, land use is considered with respect for specific land use plans of villages in the Model Area as well as watershed conservation, and a general plan is developed for the local people themselves to plant trees on a small scale. Small-scale forestation will be carried out by using infrastructure provided and improved as part of the large-scale forestation plan. It is also planned that the local people will be employed as workers carrying out a plan for large-scale forestation.

The area in the Model Area is 4,810 ha of which 3,209 ha is within the coverage of forestation in the state land model zone, except for privately owned lands and land under cultivation which are excluded from forest management. The actual re-afforestation area will be 2,391 ha and the area subject to artificial regeneration will be 329 ha, excluding reserved belts such as rivers and the right of way (see the following table).

(in hectares)

Site	Area (A)	Unmanaged Area (B)	Proposed Area for Forestation(A-B)			
			Total	Reserved Belt	Re-afforestation	Artificial Regeneration
Model Area	4,810	1,601	3,209	489	2,391	329
Study Area	25,136	13,624	11,512	1,551	7,560	2,401

The re-afforestation area and the artificial regeneration area in the whole of the study area are 7,560 ha and 2,401 ha, respectively. Line planting is applied for artificial regeneration operation.

As tree species for re-afforestation, *Acasia mangium* and *Paraserianthes falcataria* were selected from leguminous species in light of generally low land productivity and their marketing strategy conceived in this study. However, it might be able to choose other marketable and profitable species partially depending on the site condition. *P. falcataria* is intended for wet areas and gentle slopes, while *A. mangium* is intended for other areas. The planted areas of *A.*

mangium and *P. falcataria* will be 6,690 ha and 870 ha, respectively. The cutting ages of these species are nine and twelve years, respectively judging from site condition.

Seedlings will be produced by contract, but nurseries should be constructed within the project site in view of damage to seedlings in transit and the employment of the local people. For infrastructure, it is planned to construct forest roads, bridges, buildings and lookout towers. While using the existing logging roads as far as possible, forest road network will be arranged at a rate of 25.3 m per hectare.

As the project site is under the jurisdiction of the Northern Regional Office of the SAFODA, this office will take charge of this project in the whole of the study area. For this purpose, an administration and operation division will be set up, and the number of required employees will be increased as the project goes forward. Especially, to implement the project smoothly, it is essential to attain understanding and cooperation of local people. Therefore, a section which takes charge of coordinating with communities / people will be set up in the division. At the same time, special organizations are proposed to be established in community and district levels under a leading role of the Kota Marudu District Office. The number of manpower required for implementing the project (excluding the construction and improvement of forest roads) is 520 persons per year (160 persons for the Model Areas) assuming that the number of annual operating days is 120 days per person. Employment of workers will be done through the communities to get understanding each other.

Sites for small-scale forestation in the model zone of alienated land will be concentrated in a certain area and those who have native titles will be organized for implementation on the sales profit approach which is basically the same system of the PTF by the SAFODA. The small-scale forestation is a local people's own plan. In implementing its scheme, it is indispensable to attain understanding and cooperation of community/people. Of 708 ha, 259 ha will be allocated to re-afforestation and 86 ha will be allocated to natural regeneration system. As a species for plantation, *A. mangium* (with a cutting age of 9 years) is employed as in the large-scale forestation plan. Silvicultural practices will be carried out by using a network of forest roads prepared as part of the large-scale forestation plan.

Forestry Development Plan-B

Forestry Development Plan B is based on the results of the social survey of the Model Area. This plan assumes that there is no state land in the area and all land is alienated. A land use classification was prepared with respect to watershed conservation on the basis of communities' own plans for land use, and a forest development plan was prepared thereby. According to the plan, 2,750 ha out of the Model Area occupying 4,810 ha is intended for forest use, 2,204 ha of the latter is allocated to re-afforestation and 536 ha is to artificial regeneration.

In terms of sales strategies, it is preferable to carry out forestry development on a commercial scale. Therefore, a plan for such development is prepared assuming that the existing entities like the SAFODA will undertake the development on the land rent approach ,viz. leased land forestation system. Profit sharing system at harvesting is considered as an alternative approach. However, this system is hard to be applied at present because it follows a risk concerning the sales profit and can not be high incentive for local people. The development will be carried out as in the case of large-scale forestation. As a tree species for plantation, *A. mangium* (with a cutting age of nine years) was selected. The required manpower as an opportunity for local employment is about 130 persons per year assuming that they will work in 120 days per person per year.

Plan-B depends on local people's consent. It is essential that the local government office attains as lead agency understanding and cooperation of communities/people, equal partners of the project.

Marketing Strategy for Plantation Trees

The possibility of supplying timber from plantations was examined by reviewing markets for particle boards, pulp and paper, and block boards from *A. mangium* and *P. falcatria* selected for this project. As a promising target including the Bengkoka area for *A. mangium*, it is most reasonable to opt to export in the form of chips to Japanese paper and pulp plants. A promising target for *P. falcataria* is block board factories in Sandakan and Tawau.

Chapter IV Project Evaluation

Financial Analysis

Both Forestry Development Plan A and B were analyzed from a financial point of view. Small-scale forestation under Plan A was evaluated in respect to financial effects assuming that it would be additionally carried out following large-scale forestation. Enrichment planting was excluded from this evaluation covering only re-afforestation. Prices for chips and block boards and expenses for chipping and loading were analyzed on certain assumptions, including that *A. mangium* and *P. falcataria* would be sold in the forms of chips and block boards, respectively. In the case of large-scale forestation under Plan A, IRR (internal rate of return) was estimated at 13.9% and NPV (net present value) was at MR5,016,000 at a discount rate of 12% in a base case. According to sensibility analysis made by changing parameters, this project could achieve an IRR of 13.9% as far as the current rate of growth (5%) in chip prices is maintained in the coming decade. If the rate falls to the same level as inflation (2.8%), NPV will fall below zero at a discount rate of 12%. If the initial price for chips falls 10%, IRR will be about 12%, and the financial feasibility of this project will become marginal. In the case of small-scale forestation, profitability will be higher (IRR of 31.4% and NVP of RM912,000) because the infrastructure cost will be covered as part of large-scale forestation costs.

In the case of Plan B, rents will vary from site to site in terms of whether the site is suitable for rubber or oil palm production. If it is suitable for that, the rent will rise and significantly affect the profitability of re-afforestation. When evaluating the project on the assumption that areas unsuitable for such production will be re-afforested, IRR will be 15.8% and NPV will be RM1,908,000 as a discount rate of 12% in a base case. Sensibility analysis also showed that this project would be generally profitable.

Environmental Impact Assessment

Although this project is intended to recover the degraded vegetation, lots of problems may occur in the natural environment and people's lives in the course of implementation. With regard to the natural environment, there is no fear that precious animals and plants will disappear as a result of this project, but sufficient precautions are needed against soil exposure. The predicted problems mainly include soil exposure following road construction work, soil erosion due to improper removal of surplus soil, and river contamination and sedimentation due to oil spills and improper drainage from bunkhouses. Appropriate measures should be taken: e.g., planting trees over the exposed soil, proper treatment of waste water, and proper removal of surplus soil. To preserve water quality, the proper control and use of fertilizers and chemicals is important. To protect rivers, maintaining green belts on both sides of rivers deserves consideration. To prevent planted trees from being damaged by insects and diseases, resistant varieties need to be bred.

Dust, noise and water contamination caused by construction work are predictable as potential effects on people's lives. To prevent them, the project should be carried out in the fixed period (dry season) and in the fixed hours, and sewage should be properly treated at bunkhouses. It is also necessary to take a preventive measure against dust during the transportation of harvested trees. The problem of land is particularly important for people's lives. People live on the basins and there are many lots to which they have already received native titles or for which they have applied. This is an immediate problem for the local people. When the forestry development plan is established, adequate explanation should be given to the communities in the presence of DOs and CDOs as regional representatives to eliminate obstacles through mutual understanding.

Since the effects of this project on the environment is allowable, it will rather make a greater contribution to regional development as long as taking appropriate mitigation measures.

Thus, this project is judged to be financially feasible and practicable if it attaches importance to environmental aspects in the course of implementation, along with receiving understanding and cooperation from local people.

Summary of Evaluation

According to Forestry Development Plans A and B, this project is feasible from financial and environmental points of view. A great constraint to the implementation is the land problem in the area. It is not deniable that state land will be gradually alienated as progress is made in examining applications for native titles. It is expected that a realistic form of land ownership will be in the middle of ones suggested in Development Plans A and B. When foreseeing the future status of land ownership, forestation system combined of Plans A and B is suggested as practical system. The proposed project will be successfully implemented in a large-scale by a combination of the state and rented forestations.

Since the project is aimed at watershed conservation and development of local economy, the local government office has an important role. Therefore, the Kota Marudu District Office is required to attain local people's understanding and cooperation for the project as lead agency through establishing the special organization.

Recommendations

Even if the study area is outside the forest reserves, proper land use is needed for watershed conservation not to sow the seeds of future troubles. To implement this project, it is strongly recommended that:

(1) Administrative agencies should make a decision on land use classification for the watershed as a whole; and

(2) Clerical work for examining applications for native titles should be facilitated.

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[1] Terminology of forestation is comprised of criteria of re-afforestation and artificial regeneration.

Details of the Study

1. Background

Although the economy of Sabah state (with an area of 7,370,000 ha) depends on forestry, timber production has rapidly decreased as forest resources are depleted by exploitation and shifting cultivation. To restore degraded forest resources and promote local economy, the Sabah state government established the Sabah Forestry Development Authority (SAFODA) in 1976 and has actively promoted the planting of fast-growing species. However, soil conditions in Northern Sabah do not always fit into rural development, and much of the grasslands has remained undeveloped due to shifting cultivation. Against this background, the government of Japan responded to the request of the government of Malaysia through the Japan International Cooperation Agency (JICA), and JICA prepared "The Master Plan Study for Forest Plantation Development in Northern Sabah in Malaysia" for the purpose of developing the region through forestry and submitted it to the government of Malaysia in November 1994.

This plan is designed to:

(1) Promote sustainable forestry activities in consideration of natural and social environments;
(2) Improve socioeconomic conditions for local people through forestry activities; and
(3) Restore and improve the degraded natural environment through forestry activities.

This master plan covers a huge area of 323,000 ha in Northern Sabah (Kudat, Pitas, Kota Marudu and Kota Belud), excluding military areas and national parks. Out of this area, 236,000 ha will be allocated to forest operations. A forestry plan for the forest operation area was prepared by dividing operation by scale into large, medium and small. As for large-scale forestation, the four consolidations of Langkon, Tandek, Sonsogon and Marak Parak were selected as appropriate sites and a forestation plan was prepared for these areas.

After submission of the plan, the government of Malaysia requested that Japan conduct a feasibility study (F/S) of it by selecting a suitable site for forestation in the Marak Parak consolidation, taking into consideration watershed conservation and the needs of local communities.

In response to this request, the government of Japan dispatched a preliminary study team (S/W conference) and signed the Scope of Work (S/W).

This study was carried out by the JICA through Japan Overseas Forestry Consultants Association (JOFCA) on the basis of the S/W.

2. Purpose

The purpose of this study is to determine whether the above-mentioned master plan is feasible or not in the Marak Parak consolidation selected as one of the sites for large-scale forestation.

More specifically, proposals will be made regarding appropriate methods for timely and proper implementation of the plan with the intention of promoting sustainable development of the Marak Parak consolidation and sound watershed conservation. At the same time, the study team will transfer technology to their Malaysian counterparts, including the staff of SAFODA through this study.

3. Study Area

This study covers an area of 50,523[1] ha located in Kota Marudu District, Northern Sabah and designated as the Marak Parak consolidation in the Master Plan. The Kota Marudu district is located about 120 km northeast of Kota Kinabalu which is the capital of Sabah state, extending from the coastline of Marudu Bay to the source of the Kinaromu River. The study area is located in the southernmost part of the Kota Marudu district (see location map of the study area). The Kg. Marak Parak is at the center of the study area and is about 20 km south of Kota Marudu where the District Government Office is located. This area, whose land has been degraded, is depopulated compared with other areas in Northern Sabah.

There is no local industry in this area, which has been left behind other areas in the development by its infrastructure.

4. General Plan

This study involves the following operations:

(1) Preparation of topographical map
(2) Preparation of an implementation plan
(3) Economic evaluation (cost-benefit analysis)
(4) Environmental impact assessment
(5) Surveys required for the above operations

This study was conducted over a period of eighteen months and is divided into two phases as follows:

Year	Phase	Study
April-December 1996	Phase I study	Preparation in Japan, Stage 1 study (field survey & work in Japan), Stage 2 study (field survey & work in Japan)
January-March 1997	Phase II study	Stage 3 field survey
April-August 1997	Phase II study	Stage 3 work in Japan, Stage 4 survey (field survey & work in Japan)

The study was carried out according to the general schedule. These surveys are illustrated in Fig. 1.

Each phase of the study is outlined below.

A. Phase I

Preparatory Domestic (in Japan):
Prior to the start of this study, relevant matters were examined by referring to all existing reports, including the Master Plan and following was prepared:

(1) General plan
(2) Inception report
(3) Draft plan for transfer of technology.

[1] The study area was 54,000 ha at the initial stage, however, thereafter it was changed to 50,523 ha because the boundary of Forest Reserves adjacent to the study area was rectified.

Stage 1 Study:

In the Stage 1 study, a field survey was conducted and subsequently work was done in Japan, including the following assignments:

(1) Explanation and review of the inception report
(2) Subcontract for the preparation of a topographical map
(3) Local confirmation of the study area
(4) Survey on natural conditions
Including forest survey, basic survey on forestland productivity, and a watershed conservation survey.
(5) Socioeconomic environment survey
(6) Survey on environmental conditions

Stage 2 Study:

In the Stage 2 study (field survey and work in Japan), the following assignments were completed.

(1) Soil survey
(2) Current land use survey
(3) Survey on socioeconomic conditions
(4) Forest Survey
Forest vegetation classification (including aerial photograph interpretation), survey on watershed characteristics, forestland productivity classification, etc.
(5) Preparatory survey for environmental impact survey
(6) Preparation of topographical, soil and current land use maps
(7) Preparation of a forest inventory book
(8) Preparation of an interim report.

B. Phase II

Stage 3 Study:

In the Stage 3 study (field survey and work in Japan), the following assignments were carried out.

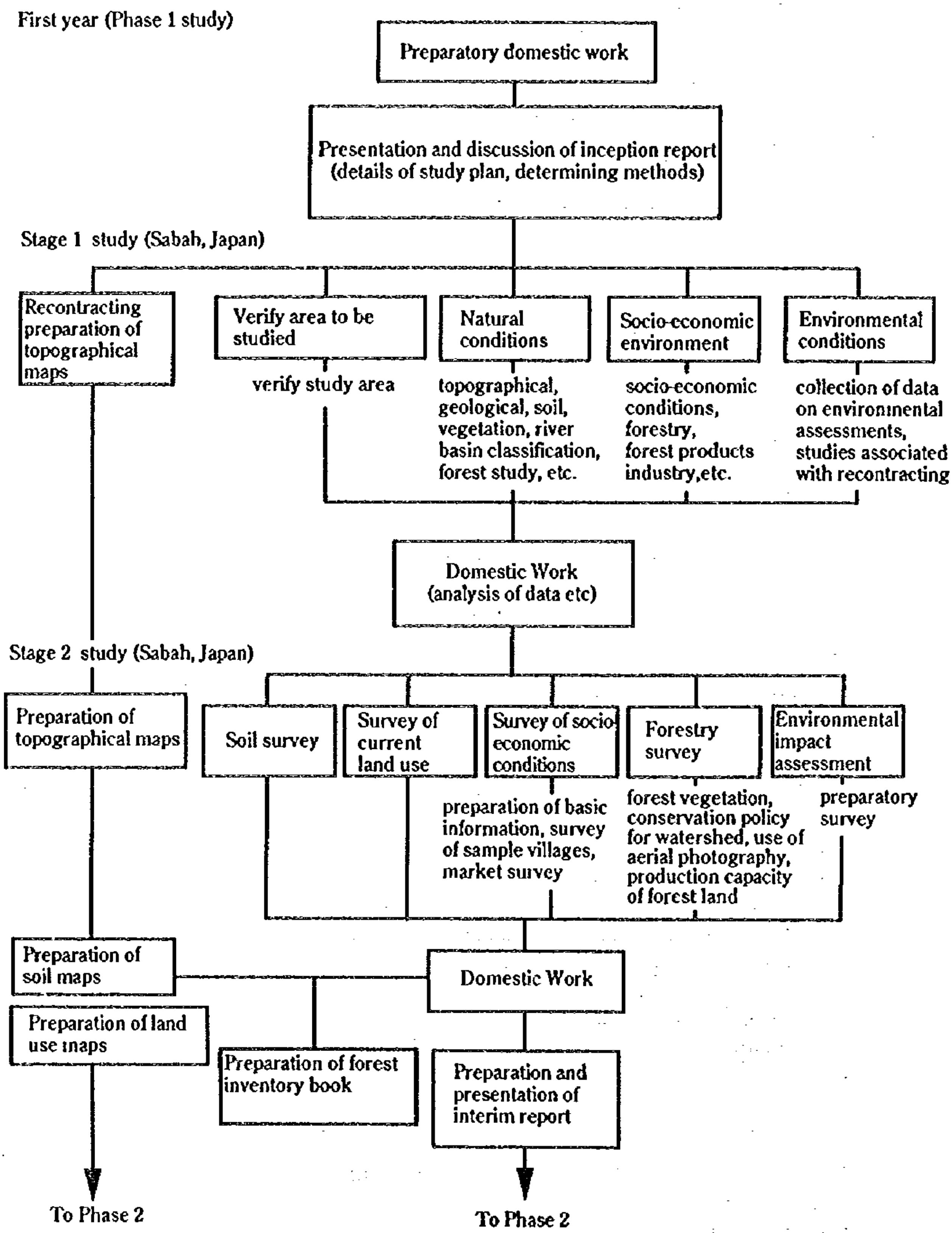
(1) Explanation and review of the interim report
(2) Preparation of a land use plan
(3) Survey for preparing an implementation plan
Forest management plan, planting and cutting plan, seedling production plan, natural forest practices, forestry with the participation of local people, etc.
(4) Project evaluation
(5) Environmental impact assessment
(6) Preparation of a forestry development planning map
(7) Preparation of a draft final report.

Stage 4 study:

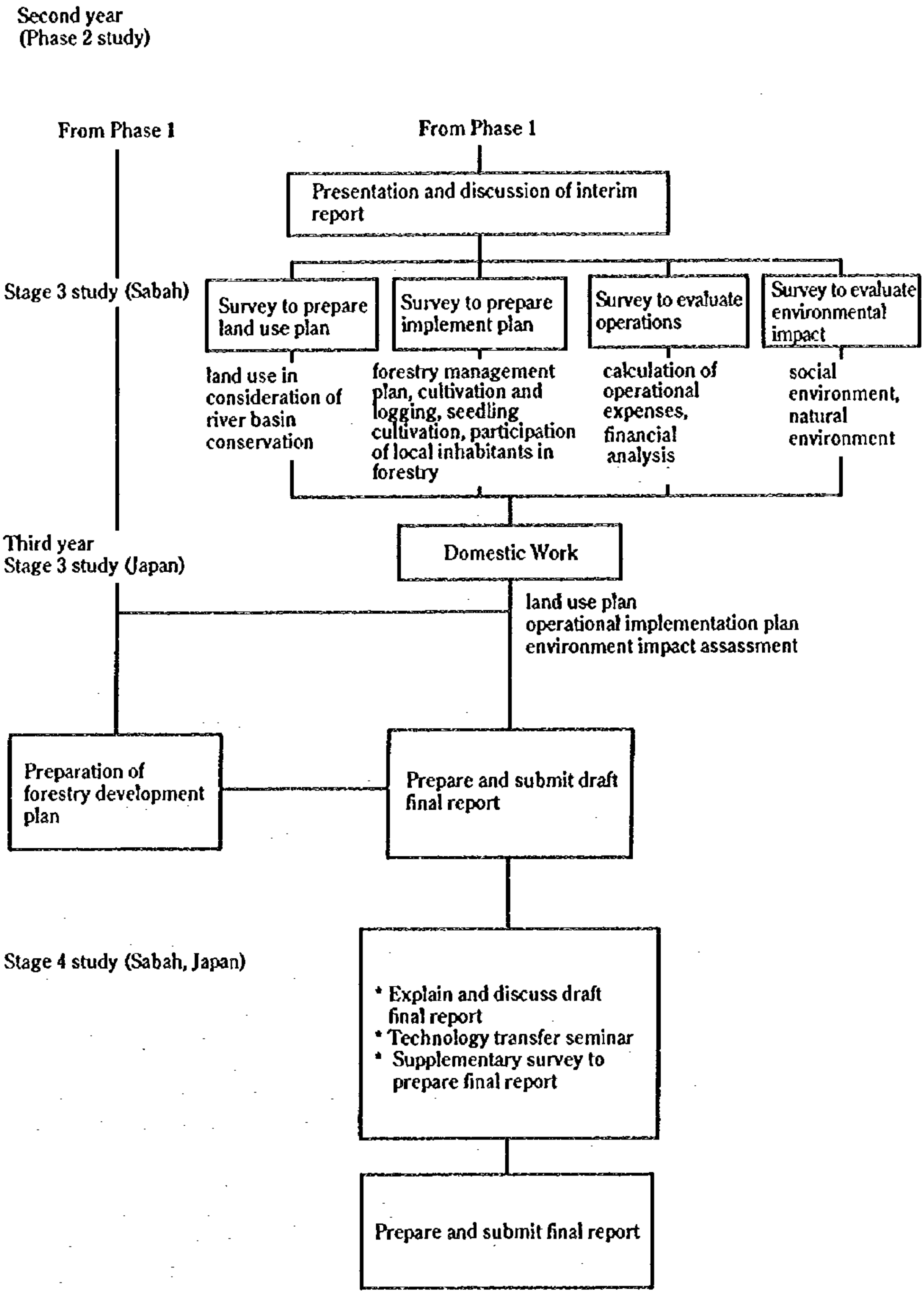
In the Stage 4 study (field survey and work in Japan), the following assignments were be carried out.

(1) Explanation and review of the draft final report
(2) Seminar on transfer of technology
(3) Complementary study for preparation of the final report
(4) Preparation and submission of the final report.

A Flowchart of Study Operations



A Flowchart of Study Operations



5. Progress of the Study

1) General

This study began in April 1996 and has been carried out in accordance with the fore-mentioned general plan. Phase 1 was completed in December 1996.

Prior to the start of the study, the study team explained the inception report to the people concerned with Sabah state and discussed it with them. A fundamental agreement on the contents of this study and the method to be used in conducting it were determined at this meeting. The minutes of this discussion are shown in Attachment 1.

The study team conferred with the people concerned with Sabah state when required during the course of this study. Whenever a field survey was carried out, a field report summarizing the results was prepared, submitted and explained to SAFODA.

It was proposed that the following be considered in implementing the study:

(1) This study will be collaboratively conducted by the study team and their Malaysian counterparts.
(2) Although native customary tenure is legitimate, actual land use needs to be locally confirmed. In this study, it is necessary to let local people know the purpose of the study before such confirmation.
(3) Data necessary for preparing a topographical map will be recorded on the digital system and submitted to SAFODA.

In Phase 1, field surveys were focused on natural and socioeconomic conditions. There are considerable number of yarding roads constructed in the study area, which, however, do not give good access to the area owing to landslides and broken bridges. To make up for this inconvenience, relevant data were collected by preparing a new topographical map and using aerial photographs In addition, necessary data were collected with the cooperation of relevant agencies, including the Forest, Agriculture, and Land Survey Department. The results of the study in Phase 1 were summarized in an interim report, which was explained to and discussed with our Malaysian counterparts at the beginning of Phase 2 These activities were described in the minutes (see Attachment 2), in which a major problem was land ownership. As stated in the preceding summary (Chapter III Forestry Development Plan), the question is how a general plan for forestry development should be developed in the variable state of land ownership. SAFODA itself has filed an application for using land with an area of 47,500 ha for this project. The application is to be treated in the same way as many other applications filed by people. This situation makes it difficult to finalize a site for forestry development. Therefore, it was determined as a policy that a development plan would be formulated by setting Model Area corresponding to different forms of land ownership.

In Phase 2 field surveys were carried out under the aforementioned agreement. As the establishment of Model Area was not initially planned, an additional survey was needed. Based on the results of these surveys, a forestry development plan was formulated and the project was assessed. To summarize them, a draft final report was prepared and submitted to Malaysia. The study team explained it to and discussed with the Malaysian side. Discussion on the draft final report is summarized in the minutes (see Attachment 35). After that, based on the comments presented from the Malaysian side, a final report was prepared and submitted to the government of Malaysia.

Furthermore, preparation of topographical map and environmental impact assessment (EIA study) were implemented through contracts with local consultants in Malaysia. Topographical map was prepared by Jurukur Printis, and the EIA study was conducted by Sustainable Environmental Management Consultants (SEM). As for the EIA study in this report, only outline is described in Chapter IV (Section 3) based on the EIA report prepared by SEM.

2) Socioeconomic Survey

Purpose of the Survey

A socioeconomic survey (hereinafter called social survey) in this study was carried out in two phases. The ultimate purpose of the survey is to provide an option for local people to participate in the forestry development plan. This purpose is divided into the following two objectives:

(1) Reflection of interests and needs of local people/communities in the design of the forestry development plan.
(2) Formulation of the framework for participation of local people/communities in the whole project cycle of the plan (design, implementation, monitoring and evaluation) and the creation of opportunities for their participation.

To achieve these objectives, the social survey in Phase 1 focused on understanding the socioeconomic aspects of relevant communities, especially in connection with the plan. The survey covered villages in and around shrub/low forest areas (F2/F3 in the vegetational classification in the Master Plan) which seemed to be suitable sites for forestation in the Marak Parak consolidation.

Method of the Survey

The survey was carried out in two parts in order to identify both general and specific social conditions of relevant communities. Prior to the start of the survey, its framework was established at a data-gathering workshop (as part of the work for the Stage 1 study).[1] The survey portion on general conditions was designed to grasp general features of relevant communities in the study area by interviewing key informants and giving questionnaires to the representatives of villages. At the time of the general survey, there was no clear information on the names and locations of the villages existing within this consolidation, and therefore, the villages within the study area could not be identified. For this reason, questionnaires were distributed to only 17 villages within mukim Marak Parak which could actually be confirmed by that time (Fig. I-6).

The second, more specific portion of the survey was carried out by examining the villages and interviewing people from relevant agencies, with a focus on (1)land tenure/use, and (2)relationships between local people and projects. The original plan involved choosing villages based on the results of the general survey in view of geographical location, population, progress in development (state of infrastructure of various types), and differences among subethnic groups. However, villages inaccessible to vehicles due to the collapse of roads and bridges were excluded from

[1] See Attachment 7.

the survey. As a result, the villages of Marak Parak, Pompadon, Dalamason and Natu were chosen from among 23 villages existing in and around shrub/low forest areas. However, it was made known at the time of the field survey that nearly 80 % of the population of Natu village, including the chief, actually resided outside the village. Even those who resided within the village were widely scattered and could not be contacted in a short period of time. Therefore, when surveying Natu village, only the chief of the village was interviewed. Lombiding village, whose villagerial state was similar to that of Natu was added as a subject of this survey.

Prior to the village survey, a meeting explaining its purpose was held with the cooperation of the District Office in order to request that the people concerned with these villages participate in this survey. The meeting was attended by a total of 25 people, including representatives from the District Native Chief Office, the District Community Development Office, villages, and the SAFODA Northern Region Office. The study of the forestry development plan and the social survey were outlined and questions about relevant matters were asked and answered at the meeting [2].

Moreover, during the survey of individual villages, meetings were also held at community halls with the prior approval of the chief of the village concerned or the chairman of the Village Development and Security Committee (JKKK) to explain the purpose of this project and the social survey and to answer relevant questions[3]. Within this limited time, key informants (village chiefs, JKKK chairman, female leaders, seniors, the extension staff, etc.) were interviewed and discussions were held with them. Thus, the participatory rural appraisal (PRA) method was employed. To complement and confirm the results of the survey, ordinary villagers were also interviewed from time to time. This survey was carried out with the cooperation of the Institute for Indigenous Economic Progress (INDEP), a consulting company in Kota Kinabalu, the District Community Office, and the SAFODA Northern Region Office.

The social survey (participation/consideration of people) in Phase 2 is designed to develop an approach to the participation of people in the forestry development plan. The survey was originally planned to mainly cover the villages surveyed in Phase 1 when the framework of the plan was determined. However, a plan for the survey could not be made in advance because the framework of the forestry development plan or a general policy for Phase 2 could not be determined by late January 1997 when the study team visited the project site. Such determination could not be made because policies toward the problem of land ownership in the study area had to be determined through conference with our Malaysian counterparts as previously stated. As a result of conference, the development plan and the fundamental framework of the study were reviewed. It was determined that Model Area (for state and alienated land)would be established anew to develop a plan for each of these areas.

The social survey was also replanned within the framework. The survey covers five villages (Kotud, Talas, Sunsui, Polipikan and Tangkol) overlapping the Model Area established in Phase 2. The method of the survey is discussion with relevant agencies. The villages surveyed in Phase 1 were not finally included in the Model

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[2] See Attachment 8.
[3] See Attachment 9.

Area, so that the direct continuity of the survey could not be ensured. Accordingly, the fields of study for Phase 1 (basic study) were redundantly added to the survey of villages in Phase 2, due to time constraints inhibited the same level of survey as in Phase 1, and basic study items were limited to land and forest use by communities.

Prior to the field survey, the second workshop was held in Kota Marudu on February 3, 1997 with participation of relevant communities and government agencies with the cooperation of the District Office. There were a total of 45 participants in the workshop, including representatives from eighteen villages (JKKK chairman and chiefs of villages) located in areas suitable for forestation including the Model Area, representatives from relevant districts (Pamaju Mukim and WKAN, the District Native Chief Office, the District Community Development Office, and relevant government agencies, and representatives from the SAFODA (Headquarters, the Northern Regional Office, and PTF) and the study team. The following six subjects were put on the agenda: (1)Backgrounds of the project and the study, (2)objectives of the study, (3)the schedule for the study, (4)summary of the latest results of the study, (5)SAFODA's policy toward the problems of land, and (6)the schedule for the future. After discussion, questions about explanation were presented and answered[4]. The representatives of five villages covered by the study within the Model Area were requested to stay at the workshop even after its completion, and objectives and details of the social survey were explained to them for cooperation. As a result, the representatives of four villages agreed to cooperate. The schedule for the study was determined through conference with them.

The survey in the above-mentioned four villages was carried out at the community hall for two days per village. On the first day, the survey began with the explanation of the project and the study. Many people made negative comments on the project in succession and requested the study team to exclude them from the coverage of the study. Therefore, the study team had to repeatedly explain the purpose of the study to them for understanding and cooperation.

(1) As the Model consolidation was established for convenience's sake, it has not yet been determined that forestation will be necessarily carried out in the villages surveyed within these consolidations.

(2) Cooperation for the study does not directly mean the support of the project.

In all these villages, the prolonged discussion about the project prevented the survey from starting substantially on the first day. In Tangkol Village, the study team judged it difficult to receive understanding and cooperation from villagers in a limited period and excluded the village from the survey as requested by them. After all, the substantial survey of villages was carried out in a total of three villages, including two villages (Kotud and Sunsui) in the model area of state land and one village (Polipikan) in the model area of alienated land.

The field study for Phase 2 was conducted with the cooperation of Sustainable Environment Planning and Management (SEM), a consulting company in Kota Kinabalu.

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[4] See Attachment 25.

Chapter I Basic Study of Marak Parak

1. Natural Environment

1-1 Location and Area

The study area is located in the northwestern part of Sabah State at 6°15' to 6°25' North Latitude and 116°40' East Longitude about 120 km from Kota Kinabalu which is the capital of Sabah state. This area administratively belongs to the Kota Marudu district, which is at the head of Marudu Bay. The largest town is Kota Marudu where the District Office is located.

The coverage area of the study is located in the southern part of the district. If you go southerly about 28 km from Kota Marudu, you will reach Marak Parak, the central village of the area (see map on the opening page of this report). Whole area is surrounded by steep mountains covered with degraded forests, except in some basins under cultivation. Most of the remaining forests are low-quality secondary ones resulting from cutting and shifting cultivation.

The Kinaram River originating in Mt. Tambuyukon and adjacent to Mt. Kinabalu flows down northeasterly in the center of the study area and joins the Pamaitan River on the way to become the Bongan River which flows into Marudu Bay. The Kinaram forms the largest basin in the study area, around which villages, farms and rubber plantations are scattered. In addition, there are also four basins both large and small in the study area. Shifting cultivation is often seen in this area except in some lowlands. The study area bounds on forest reserves with the exception of in the northern part.

The study area is comprised of 50,523 ha, accounting for about 26 % of the total area of the Kota Marudu district (192,000 ha).

1-2 Climate

Northern Borneo Island where the study area is located falls under tropical rainforest climate zones (Af) and features by high temperatures and high humidity on average according to Köppen. At the same time, this region is strongly affected by monsoons. It tends to be drier in Northern Sabah.

1-2-1 Precipitation

Since no meteorological station is located in the study area, precipitation must be estimated on the basis of data obtained from three meteorological stations in Kota Marudu, Kota Belud and Ulu Kukut near the study area (see Fig. I-1). According to these data, precipitation in Ulu Kukut is slightly less than in the other two areas. It is supposed that precipitation in the study area centered in Kg. Marak Parak tends to be almost similar. Mean annual rainfalls in Kota Marudu in the 1981-1995 period, in Kota Belud in the 1991-1995 period, and Ulu Kukut in the 1986-1995 period were 2,432.0 mm, 2,624.0 mm and 2,027.1 mm, respectively.

Looking at precipitation patterns, it rains throughout the year, but the so-called rainy season in Sabah lasts from October to January, when it rains a lot. A mean monthly maximum rainfall of 307.7 mm was recorded in November in Kota Marudu, and the largest rainfall in the past 15 years, measuring 760.1 mm was recorded in May 1984. In Kota Belud, a mean monthly maximum rainfall of 373.8 mm was recorded in October, and the highest level in the past five years, measuring 549.8 mm was recorded in December 1993. In Ulu Kukut, a mean monthly maximum rainfall of 294.2 mm was recorded in January, and its largest rainfall in the past ten years, measuring 675.4 mm was recorded in December 1993. In Kota Marudu, a daily maximum rainfall of 238.7 mm was recorded on November 30, 1988 in the 1985-1990 period (no data available for 1986). By contrast, it rains only a little from the end of Chinese New Year's day in February through April. This period is the so-called dry season in Sabah.

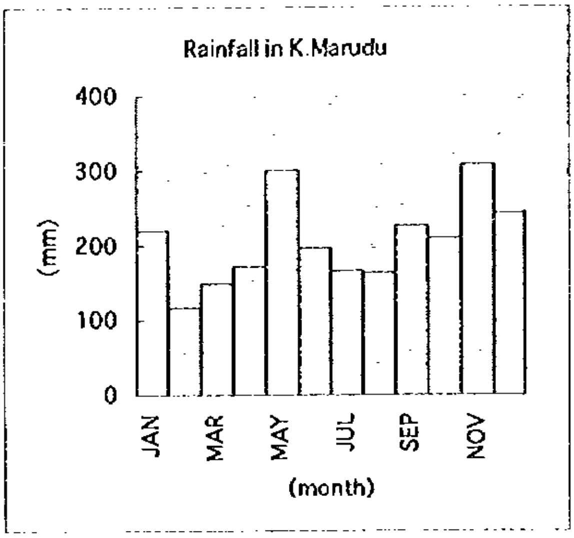
1-2-2 Temperature

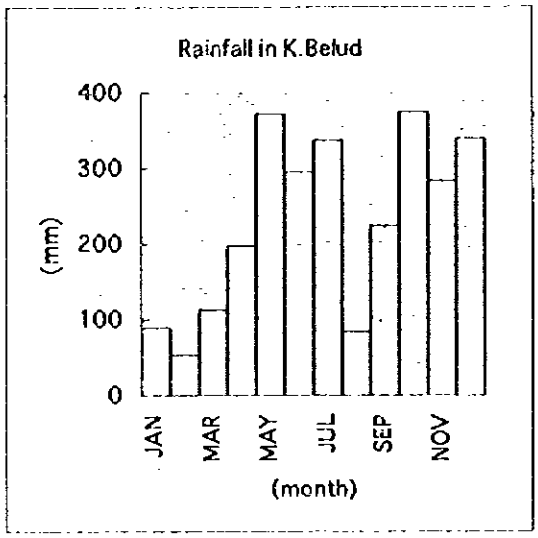
There is also no meteorological station which records temperature in the study area. The Kudat Airport Station is the nearest observatory recording temperature in this area. Data from this station was referred to in this study.

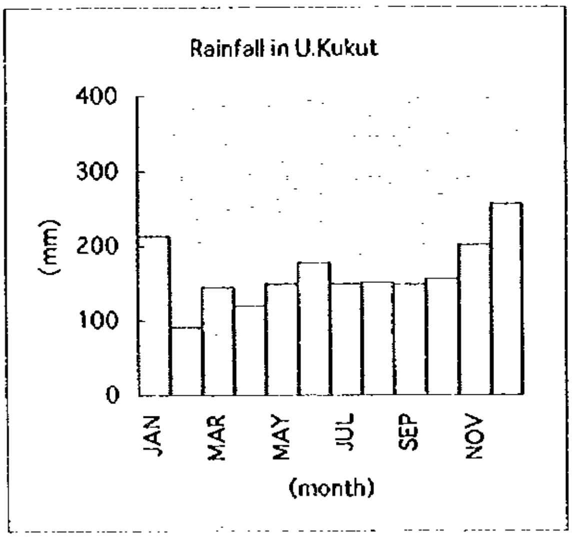
Fig. I-2 shows changes in high and low temperatures at the Kudat Airport in the 1985-1990 period. According to this graph, it can be seen that the temperature seldom changes throughout the year. The difference between high and low is as small as 6°C or 7°C on average. The daily range is also relatively small. However, it can be expected that the temperature is slightly lower and the daily range is wider in Kg. Marak Parak than those in this figure because the village is located in the mountainous are about 500 to 600 meters on average above sea level.

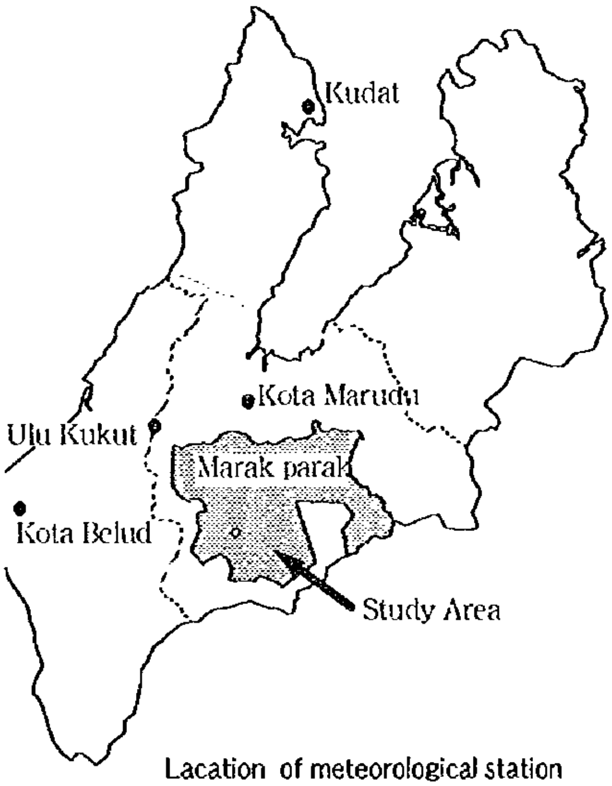
Fig. I-3 is a climograph in the Kudat Airport for which both precipitation and temperature data are available. As seen in this figure, mean monthly precipitation falls below 100 mm from March to April and in June. Thus, the past data[1] show the existence of the so-called "small dry season" in Northern Sabah, which is, however, not very harsh.

[1] The land capability classification of the west coast residency, Sabah, Malaysia (1974).









Lacation of meteorological station

Fig. I-1 Precipitation around the Study Area

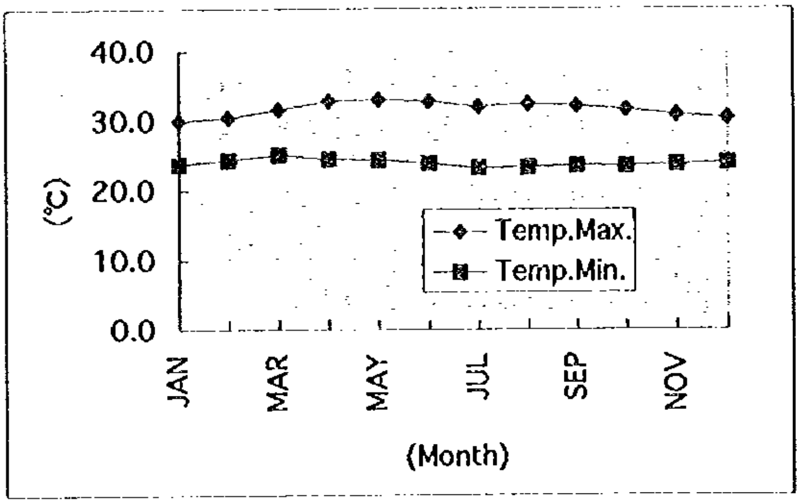


Fig. I-2 Max. & Min. Temp. in Kudat Airport

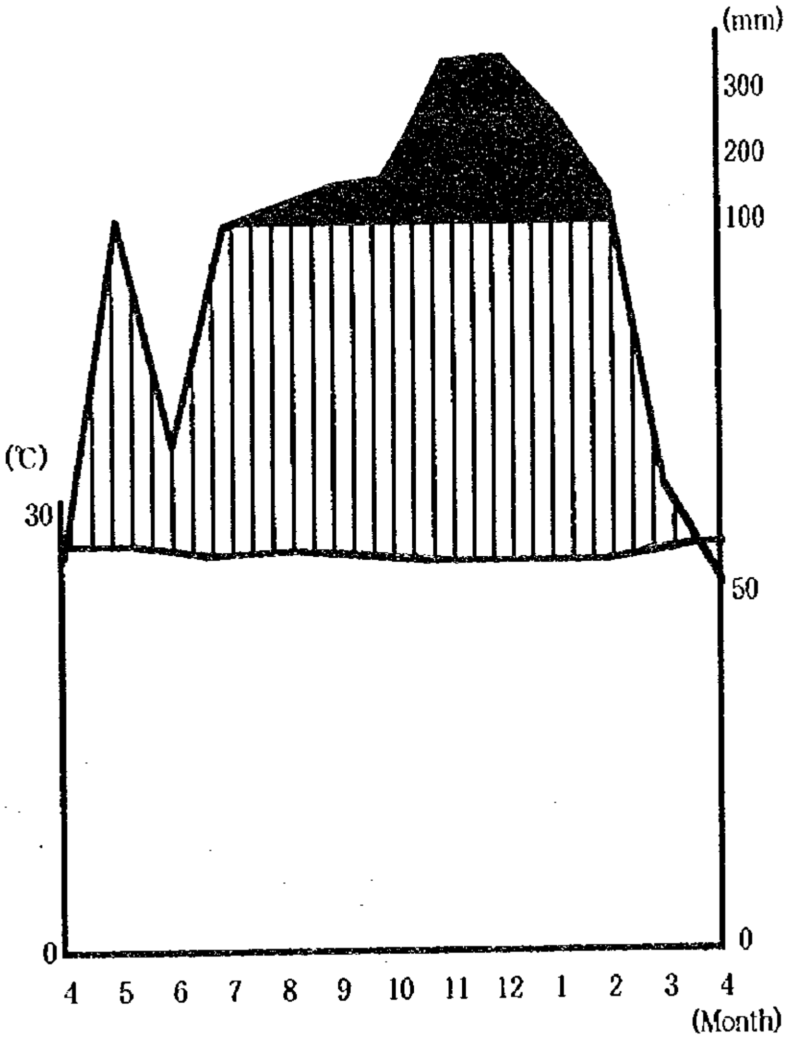


Fig. I-3 Meteorological Diagram in Kudat Airport

1-3 Topography

Marak Parak consolidation is a transition zone from the Marudu Plain to the mountainous district. The plain extends from the head of Marudu Bay between the two peninsulas of Kudat and Bengkoka projecting northerly into Northern Sabah.

The mountainous district covered by this study is at an altitudes of 500 to 600 m on average. Even the peak is no more than 1,100 m. However, mountains have been remarkably dissected and are generally steep. On the other hand, a gentle basin slope extends along the Kinarom, forming the largest basin in the study area.

Four out of five rivers in the study area flow northerly and northeasterly into Marudu Bay through the Marudu Plain. The easternmost Bengkoka River flows easterly outside the plain, meanders down the Bengkoka Peninsula and flows into Marudu Bay near Pitas in the middle of the peninsula. The head of the Bengkoka is a flat plateau at an altitude of about 700 m adjoining the Kaindangan Peneplain. The study area is intensely folded. The west side of the area is mainly occupied by mountains prevailing from the northeast to southwest. The east side is occupied by mountains ranging from the northwest to southeast rectangularly to the western mountains.

1.4 Geology and Soil

1-4-1 Geology

The study area is comprised mostly of marine sedimentary rocks originating in the Eocene and Oligocene in the Palaeogene period. These rocks are composed of Flysch-type sandstone, shale and siltstone, the layers of which contain tuff, limestone, breccia and agglomerate.

Marine sedimentary rocks (sandstone, chart, conglomerate, volcanic breccia, agglomerate, basalt and spilite) which originate in the Cretaceous period, and gabbro and basalt which originate in the Cretaceous and Palaeogene periods are also found in some parts of the area adjacent to the Kinabalu National Park, southwest of the study area. Mt. Tambuyukon, the source of the Kinarom, is composed of these rocks.

The geology of Northern Sabah is shown in Fig. 1-4.

1-4-2 Soil

In the whole of Northern Sabah, soil is inferior because parent materials of sedimentary rocks extensively distributed throughout the area are remarkable in nutrient leaching due to high level of precipitation. Fertile soil made of ultra basic rocks is partially distributed in a few areas. Soil distribution in the study area is fairly uniform throughout and varies little. Main types of soil seen in this area are acrisols and cambisols which are found extensively in tropical monsoon zones, and luvisols and lithsols which are found in some places. Clayey soil is found much in the Kg. Marak Parak and the flat around Gana area and is likely to be affected by ground water, due to bad drainage during the rainy season. In the mountainous area where the soil is shallow and sandy, acid soil is extensively distributed.

Fig. 1-5 shows the distribution of soil in Northern Sabah.

1-5 Forest and Vegetation

Sabah state covers a total area of 7,371,000 ha (Sabah Yearbook of Statistics, 1994), of which 4,315,000 ha is covered by forest which accounts for 59 % of the total area (Table 1-1). Of these, 94% are state forests composed of a total of 4,070,000 ha (forest reserves and others).

The remaining six percent (245 ha) are national parks. The quality of these forests has been degraded by shifting cultivation, in addition to forest exploitation. Untrodden virgin forests account for only 9 % (Table I-2). Secondary forests have taken the place of virgin ones and represented the majority.

Many of the state forests are reserves (3,349,000 ha). Forest reserves were designated for use as forests in the future and are to be maintained. Other areas of forest can be converted into other forms of use. The criteria used to determine land use classification is based on the possibility and productivity of agricultural development. The State Council legislated in 1984 that forests with an area of 4.2 million ha (56 % of the total) should be conserved in the future. Apart from environmental and wildlife protection, this political proposal is based on the notion that sustainable production activity should be maintained at a high level. The designation of forest reserves has been promoted by examining the characteristics of individual forests as well as the general function of forests. However, only about 3.3 million ha has been actually designated. The distribution of forest reserves is not regionally balanced. There are a few in the west coastal and northern areas and many in the central and southern areas.

Forest reserves are managed by classifying them into seven classes according to function. These classes include protection, commercial, amenity, mangrove, domestic, virgin jungle and wildlife reserves (Table I-3).

Table I-1 Forests in Sabah

	Area (1,000 ha)	Share (%)
Total Area	7,371	100
Forest	4,315	59
Forest Reserves (state)	(3,349)	
Others (state)	(721)	
National park	(245)	
Others	3,056	41

Source: Yearbook of Statistics (1994) - Sabah, Tables 4.19 and 4.20.

Table I-2 Forest Classification in Sabah
(Breakdown of 4,315,000 ha)

Category	Area (1,000 ha)	Share (%)
Mangrove	318	7
Coastal/Wetland Forest	193	4
High Virgin Forest	376	9
Montane Forest	716	17
Others (secondary, immature)	2,712	63
Total	4,315	100

Source: Yearbook of Statistic (1994) - Sabah, Table 4.19.

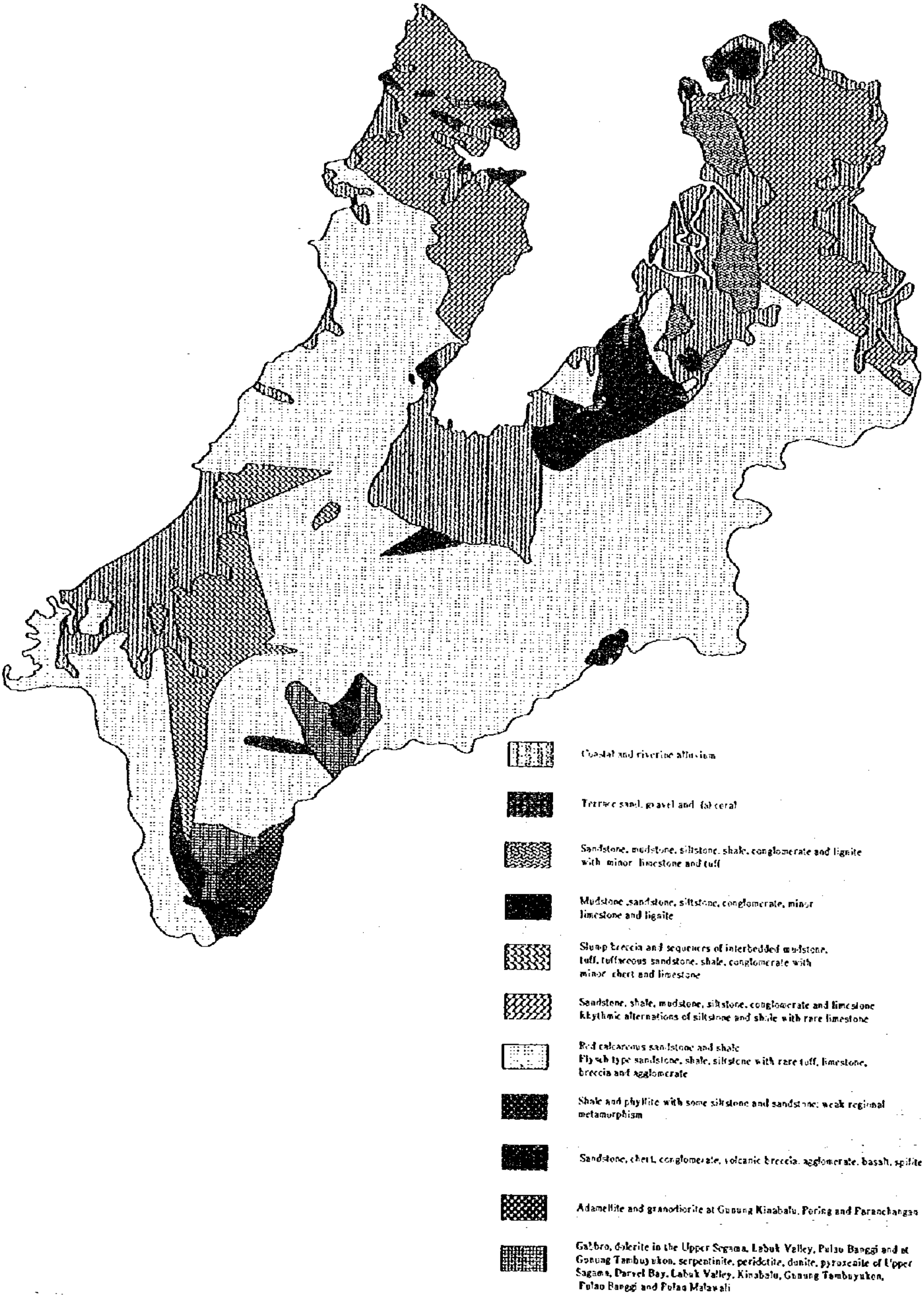


Fig. I-4 Geology in the Northern Sabah Area

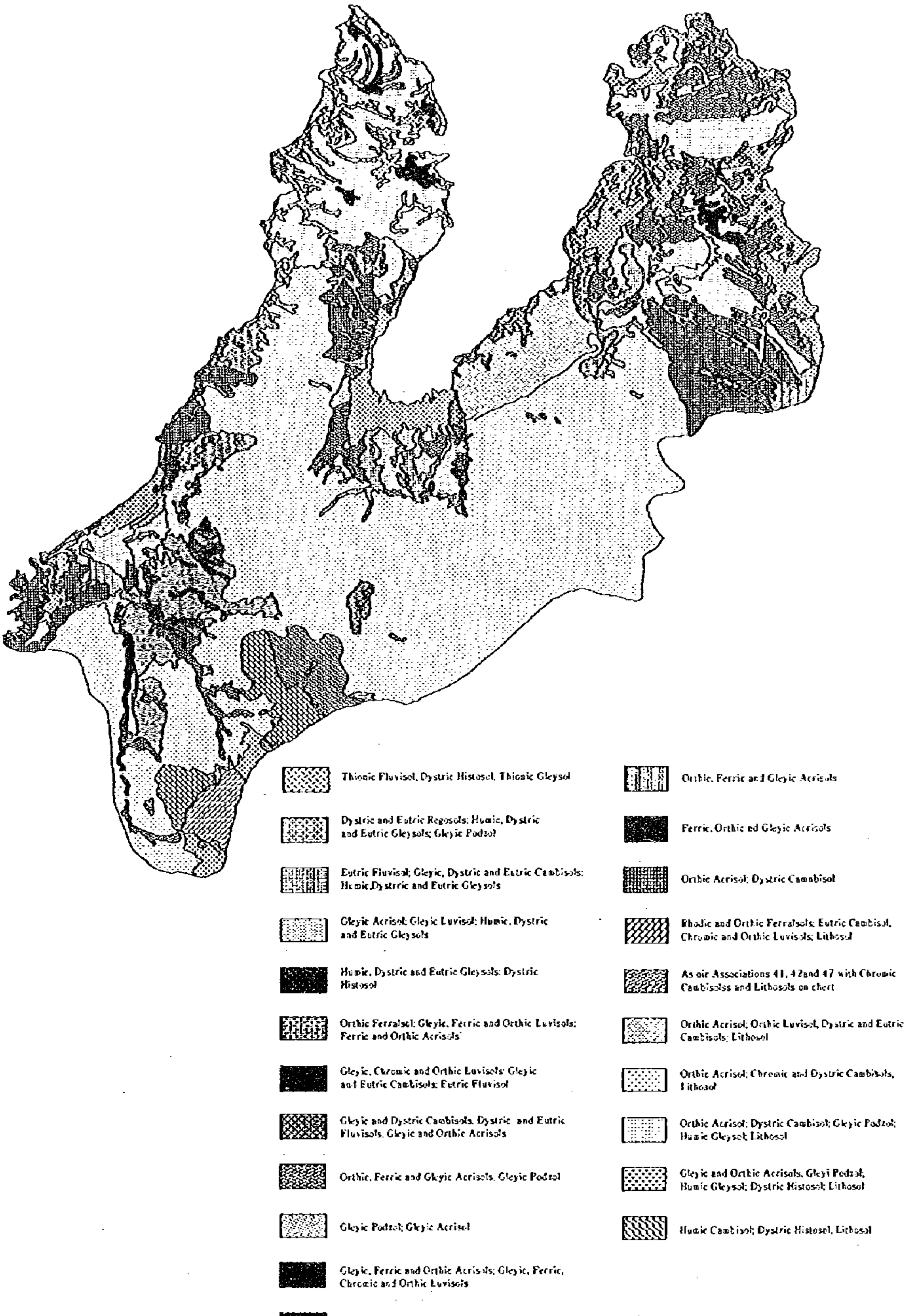


Fig. I-5 Soil in the Northern Sabah Area

Table 1-3 Classification of Forest Reserves

Class	Area (ha)
I: Protection Forest Reserve	250,868
II: Commercial Forest Reserve	2,530,099
III: Domestic Forest Reserve	7,355
IV: Amenity Forest Reserve	20,767
V: Mangrove Forest Reserve	316,457
VI: Virgin Jungle Reserve	90,782
VII: Wildlife Reserve	132,653
Total	3,348,981

Source: Yearbook of Statistics (1994) - Sabah, Table 4.20.

- Commercial forest reserves are intended to produce timber and other forest products. Most of the lowland and hilly *Dipterocarpaceae* forests at an altitude of 800 m or less fall under this category.
- Domestic forest reserves are designated for local consumption of timber and other forest products for the benefit of local people.
- Amenity forest reserves are intended for recreation, research, education, and precious plant protection. Exotic species have been introduced into these reserves in order to improve environmental conditions.
- Mangrove forest reserves are intended for supplying timber and other forest products, and the most productive species are *Rhizophora* spp, which have a wide range of applications from uses as fuel to fishing posts.
- Virgin jungle reserves are conserved in a natural condition for research purposes. However, some reserves are illegally felled as was seen in the Sepilok Virgin Jungle Reserve.
- Wildlife reserves are designated primarily for the protection of wildlife species. There are only two such reserves on the Dent Peninsula.

Table 1-4 Breakdown of Forests (Sabah State and Kota Marudu District)

		Sabah State		Kota Marudu District	
		Area (1,000 ha)	Share (%)	Area (1,000 ha)	Share (%)
Total Land Area		7,371	100	192	100
National Park		245	3	17	9
Forest & others		3,777	51	140	73
Forest Reserves		3,349	46	35	18
Classification of Forest Reserves	. Protection	251	8	3	9
	. Commercial	2,300	75	21	60
	. Domestic	7	-	2	6
	. Amenity	21	1	-	-
	. Mangrove	316	9	9	25
	. Virgin	91	3	-	-
	. Wildlife	133	4	-	-
	. Total	3,349	100	35	100

Source: Yearbook of Statistics (1994)- Sabah, Tables 1.1 and 4.20.

Forests which can be converted into other uses are mainly utilized for agriculture. From the 1940s, forests were converted into plantations cultivating para rubber, coco palm, tobacco, and cash crops for foreign currency. In the 1960s, oil palm plantations were developed, as were cacao plantations in the 1970s. With regard to the area under the cultivation of main crops in 1991, rice, pararubber and coconut palm plantations covered an area of 50,000 to 100,000 ha, whereas oil palm and cacao plantations covered a remarkably large area with 343,000 ha and 201,000 ha, respectively. These latter plantations grew rapidly in the 1980s and this trend seems to continue into the future.

By 1994, one national park and five state parks had been designated, occupying a total area of 245,000 ha.

The total area of forest in Sabah is said to have begun to decrease in the 1980s. Particularly during the decade up until 1992, hilly forests decreased substantially to 1,310,000 ha compared with the area covered by mangrove, wetland and montane forests which remained level or decreased only slightly. In contrast with these figures, areas of young forests, degraded forests whose natural regeneration is inhibited and also devastated areas, are increasing. It is urgently required that some measures be taken with regard to these forests.

Such deforestation is attributed to agricultural conversion, shifting cultivation, and cutting. The area under shifting cultivation was 1.1 million ha in 1985, accounting for 14 % of all state land. Every year shifting cultivation causes fires in secondary and man-made forests, which further devastates forest land.

The Marak Parak consolidation covered by this study belongs to the Kota Marudu district in terms of administration and forest management classification. This district has a small share of the forest in Sabah. The east share of forest (16 %) is held by Kota Kinabalu which has made a great deal of progress towards development. The Marak Parak is a mountainous district surrounded by forests. Forest reserves in the Kota Marudu district including this area account for 18 % of the total and the national park (Mt. Kinabalu and its vicinity) accounts for 9 %. The largest area is occupied by forests (other than forest reserves) and other land (state), accounting for 73 % of the total. With the exception of forest reserves and the national park, this area can be converted for other use. In practice, the conversion is determined by taking site conditions into account on a case-by-case basis when the need for some other use arises. The study area is used for various purposes, including building, farming, rubber plantation and grazing, in consideration of specific conditions. The above-mentioned forest reserves are managed and operated by the State Forest Service. SAFODA performs forestation in forest land other than on reserves.

The study area is surrounded by forests of both good and poor quality. This area has no forest reserves and is used in various ways, including as forests, land under cultivation, grasslands, land under shifting cultivation, and villages. No virgin forests exist in this area. All secondary ones, which have been degraded by repeated cutting and subsequent shifting cultivation. High forest areas (tree height of 30 m or more) account for about 1 % of the coverage area of this study. By contrast, medium and low forests areas accounts for about 60 % of the total. Shrubs account for about 33 % (Table. I-20).

As mentioned in the section on topography, the study area is at its highest about 800 m above the area. Accordingly, a large variance is not found in the vertical distribution of vegetation. Judging from the current land use, the original vegetation is hardly seen anywhere in lowland areas, where tropical lowland rainforests are supposed to have originally prevailed with *Dipterocarpaceae* as the dominant species, including *Shorea* spp., *Parashorea* spp., *Vatica* spp., *Dryobalanops* spp., *Dipterocarpus* spp., and *Hopea* spp. In the hilly and mountainous districts over 500 m above sea level, tropical lower mountain rainforests (montane oak forests) are gradually seen comprising evergreen broad-leaved trees of *Quercus* spp., *Castanopsis* spp., and *Trigonobalanus* spp.

2. Socioeconomic Environment

2-1 Overview of the Survey Area

2-1-1 Administrative Division and Location

The Marak Parak Consolidation is located between mountains in the southern part of the Kota Marudu District, administratively overlapping the whole mukim (sub-district) Marak Parak and some sections of mukims such as Luba Pelumpung, Talantang, Gana and Simpangan. Since there are no maps delineating mukim boundaries, the location of each mukim cannot be accurately shown. However, the center of the Consolidation is occupied by mukim Marak Parak. The aggregation overlaps Simpangan on the north side, Luba Pelumpung on the west side, Talantang on the northeast side, and Gana on the south side (Fig. I-6). There are a total of 32 villages in the Consolidation, which are mainly scattered along the river. In the past, these communities often moved from one place to another, looking for better soil after the fertility of the surrounding soil had been degraded by repeated shifting cultivation[1). At the present time, however community boundaries have been established, and there is no longer village migration. There are 23 villages in the area covered by the socioeconomic survey (low forest/shrub areas, proposed sites for the Forest Development Project). About two-thirds or 16 of the villages are concentrated in mukim Marak Parak.

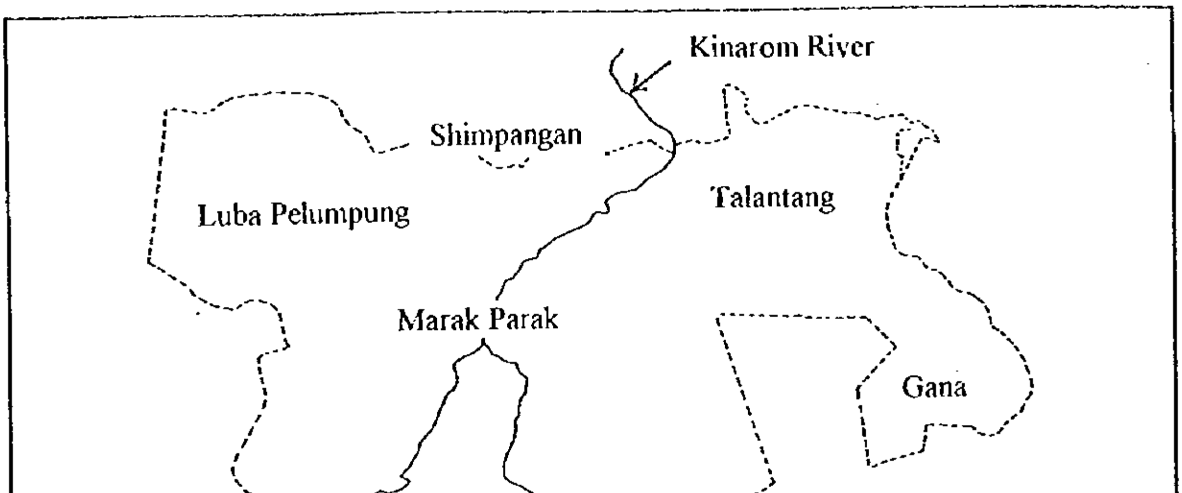


Fig. I-6 Administrative Division of the Marak Parak Consolidation

[1) Such village migration makes significant difference in the identification and location of villages between the locally available map (prepared in 1975) and reality. This is why the study team had to start with the counting, identification and location of villages in the survey area. This work was done by interviewing the people concerned with these villages and the promotional staff as well as conducting reconnaissance based on the topographical map completed in August. In this connection, it was found that 17 villages, the number reported in the Scope of Work mission, was an error resulting from confusion. The Marak Parak consolidation conveniently demarcated in this study was confused with mukim Marak Parak as an administrative division. Since there is also a Marak Parak Village in mukim Marak Parak, a great deal of care should be taken not to confuse these three names.

The surveyed villages are topographically divided into a group of eight villages located on the valley along the Kinarom and another group of fifteen located on slopes and ridges. Many villages along the Kinarom are located within 2 to 3 km of the gravelled main road and are accessible by vehicle throughout the year, except in the villages of Polipikan and Sunsui. These villages are on the opposite sides of the river. A suspension bridge is the only means of crossing the river and there is no bridge for vehicles. When the river floods in the rainy season, vehicles cannot access these villages. On the other hand, there are only logging roads leading to the villages on the slopes and ridges, which are not sufficiently maintained or repaired. As a result it often becomes impossible for vehicles to reach these villages in the rainy season. In addition there are several bridges and roads which have collapsed due to heavy rains and floods which makes it impossible to get to some villages (Kg. Paka, Kg. Melangkap Darat, and Kg. MelangkapTengah) by motor vehicles, even during the dry season.

2-1-2 Population

People living in the consolidation belong to the Dusun ethnic group. As of 1996, there were about 7,000 people living in the aggregation, of whom about 5,600 resided in the survey area. In mukim Marak Parak, whose population accounts for slightly more than 70 percent of the total population of the survey area, people under 50 years of age represent 86 percent while men and women in their thirties account for the highest share. In contrast, people aged 60 years or older account for no more than five percent, indicating that the average life expectancy is short. The number of people in their teens and twenties is relatively small, most likely because the young migrate out to urban areas such as Kota Marudu, and Kota Kinabalu (Fig. 1-7).

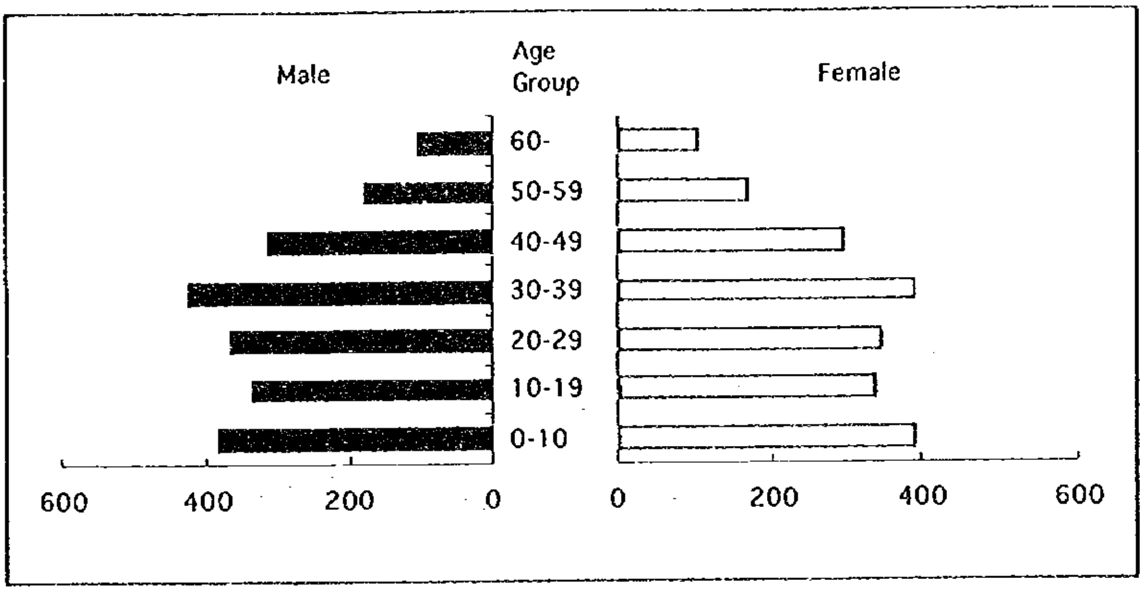


Fig. I-7 Population Structure by Age Group in Mukim Marak Parak

Looking at the distribution of population by village in the social survey area, the populations of the surveyed villages range from 89 persons (kg. Kias) to 350 persons (Kg. Melangkap Tengah), except for two large villages exceeding 600 persons each (Kg. Melangkap Darat and kg. Marak Parak)[2]. Villages which have 100 to 200 people each hold the highest share of 80 percent (Fig. I-8).

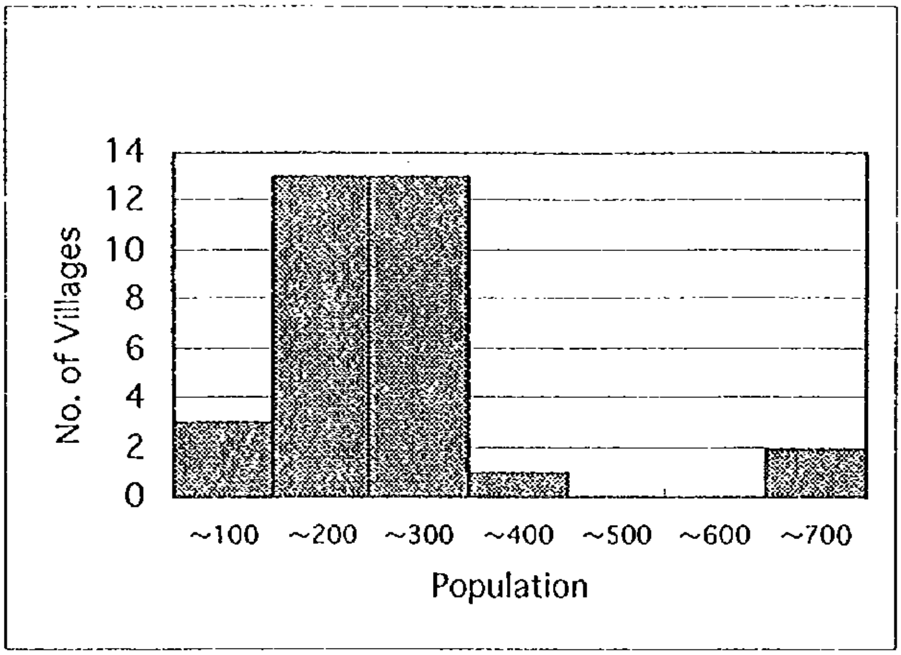


Fig. I-8 Distribution of Population by Village in the Social Survey Area

2-1-3 Living Environment

1) House

A traditional house typical of the survey area is constructed of: rumbia and nipa leaves placed on a wooden frame and has a raised floor, which is surrounded by walls made of bamboo and/or rattan. Many of the relatively rich people in the area often have houses with tin roofs and glass windows. Houses are usually built by the villagers themselves, with the support of the traditional mutual aid system called "gotong royong." In many cases, the people themselves go out into the forests to collect building materials and sawtimber in their villages It takes about one year for a farmer to build a house in his/her spare time.

2) Energy

Electricity is not supplied to the social survey area, with the exception of kg. Marak Parak. Kerosene lamps generally serve as a source of light. Candles and resin are also used. Kg. Marak Parak has a solar power generator which began to transmit power in June 1996. Firewood is collected from forests and used as fuel for

[2] See Attachment 10.

cooking. It is often collected by people on their way to farm land and back home. Its collection is not a role exclusive to women. Relatively high-income households use propane gas in some villages (Marak Parak, Melangkap Tengah, Pongopuyan Baru and Bambangan).

3) Health, Medical Care and Hygiene

Traditional healers called "Bomoh" treat patients in some villages. The only modern medical facility is a clinic which exists in Kg. Marak Parak. The mobile clinic travels from one village to another every several months. Although many villages have gravity pipes, rivers and fountains remain important sources of drinking water, which are often contaminated and cause water-related disease such as diarrhea and cholera. In addition to these diseases, malaria and pneumonia are prevalent. Children often suffer from thalassemia, chicken pox, parasites, and leukemia, as well as from the other illness mentioned above.

4) Education

There are currently only three primary schools in the survey area (Kg. Marak Parak, Kg. Melangkap Darat and kg. Polipikan). Many children cannot go to school for economic reasons as well as reasons of remoteness. There is no junior high school in this area. Many middle-aged and elderly people have never received any schooling at all Even in the case of those who have been to school, graduation is rare, as many of them drop out. There are many illiterate adults, especially female ones.

Nevertheless, many of the local people recognize the importance of education. Some move to other villages or towns where a primary school is located so that their children can be educated. This is one of the factors which has increased the population of villages with primary schools, including kg. Marak Parak.

2-1-4 Economy

1) Agriculture

(1) Shifting Cultivation

Shifting cultivation is the primary means of life in this area. Patches of farmland and fallow fields are extensively scattered around villages. In addition to hill rice, yams, cassavas and maize are also cultivated as staples. Perennial crops like bananas are grown in some cases as well. However, many farms cultivate fruits and vegetables in their home gardens, in addition carrying out shifting cultivation for food crops. These crops are basically for self-consumption and only surpluses are put on the market.

The land under shifting cultivation is often located on the slope. Farmers walk on mountain roads for about thirty minutes to one hour. Two to five acres per farmer under hill rice cultivation and each plot is cultivated only once. The period of fallow lasts ideally until a secondary forest regenerates to "a certain height," but in practice actually ranges from about one to six years. Shifting cultivation has a cycle of operations:(1)site selection, (2)slashing and felling, (3)burning, (4)ploughing, (5)sowing, (6)weeding, and (7)harvesting. Fundamentally, men and women work together. However, site selection is, normally, assumed by men. The farming season lasts from

October to December and from March to April. Even children help their parents perform these operations in many communities. Under the system of "gotong royong" shifting cultivation was traditionally carried out by the collaboration of several farms together. In recent years, however, individual farms have generally come to cultivate crops on their own. The schedule for cultivating hill rice and the division of labor within a household are shown in Table I-5.

Table I-5 Major Activities of the Shifting Cultivation Cycle (for hill rice) Common in Mukim Marak Parak

Work	Period	Division of Labor
(1) Site Selection	May-June	Men
(2) Slashing and felling	June-July	Men and Women
(3) Burning	July-September	Mainly men
(4) Ploughing	October-November	Men, Women & Children
(5) Sowing	October-November	Men, Women & Children
(6) Weeding	November-December	Men, Women & Children
(7) Harvesting	March-April	Men, Women & Children

(2) Smallhold Farming

Some farmers also grow cash crops as well as food crops, in the form of smallhold farming in some villages. Smallhold farming is promoted by several extension agencies[3] for the purpose of settling cultivated land and modernizing agriculture. They encourage farmers to cultivate relatively high-value cash crops such as fruits (passion fruit, durian, etc.), rubber and peanuts. In principle, such extension programmes cover farmland with legal tenure.

Table I-6 Shifting Cultivation and Smallhold Farming

	Land Use	Main Crop	Use	Extension Service
Shifting Cultivation	Intermittent	Food crops such as hill rice, maize, cassava & banana	(Only surpluses sold)	None
Smallhold Farming	Continuous	Perennial crops including fruits and estate crops, and vegetables	For sales and self-consumption	Provision of Fertilizers, Herbicides, & Seedlings or Sales/Subsidies/Technical Advice/Crop Purchase/ Marketing (for registered or approved farmland)

(3) Tree Planting

In the case of mukim Marak Parak, the most important tree species for planting in home gardens and farms include fruits, rubber, coco palm, *Acacia mangium*, rattan and bamboo. As shown in Table I-7, the preferred species are not only marketable but also multipurpose, such as food, building materials, and saw timber.

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[3] See Paragraph 2-2 "Agricultural Development Authority."

Table I-7 Major Tree Species Planted in 17 Villages in Mukum Marak Parak

Species	Number of Villages	Use (in order of Villages' priority)
Fruits (details unknown)	12	Cash, Food
Rubber	11	Cash, Building
Coco Palm	6	Cash, Food
Acacia Mangium	6	Cash, Building
Belunu (fruit)	5	Food, Building, Cash
Langsat (fruit)	4	Food, Building, Cash
Rattan	3	Cash
Bamboo	2	Handicrafts, Cash

* Respondents listed plural species which they thought important and their use.

(4) Domestic Animals

Many farmers breed domestic fowls for cash. Swine, cattle, buffaloes and goats are also bred. Domestic animals run loose throughout farms in many cases. Some villages also share community grazing land (i.e. kg. Marak Parak).

(5) Marketing

To sell farm crops, farmers usually have to go to the market in Kota Marudu[4] ,but bad traffic conditions obstruct their marketing. Generally, farmers walk on logging roads or village paths out to the main road, from which they take a mini-bus or ask logging trucks for a ride. In some villages, farmers have to walk for several hours on steep mountain roads to reach the nearest bus stop. These roads are not well maintained and are broken by landslides in some sections. Some farmers are unable to pay the bus fare[5] . In some villages where there are villagers who have their own cars, farmers ask them for a ride when they go to the town. However, this dependency on the car owners is inconvenient for regular marketing. In kg. Lombiding, those who can afford sometimes rent a mini-bus in groups of eight to sell their crops in the town at the harvesting time. However, it is not practiced regularly as the earnings become small when the rental fee is subtracted from sales[6] A market is opened weekly in Kg. Marak Parak.

2) Collection of Forest Products

Forest are an integral part of the rural economy. Local people collect various forest products, including fruits, honey, wild meats, firewood, medicinal herbs, building materials, and materials for household items. Selangan batu and Kapur are often used as building materials and are sometimes cut for sales. According to forest laws and regulations, native people are permitted to cut down natural trees only for self-consumption. Cutting for sale is an illegal act unless the Forest

[4] The program for smallholders by an extension agency covers the purchase and marketing of recommended crops

[5] A one-way bus ticket to Kota Marudu costs 5 Ringgit.

[6] Usually, a group of eight farmers rents a bus at 80 Ringgit per day.

Service issues a license[7]. The true scale of such illegal logging by local people is still unknown but local people believe that the forests have belonged to them since early times and see no problem in cutting down trees for sale.

2-1-5 Problems for Local People

According to participants in the workshop held during the first study, a primary problem for local people is "low income"[8]. The income referred to here means both agricultural and non-agricultural income. There are three direct causes of "low agricultural income", namely "low agricultural productivity", "bad market access" and "low prices for farm products". The direct cause of "low non-agricultural income" is "the absence of employment opportunities in villages". Arguments on these direct causes are summarized in Fig. I-9[9].

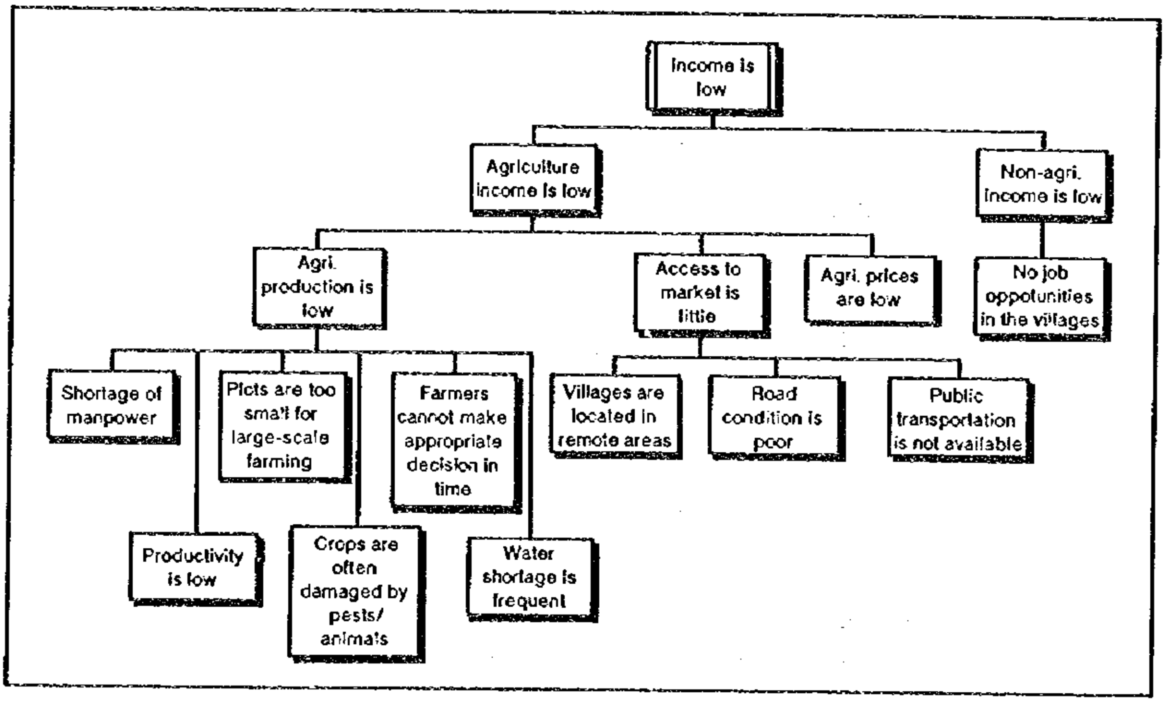

Fig. I-9 Causes of the "Low Income" Problem

7) See Subparagraph 2-4-2 "Native Rights to Use Forests"

8) For the outline and summary of the workshop, see Attachment 7.

9) As the time was limited, arguments on the issues "low prices for farm products" and "the absence of employment opportunities" were omitted at the workshop.

The major discussion showing that "low agricultural productivity" and "bad market access" are direct causes of "low agricultural incomes" are outlined below.

• Low Agricultural Income

"Low Agricultural Income" is the result of the following:

① Labor required for agriculture is insufficient. A number of people have moved to urban areas, such as Kota Marudu, in order to obtain employment and better education. In addition, many young people have no interest in agriculture and there are no incentives for working in the agricultural sector.

② Land productivity is low. Soil is not very suitable for agriculture. Furthermore, many farmers are engaged in traditional agriculture (shifting cultivation) and have little knowledge of modern agricultural technology. As a result, they cannot improve productivity. Additionally, since they do not have enough funds to purchase modern farming machines, farmland is not adequately prepared for cultivation. The quality of seeds is not good either, since farmers use seeds which they have collected themselves rather than using improved varieties.

③ Agricultural expansion is difficult. The area under cultivation per person is too small and farmers have insufficient funds to expand. Since they know nothing about agricultural financing, they cannot borrow the necessary funds to cultivate land on a large scale. Although a legal title is a requirement for financing, many farmers do not have such a title and therefore cannot receive any loans. They cannot establish their titles because the land authorities are slow in processing applications for Native Title (a deed issued to natives)[10].

④ Crops are damaged by pests before harvesting. Farmers cannot control pests for lack of knowledge. Moreover, pesticides are too expensive for them to purchase.

⑤ Agricultural operations cannot be timely performed in the absence of accurate meteorological information.

⑥ Water often runs short.

• Poor Market Access

Poor markets access results from the following:

① Many villages are remote and isolated.
② Roads are in bad condition.
③ There are no public means of transportation

2-2 Rural Development Institutions

Rural development institutions/organizations which are active at the village level in the study area are shown in Table I-8.

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10) For Native Title, see Subparagraph 2-4-1 "Native Land Ownership/Usufruct Rights".

Table I-8 Rural Development Institutions/Organizations in the Survey Area

Field of Development	Institution/Organization
(1) Community Development	Village Development and Security Committee (JKKK)
(2) Agricultural/Forestry Development and Extension	District Agriculture Office
	Rural Development Cooperative (KPD)
	Sabah Rubber Fund Board (SRFB)
	SAFODA/Private Free Farming (PTF)

2-2-1 Community Development

Village Development and Security Committee (JKKK)

The JKKK is a subsystem of the District Community Development Office, which is set up in every village. It serves as a mediator between the government and local people in connection with development programmes. The administration of development by the District Community Development Office is divided into the constituencies of Langkon and Tandek. One Community Development Officer (CDO) is assigned to each constituency. Pemaju Mukim having jurisdiction over JKKK at the mukim level is assigned to every mukim under the CDO.
According to a government document produced[1] in 1985, JKKK has five primary functions:

① To ensure that the implementation on village projects are properly carried out;

② To ensure that members of the community actively participate in the development projects of the community;

③ To ensure that the projects of the People's Economic Programme (Rancangan Ekonomi Rakyat) are implemented in the respective community;

④ To ensure that all the amenities for the respective kampongs are undertaken by the agencies concerned;

⑤ To guide and assist the people in obtaining maximum benefit from the development projects implemented by the government in the respective community.

To fulfill its responsibilities, JKKK should undertake its duties in the following five fields: (1) development, (2) health and hygiene, (3) security, (4) education, and (5) unity. The members of JKKK are fundamentally villagers, who receive allowances from the District Office. Ketua Kampung[2] as a traditional village head is also a member of JKKK and managers JKKK in cooperation with the chairman (JKKK Pengurusi)
When the people concerned with churches as well as the agricultural extension officers come to villages, they will also serve as members of JKKK. Meetings of JKKK and

[1] Peraturan Dan Perialanan Jawatankuasa Kemajuam Dan Keselamatan Kampung Dan Jawatankuasa Kemasyarakatan Dalam Kampung, Chief Minister's Office, July 1995

[2] The chiefs of villages are not legal representatives of villages but secure an interface between the local government and villages through the District Native Chief Office. They take charge of customary laws in their communities, mediate parities in dispute in accordance with such laws and determine on land distribution within their boundaries. (see Subparagraph 2-3-2 "Native Land Ownership/Usufruct Rights"). The relation between chiefs and the Native Chief Office is as hierarchical as that between JKKK and the Community Development Office. The director of the Native Chief Office is called District Chief (Ketua Daera), under whom Native Chief (Ketua Anak Negri, shortly KAN) is placed in every constituency and moreover Deputy Native Chief (Wakil Ketua Anak Negri, shortly WKAN) is placed in every mukim. The chiefs of villages were formerly elected by villagers but have recently been appointed by the members of the State Council from the constituency concerned in many cases.

local people are held monthly in many villages, providing a forum for discussing project proposals and community problems.

2-2-2 Rural Development and Extension[3)]

1) District Agriculture Office

The District Agriculture Office is a branch office of the State Department of Agriculture located in Kota Marudu. The office is divided into the four sections of: (1) Development, (2) Extension, (3) Home Economics, and (4) Farmers' Enterprises and performs the activities listed below.

Table I-9 Major Activities of the District Agriculture Office in Kota Marudu

Section	Major Program/Activity
Development	• Review of applications for transfer/use of state land for agriculture • Paddy rice subsidy • Hill rice subsidy
Extension	• Training and Visiting (promotion of fruit trees) • Smallholder Assistance Scheme (promotion of estate crops) • Promotion of short-term crops • Promotion of long-term crops
Home Economics	• Training of female farmers
Farmers' Enterprises	• Promotion of farmers' enterprises

The District Agriculture Office carries out its extension activities by organizing farmers at the village level through (1)Training and Visiting and (2)Smallholder Assistance Schemes by the Extension section, and (3)training of female farmers by the Home Economics section.

(1) Training and Visiting

Training and Visiting (TV) involves promotion of fruit trees by organizing farmers into groups of 10 male farmers or more (Ahli Kumpulan Tani) at the village level. Group members are given fertilizers, pesticides, seedlings and seeds for of charge and are trained in planting, cultivating and harvesting crops. The extension staff comprises 15 members, who visit these groups in villages every two weeks to give them guidance. A total of 75 groups were active in Kota Marudu (as of April 1996).

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3) For SAFODA's PTF programme, see another chapter outlining it.

(2) Smallholder Assistance Scheme

The Smallholder Assistance Scheme promotes the group farming of estate crops (coco palm, oil palm, and rubber) by organized smallholders. These crops are cultivated in grouped farmland with an area of 300 to 400 acres on average. When crops are planted, a one-time allowance of RM300 per acre will be paid to farmers by way of wages. Moreover, the cost of maintenance will be paid every year until crops grow to a certain level. In the case of oil palm, for instance, RM100 per acre will be paid in each of three years. In addition to the above, seedlings, fertilizers and pesticides will also be distributed to farmers.

(3) Home Economics

The Home Economics section trains female farmers by organizing them into groups (Kumpulan Keluarga Tani) at the village level for cooking, child care, sewing, and farming. The extension staff includes a total of nine female members, who visit these groups in villages every two weeks to give them guidance. A total of 55 groups of farmers are active in Kota Marudu.

2) Koperasi Pembanguanan Desa (KPD)

KPD is a quasi-government agency and implements its activities in cooperation with the District Agriculture Office (i.e., seed supply). KPD was set up in 1979 in the Kota Marudu district primarily to provide technical support to farmers so that they may become modern producers and entrepreneurs. The principal programme is contract farming launched in 1986. The term of contract is five years (renewable). The programme is promoted to cultivate hill rice, sweet potatoes, maize, peanuts and cassavas as short-term crops and passion fruit and other fruits as long-term ones. KPD organizes contract farmers into male or female groups of 5 to 10 men or women who receive training in cultivation techniques. Crops are purchased and marketed by KPD. In this case, KPD pays the selling price less the fee to farmers. For example, passion fruit can be sold at RM0.4 per kilogram. However, KPD takes RM0.1 and farmers will receive the balance as earnings. KPD does not distribute agricultural materials to farmers at its cost nor does it subsidize them, rather it sells fertilizers, pesticides and herbicides at market prices, as well as good-quality seeds obtained from the District Agriculture Office.

KPD set up an office in Kg. Marak Parak in 1992 as a base of activity in mukim Marak Parak. Six staff members including a driver are stationed at the office, which covers 36 groups (in April 1996). These groups hold a meeting monthly and representatives of the groups gather in Kg. Marak Parak every three months to confer with KPD.

3) Sabah Rubber Fund Board (SRFB)

SRFB promotes rubber cultivation through contract farming. It provides rubber seedlings and fertilizers to contract farmers at its cost and grants a subsidy of RM600 per acre to rubber plantations. Rubber collected by farmers is purchased by SRFB at RM2.4 per kilogram. As rubber can be collected at a rate of 5 or 6 kilograms per acre a day, the daily income of farmers per unit area is about RM10 to RM14.

Currently, SRFB is planning the Rubber Scheme Project in mukim Marak Parak. This project is intended to create rubber plantations accompanied by a settlement to be established on an area of about 5,000 acres of the State Land. It is planned that a school will be constructed on the settlement and a rubber plantation of 15 acres, a quarter acre of land and one house per household will be leased to participants. The cultivation of the state land and the planting and tending of rubber trees will be undertaken by contractors employed by SRFB. The Board expects a total of 300 families from four villages in this mukim to participate in this project. It must be noted, however, that the District Agriculture Office has opposed the project on the ground that the soil of the site is unsuitable for rubber cultivation. Nevertheless, SRFB expects this project to be approved in 1998 or 1999.

2-3 Overview of the Surveyed Villages

2-3-1 Location and Access

The location of the five villages surveyed is shown below.

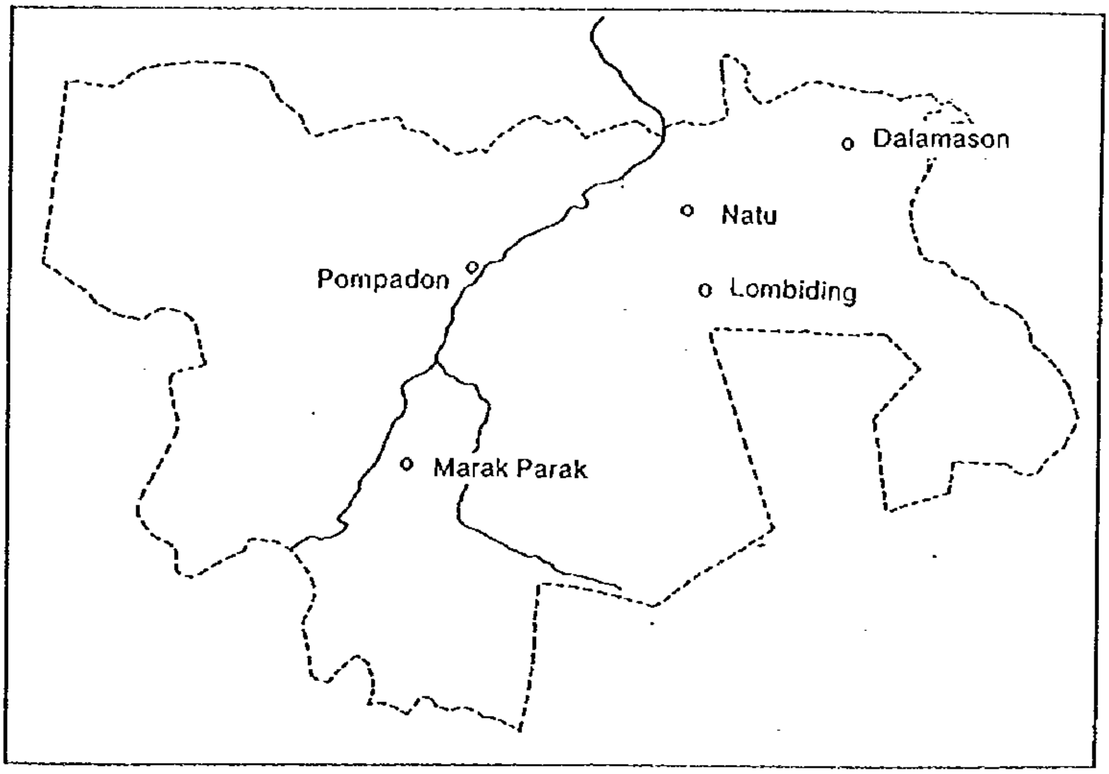

Figure I-10 The Location of the Surveyed Villages

Kg. Marak Parak and kg. Pompadon are located in a basin where the principal gravel road and the Kinarom River run north south.

Kg. Dalamason is located on a mountainside to the left of the Manuradiang' River, while the east side of the village (ridge) adjoins the Linkarau Forest Reserve. Kg. Natu and kg. Lombiding are located along a logging road which runs west to Gana.

Since kg. Marak Parak is located along a main road and kg. Pompadon is two to three kilometers away from a main road, both villages are easily accessible by car and mini-bus stops can be reached on foot. However, it is impossible to drive cars to the villages on the hillsides (which include Kg. Dalamason, Kg. Lombiding and Kg. Natu) during the rainy season. Even in the dry season, the only transportation available is logging truck. To get to the nearest bus stop, they have to walk for more than three hours along logging roads.

2-3-2 Population

The Community Development Office released table I-10 below, showing the population of the villages in the area.

Table I-10 Populations of the Surveyed Villages

	Total Population			Households	Average Number of Household Members
	Total	males	females		
Marak Parak	627	314	313	157	4.0
Pompadon	156	75	81	32	4.9
Dalamason	265	NA	NA	NA	NA
Lombidin	186	NA	NA	NA	NA
Natu	140/(30)*	66	74	25	5.4

Source: The Kota Marudu District Community Development Office

( )* the actual number of people living in Kg. Natu

As already mentioned, Kg. Marak Parak is one of the two largest villages, with over 600 people. Increases in the number of villagers and development in Kg. Marak Parak resulted from the building of roads, elementary schools, and the Sidang Injil Borneo (SIB) Church. These facilities led neighboring people to move to Kg. Marak Parak. The remaining four villages have populations of between 100 to 300, the standard population range of villages in the area. However, 80 percent of Kg. Natu people have left their homes to get jobs or to be educated and only about 30 people actually remain in Kg. Natu. The reason why absentee villagers who have left Kg. Natu are still registered as Kg. Natu villagers is that they own farmland in the village. The Village head of Kg. Natu, believes that Kg. Natu people will come back when the village develops.

2-3-3 Income

1) Income Distribution[1)]

People in the surveyed villages are poorest among others in Sabah State. The Seventh Malaysia Plan (1996 - 2000) determined the poverty line as an average monthly income of RM 601. Looking at the data, about 90 percent of the families in the five villages, and when Marak Parak is excluded, 100 percent of the families in the other four villages, can be classified as living below the poverty line. These figures show that the income levels of the villages were low when compared to the incidence of poverty in rural Sabah in 1990, 39%, and the estimated incidence in 1995, 33% (source: Economic Planning Agency). Income of less than half of the poverty line level is classified as "absolute poverty". Approximately eighty percent of the five villages, and almost all the households in the four villages, excluding Marak Parak, are classified as being at levels of "absolute poverty". According to the Economic Planning Agency, the incidence of absolute poverty in rural Sabah in 1995 is estimated at 7.2 percent.

Table I-11 Income Distribution by Village (Estimate)

	Number of Families	Estimated Number of Families at Average Monthly Income (RM)								
		0~99	100~199	200~299	300~399	400~499	500~599	600~699	700~799	>800
kg. Marak Parak	117	15	20	35	28	4	-	-	12	3
kg. Pompadon	35	3	25	5	-	-	-	1	-	1
kg. Dalamason	70	58	10	1	-	1	-	-	-	-
kg. Lombiding	52	46	5	1	-	-	-	-	-	-
kg. Natu**	12	12	-	-	-	-	-	-	-	-
Total	286	134	60	42	28	5	-	1	12	4

* The total number of families by average monthly income estimated by the villagers participated in PRA

** Families actually living in Kg. Natu. The average family income of Kg. Natu people living outside the village is estimated to range from RM 400 to 500.

Among the surveyed villages, Kg. Marak Parak is ranked at a relatively higher level, but even there, about 80 percent of households are estimated to be "poor" and about 60 percent, "absolute poor". On the other hand, in the remaining four villages, virtually all families live at the "poverty level". Almost all Pomapdon household incomes are over RM 100, while almost all household incomes in Kg.Dalamason, Kg. Lombiding, and Natu are under RM 100, indicating that their economic conditions are more serious. The number of households by average monthly income in the surveyed villages shows that income is closely related to topography and access to main roads[*].

2) Sources of Income

The difference in income is caused by its source. Table I-12 shows income sources (main occupation) by average monthly income. It indicates that households earning less than RM 400 derive their income from farming. Farmers and non-farmers seem to diverge at the RM 400 income level. Among farmers, subsistence shifting cultivators earn less than RM 100 a month only. Their source of income comes from surplus food crops and fruits from the forest. This means that their income is not only low but also unstable. More than 90 percent of the households in the surveyed villages engage in agriculture, of which nearly 50 percent are estimated to be such subsistence farmers. Farmers earning more than RM 100 grow cash crops often with assistance from extension agencies. Rubber is a popular cash crop. Some farmers gain their income from irregular wage labor, which is available only in Kg. Marak Parak and Kg. Pompadon.

[1] To obtain data regarding income, Income Mapping, one of the PRA (Participating Rural Approach) methods, was used. (The estimated number of families and main occupation is split using RM100 monthly income units. However, PRA could not be conducted in kg. Natu. Instead, the village head was interviewed to collect the relevant data.)

Table I-12 Income Sources

Average monthly Income (RM)	Estimated Number of Families*	Percentage	Main Occupation
0~99	134	47 %	• Subsistence level shifting Cultivation • Pensioner
100~199	60	21 %	• Subsistence level shifting cultivation + poultry raising • Subsistence level shifting cultivation+ growing rubber • Subsistence level shifting cultivation+ wage labor
200~299	42	15 %	• Subsistence level shifting cultivation+ growing rubber • Subsistence level shifting cultivation + KPD contract farming • Subsistence level shifting cultivation+ wage labor
300~399	29	10 %	• Subsistence level Shifting cultivation+ growing rubber
400~499	5	2 %	• Retailer • Public servant
500~599	-	-	--
600~699	1	0 %	• Contract worker
700~799	12	4 %	• Public worker
>800	4	1 %	• Teacher • Public Worker
Total	286	100 %	

* total number of families by average monthly income estimated through PRA

3) Average Monthly Income and Occupation Structure

In all villages, households earning less than RM 400 a month constitute between 80 to 100 percent of the total and farming is the predominant occupation (Fig. I-11). In Kg. Marak Parak and Kg. Pompadon, there are more farmers who earn above RM 100 by growing cash crops with assistance from the SRFB and the KPD, than those engaged in subsistence level shifting cultivation only (where average monthly income is under RM 100). However, while more than 50 percent of Kg. Marak Parak farmers earn RM 200, most of Kg. Pompadon farmers earn less than RM 200. In the remaining three villages different conditions exist, with over 80 percent engaging in shifting cultivation. In Natu especially, all the households are engaged in shifting cultivation without assistance from extension agencies.

In contrast, in Kg. Marak Parak, non-farmers (with average monthly income over RM 400) accounts for 15% of the population, which makes up nearly 90% of the non-farmers in the whole surveyed villages. The relatively high ratio of non-farmer in Kg. Marak Para could be attributed to the presence of an elementary school and a clinic, which would create more employment opportunities than in the other villages. In addition its large population could provide sufficient number of potential customers for retailers to start business.

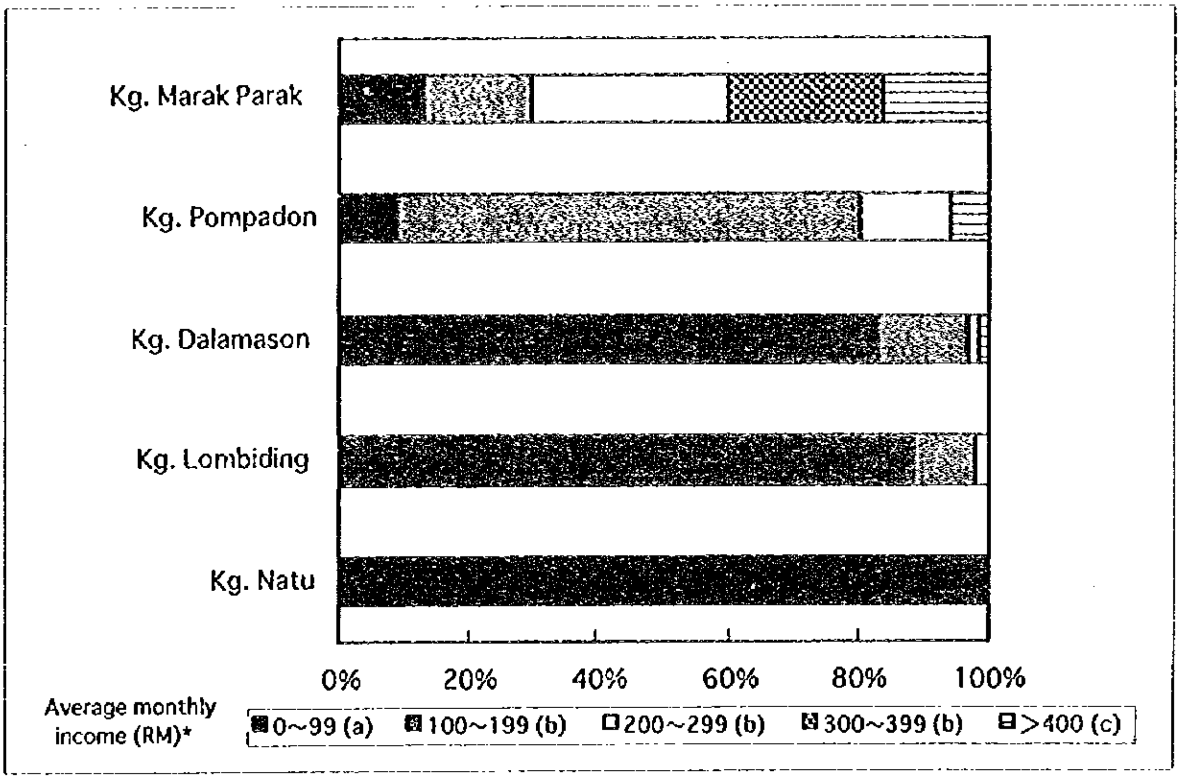

Fig. I-11 Village Occupation Structure against Average Monthly Income

* (a) Subsistence shifting cultivation
(b) Shifting cultivation + cash crops, poultry raising, wages / (c) Non-farming

2-3-4 Basic Infrastructure

With the exception of Kg. Marak Parak, the infrastructure in the villages surveyed is almost at the same level, with only basic facilities existing. All five villages have community halls and gravity piped water systems. However, in Kg. Natu, the community hall is not in use as it is located far from the road. In addition, due to a break-down of the water supply system, some residents have to walk to the rivers to get water.

Kg. Marak Parak has the most developed infrastructure when compared with the other villages. It has a clinic, the only one in the Marak Parak Consolidation, and an elementary school which is one of only three schools in the Consolidation. Moreover, a solar power system has been established which makes it the only village in the whole Consolidation with electricity. There is also a market place where a weekly market is held. There are no elementary schools in Kg. Pompadon and Kg. Dalamason but children go to school on foot or by mini bus.

2-3-5 Extension Activities

Extension services are available only in the villages that are easily accessible. In Kg. Marak Parak, there is a KPD office, the base for KPD activities in the area. A Farmer's Group organized by District Agriculture Offices is also active. SAFODA/PTF and SRFB also operate, even though on a smaller scale. Some villagers in Kg. Pompadon and Kg. Dalamason participate in SRBS's "Smallholder's Scheme" and grow rubber on a group basis. On the other hand, in Kg. Lombiding and Kg. Natu, villagers do not receive any extension services. The reason that no support is provided by the extension agencies is that it is considered to be difficult to undertake regular extension activities and to transport farm products from these villages as the only access roads, which are the logging roads are in poor condition. Furthermore, once the logging is over, the roads would be abandoned and not maintained, which would make extension activities and product transportation virtually impossible.

Table I-13 Summary of the Surveyed Villages

	Kg. Marak Parak	Kg. Pompadon	Kg. Dalamason	Kg. Lombiding	Kg. Natu
Population	627	156	265	86	140 (30)*
Mukim	Marak Parak	Marak Parak	Gana	Talantang	Marak Parak
Location (approximity to a graveled road by car in dry season)	Low land (0 minute)	Low land (10 minutes)	Low land~Hill (10~20 minutes)	Hill (40~50 minutes)	Hill (40~50 minutes)
Degree of Rural and Agricultural Modernization	. Gravity piped water . Electricity . Primary School . Health Clinic . Market place . KPD office . KPD program . SAFODA/PTF	. Gravity piped water . KPD program . SRFB program	. Gravity piped water . SRFB program . SAFODA/PTF	. Gravity piped water	. Gravity piped water

( )* actual number of people living in Natu

2-3-6 Development Needs

Lack of the adequate infrastructure in the surveyed villages, excluding kg. Marak Parak, is received as the major constraint to the community development. Above all, improvement of roads is considered to be of utmost importance, especially for kg. Dalamason, kg. Lombiding, and kg. Natu, where the logging roads need to be replaced by permanent ones to secure access to the town.

Another obstacle to the community development is the fact that administrative procedures required to gain legal ownership of land take too long. Since almost all of the people in the surveyed villages are farmers, security of land resources are very important and establishment of legal ownership is indispensable. In addition, legal title to land is required in order to receive support from government farmland extension agencies that are necessary for modernization of farm management.

Finally, many of the villagers derive their income from unreliable farming sources, and want job opportunities to earn money.

2-4 Land Ownership/Use

2-4-1 Native Land Ownership/ Usufruct Rights

1) Land Ownership/Usufruct Rights under Customary Law

In the surveyed villages, the surrounding land is customarily considered as the common property of the community, from which any community members could obtain private land through certain customary procedures (Fig. I-12). Land matters, such as distribution, adjustment, and conflicts, are traditionally mediated by Ketua Kampung (village head) who are in charge of customary laws.

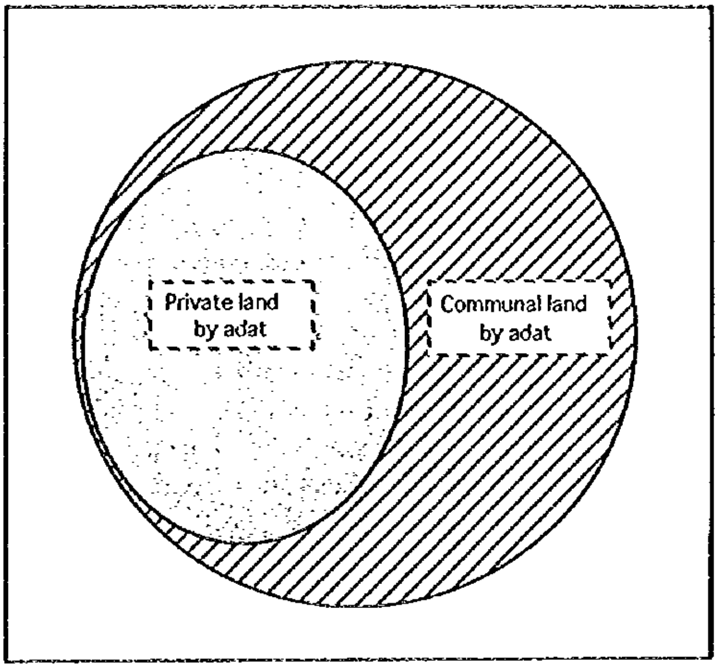

Figure I-12 Land Ownership/Usufruct Rights under Customary Law

According to the village elders, there used to be no concept of private/permanent land ownership. All the land inside community was common land to which any in the community could access. A family which claimed land first had usufruct right or temporary ownership of the land. The land would belong to the family as long as agricultural crops (hill rice, cassava, et) are grown on it. Once crops were no more cultivated on the land, the temporary ownership (or the usufruct right) was automatically voided. Then the land would become community property again, which, after a certain fallow period, could be cultivated by any community member with a permission from the village head. However, lately as privatization of farmland spreads, many villagers carry out shifting cultivation on their own land and the traditional land utilization system with temporal ownership has begun to disappear.

For a villager to establish private and permanent land ownership through customary law, the following customary procedures are required:

① The villager informs the village head which part of the available land he/she wants.

② The village head then calls interested parties (who own land adjoining the said land) and holds a meeting.

③ The meeting makes an agreement delimiting a rough border.

④ The villager goes to the said land with the interested parties to confirm the border.

A private land border established in this manner is normally marked with sticks, stones, or a name written on bark. Members of the community therefore know who is the owner of the land. In the case of a border dispute, the village head will arbitrate.

2) Land ownership/Use under Modern Law (rights under the provisions in Chapter 68 of the Land Ordinance)

It is provided in Chapter 68 of the Land Ordinance enacted in 1913 in Sabah state that to protect the right to land for natives, native customary rights (NCRs) to any state land that satisfies certain requirements shall be granted to natives. Moreover, as one of such rights, the title known as customary tenure is granted to them (Fig. I-13). To establish NCRs and customary tenure, any native must submit an application for such rights to the Collector[1]. The state land to which customary tenure is granted upon the application shall be deemed as being alienated land and a native title shall be issued as an official deed giving legal authority for owing the said land.

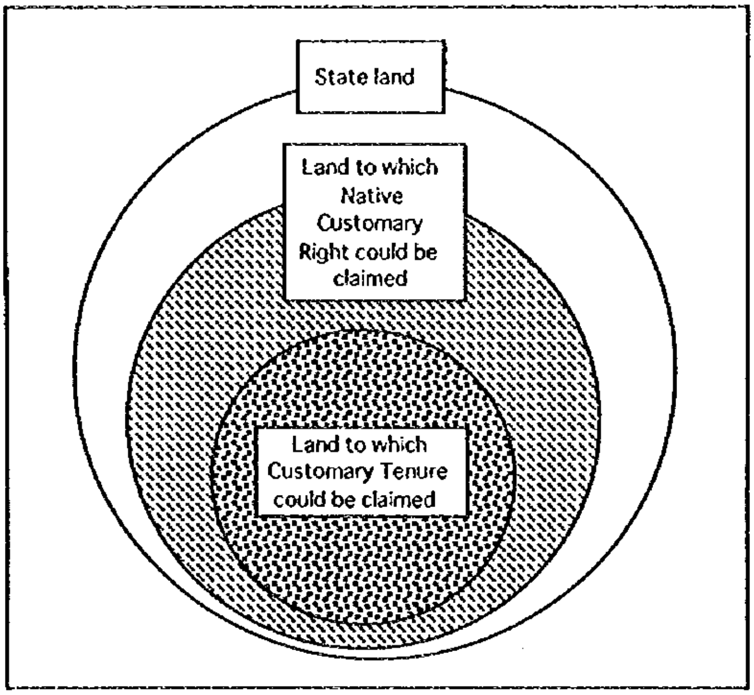

Fig. I-13 Land Ownership/Usufruct Rights under Modern Law

(1) Native Customary Rights (NCR)

According to Article 13, Chapter 68 of the Land Ordinance, when the state government receives an application for the use/lease of state-owned land from government agencies, companies or individuals, it should notify the

[1] In Kota Maruru Country, the District Officer and the Assistant District Officer judge the appropriateness of claims on behalf of the Assistant Collector of Land Revenue (ACLR).

native who claims native customary rights (NCRs) to that land so that the claimant can formally claims NCRs. If NCRs are requested within the specific period, the Collector shall judge the appropriateness of the claim. When said NCRs are established by his judgment, the state government must take the following administrative procedures. The government must either: 1) Pay money as compensation to natives having NCRs to establish the title to said land for the state; or 2) Grant the title to the native concerned.[2)]

Terms and conditions applicable to native customary rights are as follows (Article 15):

① Land possessed by customary tenure;

② Land planted with fruit trees, when the number of fruit trees amounts to twenty and upwards to each acre;

③. Isolated fruit trees, and sago, rotan, or other plants of economic value, that the claimant can prove to the satisfaction of the Collector were planted or upkept and regularly enjoyed by him as his personal property;

④ Grazing land that the claimant agrees to keep stocked with a sufficient number of cattle or horses to keep down the undergrowth;

⑤ Land that has been cultivated or built on within three years;

⑥ Burial grounds or shrines; and

⑦ Usual rights of way for men or animals from rivers, roads, or houses to any or all the above.

(2) Customary Tenure

Chapter 68 of the Land Ordinance authorized lawful ownership or "Customary Tenure" that allows natives over 18 years old who have owned or cultivated land for three or more consecutive years to own a maximum of 20 hectares (about 50 acres).[3)] Customary tenure shall confer upon the holder thereunder a permanent heritable and transferable right[4)] of use and occupation in his land. At the same time, the holder shall be held responsible for maintaining his farmland in such manner as may be prescribed. He shall also be required to register his land by entry in the Native Title Register to receive a native title. The native title is a deed certifying that his land is alienated from the state.

To establish Customary Tenure for land owned under customary law, ACLR authorization is necessary. This step is carried out as part of the application process for Native Title. Natives, therefore, should apply for Native Titles first in order to obtain land ownership rights under modern law[2)3)4)].

2) For land given by the state government, Native Title is issued through the usual procedures.

3) Natives are able to hold more than 50 acres of land, however they are required to pay a specific premium to rent land from the state government.

4) Part 1, of article 17 of the Land Ordinance prohibits the selling and buying of land between non-natives and natives. When non-natives purchase land from natives they are required to apply to the state premier for authorization, and get an agreement that the native cedes the land rights. The non-native will then pay a premium and rent land from the government.

(3). Native Title (NT)

Not a few villagers apprehend a possibility that their land ownership/usufruct infringed right may be violated by government development projects. In order to protect their vested rights, many of them have tried to establish legal tenure by applying for the Native Titles. Another incentive for land application is that legal title is required to get agricultural extension services from the government. In general, it is a custom that, before applying for a Native Title, a villager discusses it with the village head. The village head verifies that no duplicate application have been made, and sometime makes adjustments where necessary.

For various reasons, some villagers do not apply for ownership with Native Title, even if they own/use land under customary law. They may plan to have their children apply, or cannot afford to pay application costs and the charges or transportation fees to get to the District Land and Survey Office. The fact that they have not yet applied, therefore, does not necessarily mean they have given up on gaining legal ownership.

a. General Procedures for Receiving Native Title

According to the District Land and Survey Office, Kota Marudu, administrative procedures for a Native Title application consists of the following four steps: (1) registration of application; (2) review of the application; (3) survey of the land; and (4) registration of land.

An application for a Native Title is required to be submitted through the District Land and Survey Office to the Assistant Collection of Land Revenue (ACLR)[5], together with a simple (handwritten) map. Items to be filled out on the application include purpose of use, location of the applied plot and its size, etc.

Review of the land and application is carried out in the following three steps; 1) inquiries to the relevant government agencies; 2) review by the Land Utilization Committee; and 3) review by the Director of the State Department of Land and Survey.

First, an application is sent to the Land and Survey Department in Kota Kinabalu to check if the applied plot is located in the area classified as the State Land, which is alienable. The application may be rejected, for example if the plot is located inside the permanent forest area, which is managed by the Forestry Department and is unalienable. After an interview by the Department, the application is sent back to Kota Marudu to be reviewed by the concerned local agencies such as the District Agriculture Office and the District Forestry Office. The Agriculture Office examines if the soil as well as the climatic condition of the applied site is suitable for an agricultural use (for hill rice, rubber, fruit trees, etc.) specified in the application. The Forest Office finds out if there exist natural trees with timber value on the applied plot. If any timber trees exist, the Forest Office may reject the application or, alternatively, may suspend it for a certain period so that they could be

[5] In the case of Kota Marudu country, the District Officer and the Assistant District Officer work as the ACLR.

extracted before the legal ownership of the applied land is established. Secondly, after examinations by all the concerned agencies are complete, the application is reviewed by the Land Utilization Committee, which meets four times a year. The Committee, which consists of representatives from the State Department of Land and Survey approve the application. Lastly, if an application is approved by the Committee, it is sent back to the State Department for a final review by the Director.

If the Director approves the application, a survey map will be prepared and a Native Title will be issued.

b. Land under Application (LA)

A complicated nature of the administrative procedures has caused delays in the processing of land applications. As a result, there exist a great number of applied lands in the area to which Native Titles have not yet been granted, which are locally called "land under application (LA)" (steps 4) to 17) in Attachment 18). According to the District Land and Survey Office, more than 22,000 applications[6)] were registered between the period 1969 to 1996 in Kota Marudu, of which only 3,000 to 3,500, little more than 10 percent of the total, have been put before the Land Utilization Committee, the final step of district-level review (step 7)): the remaining are the LAs that are either being reviewed or not yet reviewed. The processing of a single application takes an average of seven to ten years. There are even cases where applications filed in 1960s are still classified as LAs while the applicants await Native Titles.

For the above reasons, both government extension agencies and local people often consider the LA as *de facto* land with Native Title, the alienated state land, though it is not supported by any legal basis. However, their viewpoints differ as to the exact time that the land is *de facto* alienated when an application is registered; government agencies, when an application is approved by the Land Utilization Committee or land is surveyed (or to be surveyed) by the land authorities[7)].

c. Information Gathering on Forms of Land Ownership at the Village Level

Fig. I-14 shows the land ownership forms in the surveyed villages classified by the status of Native Title application.

It is virtually impossible to grasp the exact status of overall land ownership in the surveyed villages. The only concrete data available from the land authorities are those concerning Native Titles and surveyed LAs, which are plotted on the land maps (the standard sheets) produced by the State Department of Land and Survey. However, with

6) After completion of the field survey, it was indicated that number of applications was only 1,788 (1996) on the statistics by the Land and Survey Department. There is a big difference in the number. Either way, acceleration of land application processing is necessary as prior condition for implementing the project.
7) In this connection, SAFODA/PTF Programme is carried out in the lands with Native Title and the surveyed lands (including to be surveyed).

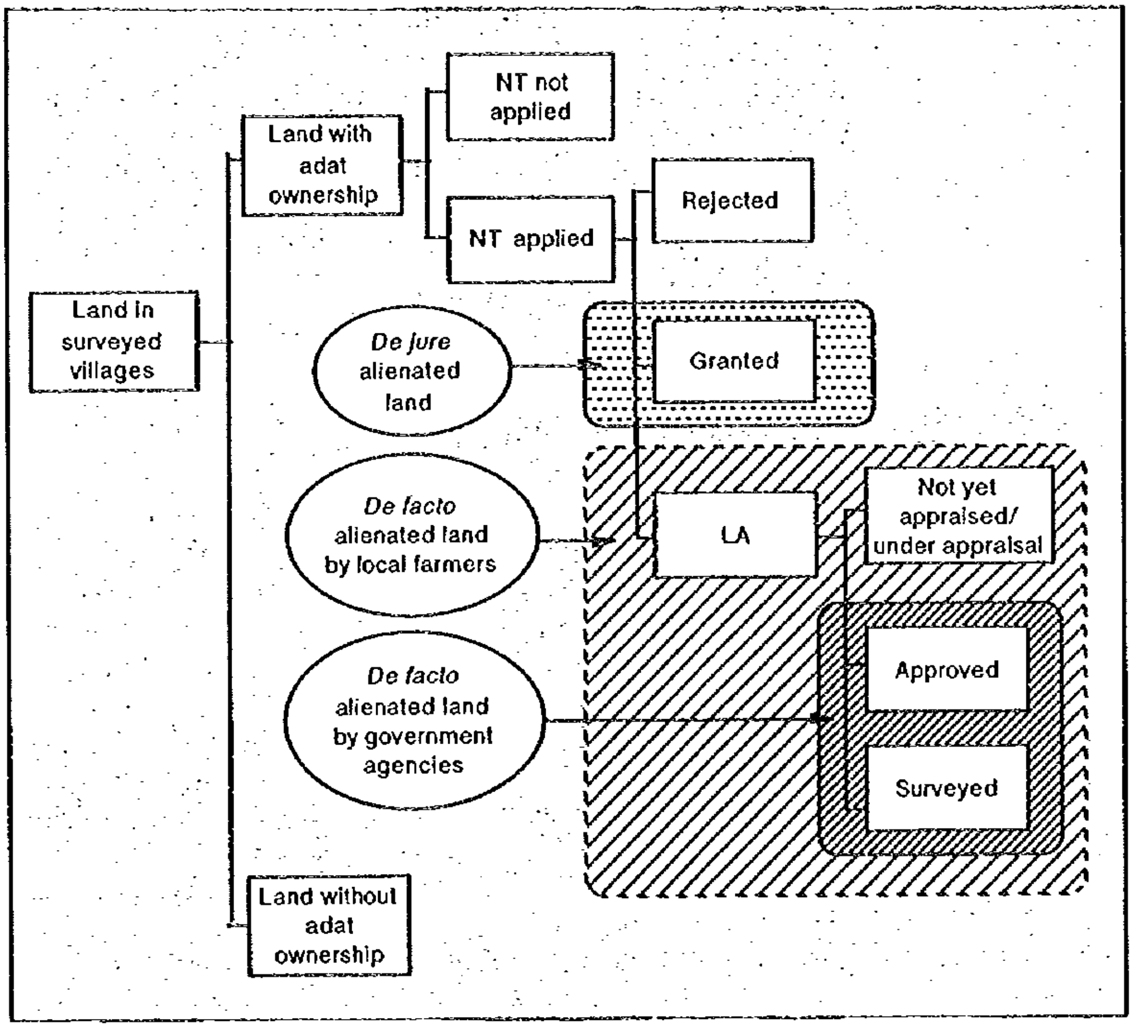

Figure I-14 Private Land Ownership under Customary Law and Native Title

no administrative boundaries indicated on the sheets, the actual status at the village level is not still clear. Moreover, as already mentioned, the number of the plots with Native Titles and the surveyed LAs together is very small, compared to that of the total land applications. With regard to the remaining, the LAs that are not yet processed or being reviewed, data are not organized in a systematic manner and only individual applications with attached handwritten maps exist at the District Land and Survey Office. Therefore, to know the state of land ownership/applications at the village-level, even the District Land and Survey Office depends on the village heads, who are traditionally in charge of land allocation and coordination matters in their respective villages, as information sources, since it is a custom for a villager to inform the village head before he/she files an application at the land authorities. There are even cases where villages, such as kg. Pompadon and kg. Lombiding, have their own maps on which all the Native Title lands and LAs are plotted (Attachment 11 and 12).

3) The Coexistence of Customary and Modern Laws

Customary and modern forms of land ownership/use are not only co-existent but also overlap in part (Fig. I-15). According to the customary laws, the village land is classified into private farm land and common land (open-access land): whereas the land is basically considered as the State Land by the modern laws. Traditional land ownership/use by customary laws are respected under the modern laws but not always supported. In contrast, not all the lands with potential native rights that are recognized by the modern laws have been claimed by local people and their legal status established.

For example, as for private lands, distributed through the customary laws, Customary Tenure is granted to and Native Titles issued to those that satisfy certain criteria only. However, as mentioned earlier, it can take seven to ten years to obtain Native Titles and most of the land applications are either being or not yet appraised. In addition, there are private lands to which their customary owners have not applied for the titles yet. The situation is similar in the case of the Native Customary Rights. While key informants from the surveyed villages claim that most part of the common land and the private land without Native Titles or LAs is covered by the "customary rights", they are not necessarily coincident with the Native Customary Rights.

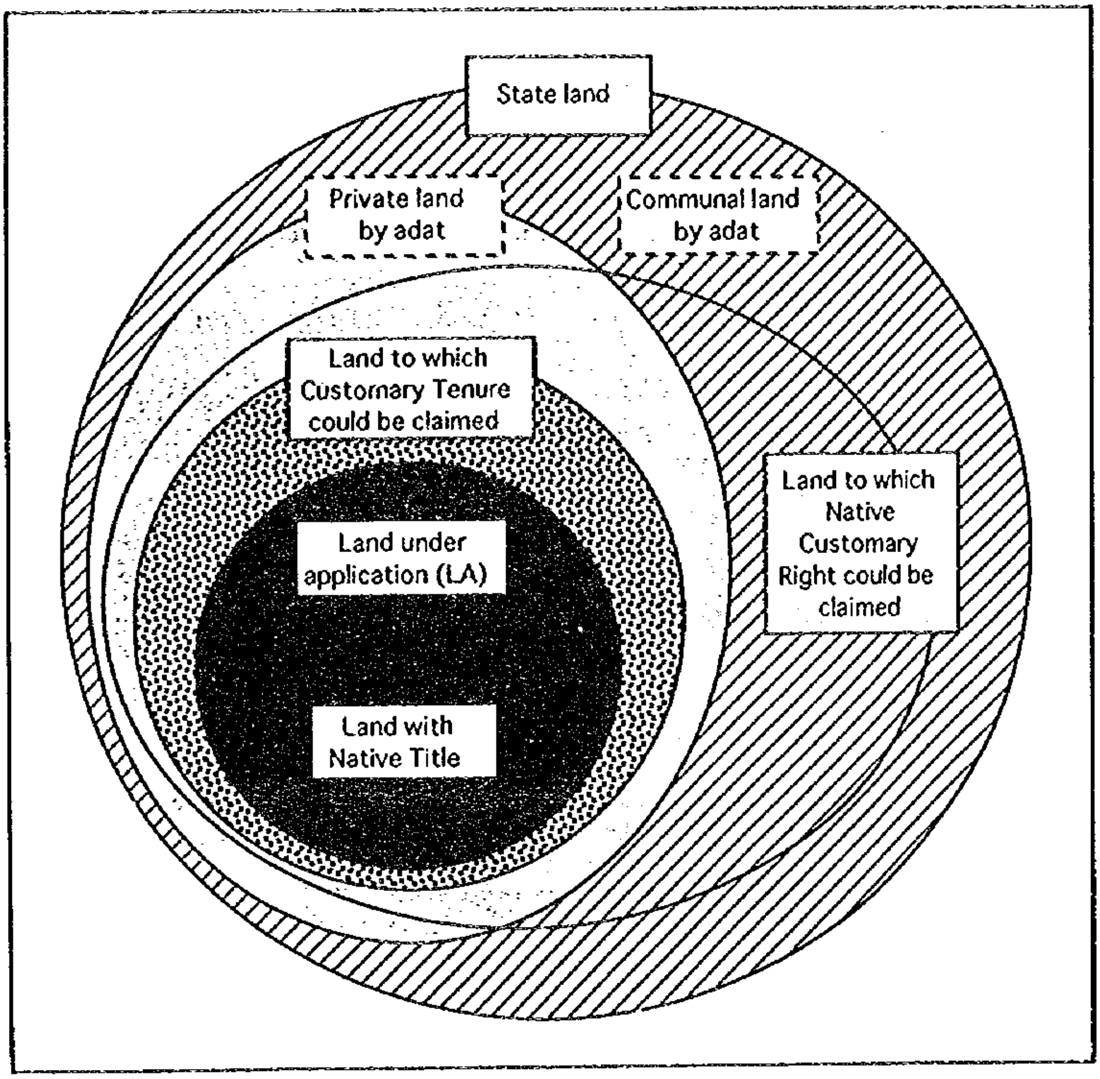

Figure I-15 Co-existence of Customary and Modern Laws

2-4-2 Native Rights to Use the Forests

1) Customary use of the Forests

In the surveyed villages, the surrounding forests are regarded as a village common, regardless of the ownership form of the land. Anyone from the village can collect non-timber products (food, including fruit and honey, wild animals, daily commodities, medicinal plants, firewood, etc.) without permission. However, tree tenure exists to timber trees or fruit trees that have been planted by villagers (or their ancestors) on their own land and, therefore, these trees cannot be extracted without the owner's permission.

2) Rights under Modern Law

Natives have customary rights to collect forest products and cultivate state land under the Forest Enactment and Forest Rules.

(1) Customary Rights to Collect Forest Products

According to Article 41 of the Forest Enactment enacted in 1968, any native has the right to cut and collect wood and other forest products in state-owned forests for:

① The construction or repair of a dwelling-house for the abode of himself and his family;
② The construction of fences and temporary huts on any land lawfully occupied by him;
③ The construction or repair of native boats;
④ The upkeep of his fishing stakes and landing places;
⑤ Firewood to be used for his domestic purposes; or
⑥ The construction and upkeep of clinics, schools, community halls, places benefit of the native inhabitants of his kampung.

Furthermore, any native has the right to collect the above-mentioned products for household use without charge under the provision of Article 8 of the Forest Rules enacted in 1969, provided, except with a free pass issued by the District Forestry Officer, such products may not be taken in a district outside that in which the native ordinarily resides, and shall be subject to the provisions of the rules as ordinarily applied and the native concerned shall be required to pay the licence fee.

(2) Customary Rights for Shifting Cultivation

It is provided in Article 9 of the Forest Rules that natives whose ancestors have been and who themselves are dependent on shifting cultivation may, without licence, fell, burn or clear forest of secondary growth on any state land for the purpose of shifting cultivation. Secondary growth for the purpose of this rule is defined as forest containing trees of not more than six years standing and not exceeding fifteen centimeters from the ground. The District Forestry Officer may, with the consent of the residents involved, declare any area in which it shall be a forest offense to practice shifting cultivation.

2-4-3 Overview of the Community Land Use

1) Vegetation

According to a "land use/vegetation" map attached to the Master Plan, a large part of the land in kg. Mark Parak and kg. Pompadon is classified as farmland or shrub forests[8], with low forests on some part of the ridges. In kg. Dalamason, the settlement area located along the logging road is surrounded by farmland, rubber plantations and shrub forests, which spread from the foot to the side of the mountain, with some low forest remaining on the ridges bordering the Lingkarau Forest Reserve. In kg. Natu and kg. Lombiding, there are shrub forests around the

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[8] Shrub areas include partially fallow for farming.

settlement areas, which are surrounded by medium-high and high forests, where commercial logging is in operation. Grassland can be seen in some parts of kg. Marak Parak and kg. Dalamason.

2) Land Use

Land in the surveyed villages is not used randomly. Rather, overall use is planned and land can be classified by its use; i.e., farmland, community grazing land, settlement area, graveyard and forest land. Forest land is generally used as an open-access land and some part is "community land reserve", farmland for the future generation. Overall land use is often planned through consultations among the villagers, including the village head and the members of the JKKK.

As previously mentioned, a large part of the farmland distributed through the customary law is in the process of application for Native Titles. As for customary common land, it is generally believed that the NCRs exist, though no claims have been made to the land authorities and, therefore, legal rights have not been established.

Features of the land use in each of the surveyed villages based on the land use maps (Attachment 13-17) prepared through a Participatory Rural Appraisal (PRA) method, are summarized below.

a. Kg. Marak Parak

Kg. Marak Parak is located on a basin where the Kinarom River and a main road cross, and most parts of the land are used for specific purposes. The settlement area of the village, which has over 600 residents, stretches from north to south along both sides of the main road. The grassland to the east adjoining the settlement area is used for community grazing land, while part of the land to the west is reserved for the construction of an airport. Excluding these common areas, a large part of the village land is divided into private farmland through the customary law. The remaining part is "village land reserve", which is purposefully set aside for the younger generation. Therefore, though it is an open-access forest at present, it will be converted to farmland in future. In the meantime, in order to conserve forest resources within the village, some forests, including those on the ridges, are designated as "community forest reserves", which will be permanently used as open-access forests[9]. The "shrub forest" located in the north part of the village was initially planned for one of such "community forest reserves". However, it was destroyed by a forest fire some years ago and, presently, there are no specific plans for its type of land use: it could be considered as an empty land pending upon further decision by the villagers.

According to the village head, nearly 80 percent of the private farmland is covered by either Native Titles or LAs. As for the common land, he claims that customary rights, corresponding to NCRs, exist though they have not been legally established. With regard to the land which has been set aside as the "community forest reserve," an application for a communal title is being prepared.

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[9] According to the Master Plan, they are classified as medium-high and high forests.

<Commercial Plantation>
In kg. Marak Parak, types of landuse have already been decided by the community, except for the wasteland located to the north of the village, whose land use is being discussed. There is virtually no "empty" land that is large enough for a commercial plantation.

b. Kg. Pompadon
Kg. Pompadon is located in a basin. The Kinarom River and a main road run from south to north through the middle of the village. Most of the land, including the slope of the mountain, has already been distributed to the individual villagers for shifling cultivation, except for the settlement area located between the river and the road. There are small-scale rubber plantations at the fringe of the settlement area, which have been developed by the SRFB contract farmers. Though there are lands without any owners on the slopes close to the ridges, they are actually "village land reserves" for the future generation.

<Commercial Plantation>
As mentioned above, almost all the village land has been or will be allocated to the individuals. In addition, most of the customary owners of the private land have already registered applications for the legal titles. According to the interviewed villagers, there is no empty land that is large enough for a commercial plantation.

c. Kg. Dalamason
Kg. Dalamason is located on the slope of the mountain which exists to the north of the Manuradiang River. A steep logging road runs from the east to the west of the village. Land use, from the west part of the village, near the main road at the foot of the mountain, to the east part adjoining the Lingkarau Forest reserve, occurs in the following order: rubber plantations; settlement area surrounded by farm land for shifting cultivation; and forest land (mainly high forest).
In Kg. Dalamason, the community depends on the village head to make decisions regarding the land use plan in the village. The village head has taken an initiative in the promotion of rubber growing with SRFB's assistance and the villagers tend to plant rubber on the farmland with approved LAs. As a result, approximately one quarter of the total village land is being developed into rubber plantations. The settlement area is located on the ridges[10] with shifting cultivation being carried out on the slopes nearby. Part of the high forest area bordering Lingkarau Forest Reserve, which occupies approximately 30 percent of the total village area, is allotted for temperate vegetable farming, based on an earlier suggestion from the Department of Agriculture. Currently, this area is not accessible due to lack of road.
However, according to the village head, the villagers would start farming once a proper road leading to the area is connected by the government.

<Commercial Plantation>
Kg. Dalamason has already made a decision that it will, with SRFB's support, develop idle land into rubber plantations. It, therefore, cannot afford to

[10] Some people live just outside of the boundary, west of the community because of better transportation.

plant any other kinds of trees on a large scale.

d. Kg. Lombiding

All land in kg. Lombiding, which is located on a mountainside, is collectively owned by the community, and a traditional system of land use is still in practice today. However, the actual area which is available for farming has been, for a long time, rather limited to a logging operation by a contractor in medium and high forest areas. Currently, shifting cultivation is mainly carried out in the common land located to the south of a logging road, which runs from the east to the west sides of the village. For legal land ownership, the community as a whole, instead of individual villagers, applied for the communal title. The application for the total area of 3,000 ares has been already approved, as has survey permission. However, the land survey has not yet been conducted since 3,000 ares is too expensive for them to pay all at once. Therefore, the title has not yet been issued, either. As a result, the village now considers subdividing the communal ownership into individual ones.

Lombiding people entrusts decisions relating to land use to the JKKK. Individuals no longer make these decisions due to the past incidents that involved the deception of the villagers by outsiders.

In the meantime, since the license period for the contractor expired a few months ago and was not renewed[11], the JKKK are exploring a possibility of developing the logged-over area of approximately 3,000 acres into rubber and oil palm plantations. This time, the land is to be allocated to individual villagers from the beginning. According to a distribution plan map already drawn up, a land with an area of 50 acres will be distributed to each villagers. For plantation development, the JKKK has already contacted the SRFB and the SLDB. Since legal landownership is required to receive assistance from these agencies, applications for the Native Titles will be made in the near future.

<Commercial Plantation>

As mentioned above, application for the communal ownership to the land with a total area of 3,000 acres in kg. Lombiding has already been approved. Moreover, an application for another 3,000-acres is now being prepared for development of rubber and oil palm plantations. Therefore, according to the villagers, there is no idle land remaining that is large enough for a commercial plantation.

e. Kg. Natu

Kg. Natu is located on a mountainside to the south of the Natu River, a tributary of the Kinarom River. In kg. Natu, farmland is allocated to individuals, and nearly 2,000 acres is covered by LAs. However, as mentioned earlier, approximately 80 percent of the registered villagers live outside the village and there are many absentee owners. Consequently, the land is under-utilized with only about 12 families living in the village using it for shifting cultivation and collection of forest products. According to the

[11] The logging is said to be still continuing after termination of the logging license. This makes a big trouble for Lombiding village.

village head, they have no specific plan for the under-utilized land, including the land presently possessed by the absentee owners. Once the village asked for a support from SRFB for development of the under-utilized land into rubber plantations, which was rejected because of the poor road conditions.

The settlement area of Kg. Natu is at present located at the fringe of Kg. Lombiding. This is because the Natu people have moved in order to be closer to a logging road which was constructed through kg. Lombiding.

<Commercial Plantation>
The village head of kg. Natu holds an another post as the village head, kg. Polipikan. According to him, there is a 2,000-acre of land which spreads over kg. Natu and kg. Polipikan, which is neither used nor owned. Kg. Natu-Polipikan has no idea regarding how to utilize this land effectively, however, it might to be possible to use it for a commercial plantation for the Project. The village head expressed his positive approval for using the area as a plantation. One main reason is that he expects new logging roads to result from the Project. As mentioned before, kg. Natu cannot receive services from government extension agencies because of its poor road condition, which has impeded its agricultural development. Also, poor transportation has led many residents to migrate out. Therefore, the village head expects that the better road situation created by the Project would bring more opportunities for the community development, other than just the direct advantages such as employment from the plantation project. He also mentioned that, like kg. Dalamason and kg. Lombiding, the Natu people entrust the decisions regarding village landuse to influential people, including the village head, and therefore, it would not be difficult for him to obtain a consensus of the villagers on the matter. However, this statement could not be double-checked since there were no opportunities to interview the other villagers in kg. Natu.

2-4-4 Land Ownership/Use by Individual Farmers

1) Farmland Ownership

In general, one household owns more than one plot of farmland, almost all of which are in the process of application for the Native Titles. With regard to land ownership, males and females have equal rights and not only husbands but also wives file the applications in their own name. The size of a farmland plot ranges from 2 to 15 acres. The reason of the maximum being 15 acres could be that it had been the maximum area that could be alienated to a single person under the Customary Tenure until a few years ago. The total area of farmland per household also varies, with an exception of kg. Lombiding, where the land has been distributed to the villagers at one time based on its land use plan.

2) Land Use

Shifting cultivation is not carried out from one plot to another, but rather within the same plot: a farmer uses one of his/her farmland plots exclusively for shifting cultivation, which is divided into several sections to be cultivated one after another. Trees such as fruits, rubber and coconuts are often planted on the other plots. Part of the farmland, however, is kept idle in many households due to lack of manpower and capital, or remoteness of the plots from the home. Farmers are interested in growing cash crops on the idle land for additional income though very few have concrete plans.

For example, as shown in Fig. I-16, one of the interviewed households in kg. Dalamason owns three plots (22 acres in total) in the names of husband and wife together, which are used for shifting cultivation (4 acres), smallhold farming 1 (15 acres) and smallhold farming 2 (3 acres) respectively. On the plots for smallhold farming, tree crops with high cash values are grown or to be planted. The household have received legal land ownership more easily than in most cases: Native Titles have been already granted to the plots for shifting cultivation and smallhold farming 1 (19 acres in total) and a LA has been approved as for the remaining plot (3 acres). One of the Native Title land, the plot for smallhold farming 1 (15 acres) is in wife's name.

The land for shifting cultivation is located approximately 30 minutes away from their home on foot. About one acre of land is cleared annually, on which hill rice is primarily planted. Hill rice can be harvested on the same site only once. Therefore, the site is abandoned in the following year and is laid fallow for three years. The largest plot, the smallhold farming plot 1, is located on a mountain side, approximately two hours away from their home. On third of the plot, 5 acres, is used for rubber and fruit tree growing. As the rubber trees were planted only recently, latex cannot be collected from them yet: the households only source of income at present is a durian tree, planted by their grandparents, which can bring in approximately RM 500 during the harvest season. The remaining land of 10 acres is used only for collection of forest products. As for the smallhold farming plot 2, a *Acacia mangium* plantation had been once established through SAFODA/Private Tree Farming programme, which was destroyed by a forest fire a year ago. Thus, with part of the smallhold farming plot 1 added up, as many as 13 acres, more than 50% of the farmland in total, is currently left idle (or under-utilized). The family plan to plant rubber trees on three of the ten-acres of idle land in the smallhold farming plot 1, in accordance with a land use decision made by the community. With regard to the remaining 7 acres, they are considering growing fruits with cash values, though they have no concrete plan. As for the site burned by the forest fire (the smallhold farming plot 2), they have not yet come up with any specific idea about its use.

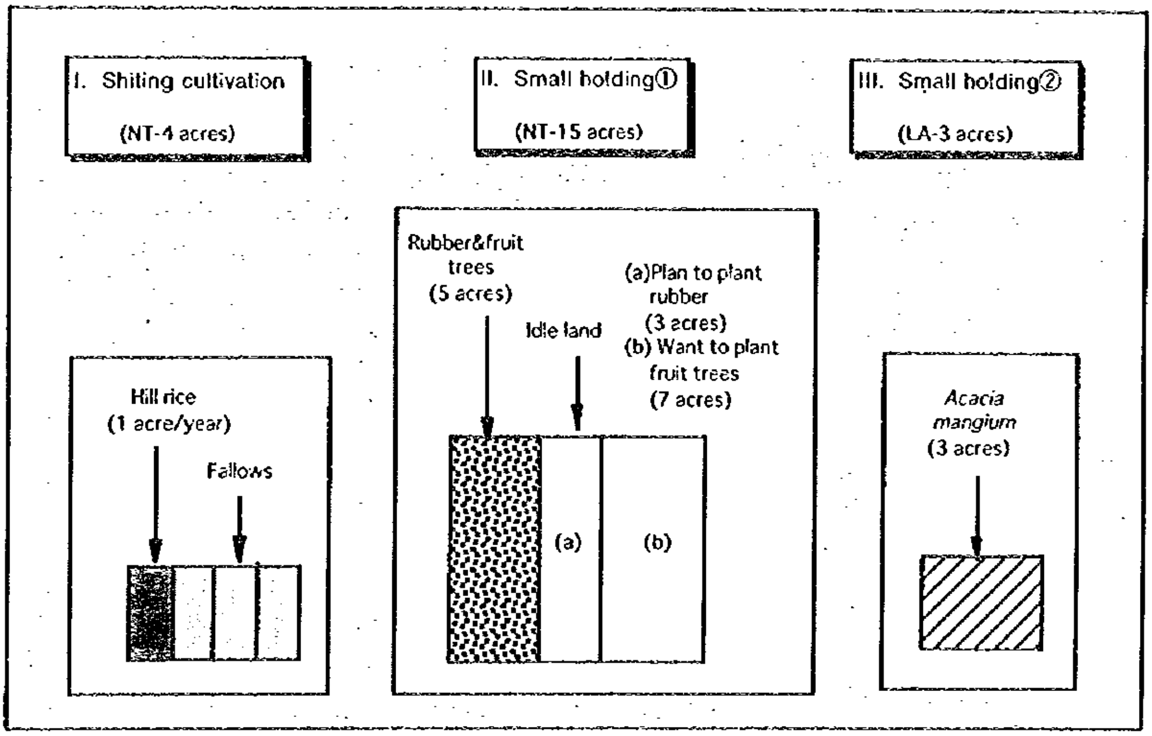

Figure I-16: An Example of Land Use by Household

3) Decision Making on Land Matters

There is no specific pattern as to who makes decisions on the land matters, rather, it depends on the households. In some households, the husband always makes decisions, whereas, in others, the husband and the wife discuss the land use together. In kg. Lombiding and kg. Dalamason, however, the villagers often depend on the village leaders (i.e., the village head and the JKKK chairman) regarding the decisions on the land matters, especially those regarding utilization of the idle land.

2-5 Local people and the Forestry Development Project

2-5-1 General Responses to the Forestry Development Project

The ultimate objective of the social study is to incorporate the local participation into the implementation plan for the Forestry Development Project (hereinafter referred to as the Project). "Participation" does not mean passive participation where local people are only invited to the relevant hearings rather: it means that the village men and women are recognized and treated as equal partners by the Project. This concept also applies to the survey stage. In this sense, the social survey can be defined as part of the preparation work that facilitates active participation of local people/communities in the Project. Prior to the survey, meetings were organized in Kota Mardu and each of the surveyed villages, at which information regarding the Project and the survey was shared with the relevant local people/communities[1). The following are the general responses from the villagers with respect to a large-scale

[1) Excluding Kg. Natu. As discussed in 1-5, the only source of information on kg. Natu is the village head.

commercial plantation and small-scale tree plantation on private land.

A. Large-scale plantation

Villagers are most concerned about the impacts of the Project on their land tenure/use. They are afraid that their land might be expropriated by the Project and they cannot use it for farming any longer. It was explained that legal land ownership would be respected by the Project. Many participants stressed that the land covered by LAs should also be respected as it is no less important than the land with Native Titles for them. However, provided that their land rights, including LAs, are secured, they could support the Project since it is expected to create job opportunities for them and to lead to development of the basic infrastructure, especially logging roads.

B. Small-scale tree planting

In the survey villages, tree planting on the farmland is common and, therefore, the villagers are receptive of tree planting itself. Nonetheless, they generally place a high priority on estate crops such as fruit trees, rubber and oil palm; and they show little interest in timber trees. Moreover, they have the following negative images about *Acacia mangium* which SAFODA/PTF promotes, which dampen their interest in the small-scale tree planting further.

① Some villagers have planted *Acacia mangium* trees based on a suggestion that the species has a high cash value: however, due to the absence of a market, the trees remain unsold even after the felling season. In addition, they have heard that the trees can be sold out at very low prices:

② *Acacia mangium*, fast-growing species, hinders the growth of other intercropped plants: and

③ *Acacia mangium*, if planted along a culture pond, kills fish in these ponds because its leaves are poisonous[2].

In contrast, villagers have positive images of teak and some are very interested in planting of this species[3]. Those who are interested think that its cash value offsets its long gestation period. In particular, some villagers in kg. Dalamason and kg. Pompadon show interest in planting teak through group or contract farming. At any rate, villagers find it important to obtain accurate information on both the benefits and costs of the small-scale tree planting before they make final decisions. The criteria for their decisions include: a)market price, b)presence of a market, c) required manpower, d)gestation period, and e)support to planters (such as subsidy and technical assistance).

2-5-2 Potential Impacts of the Project

In each of the surveyed villages, the villagers who participated in PRA, were asked to discuss in detail the positive and negative impact of the Project. The results of the discussions are summarized in the table I-14 below.

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2) The bark, not the leaves of Acacia magnium contains tannin. There are some cases in which tannin leached out of a large quantity of timber of this species that had been soaking in water, killing fish.

3) Inhabitants say the Agricultural Department is promoting the planting of teaks. but this information is an unconfirmed.

Table I-14 The Villagers' Views on Potential Impacts of the Project

Positive Impacts	• Improvement in transportation (construction and repair of roads, and an increase in traffic which facilitates the mobility of villagers) • Job creation • Expansion of market for agricultural products (due to improvement in transportation) • Transfer of technology
Negative Impacts	• Muddy rivers caused by soil sedimentation • Loss of land for shifting cultivation (including farmland for younger generations) • Loss of forest resources (forest products) • Deprivation of/or encroachment on land tenure • Influx of foreign workers • Destruction of farmland

2-6 Survey for Local Participation in Model Area

The present status of land ownership in the study area is complicated and about to be variable. It is in the situation that a general plan for forestry development, which is a main subject of this study, cannot be easily developed by dividing clearly watershed areas into state land and alienated land. Accordingly, in this study, the implementation plan was studied by setting Model Area in the study area as mentioned in Chapter III, 1. In this connection, it is important subject how to develop an approach to the participation of people in the forestry plan. Therefore, the socio-economic survey on local participation was conducted as Phase 2 study in the Model Area.

The survey was carried out by interviews and discussions at the villages in the Model Area and relevant agencies. The Model Area includes two villages in mukim Simpangan (Kg. Kotud and Kg. Talas) and four in mukim Marak Parak (Kg. Sunsui, Kg. Polipikan, Kg. Pompadon and Kg. Tangkol). Of those, three (Kg. Kotud, Kg. Talas and Kg. Sunsui) are included in the state land model zone and the other two (Kg. Polipikan and Kg. Tangkol) in the alienated land model zone (Figure III-1). Of these, the survey was conducted in three villages which agreed to collaborate with the Study Team - that is, Kg. Sunsui and Kg. Kotud in the state land model zone and Kg. Polipikan in the alienated land model zone. This chapter presents socio-economics of the Model Area[1] ((1)General features, (2)Land use/ownership, (3)Forest use, (4)Tree growing) and framework for local participation in the Forestry Development Plan ((5)Large-scale plantation project on the state land: (6)Plantation project on the alienated land, (7) Organization/Institution).

2-6-1 General Features of the Model Area

1) Location and Accessibility

The distance from the survey villages to Kota Mardu Town ranges from 14 to 26km. Kg. Sunsui is located in a basin where a graveled public road (Marak Parak Road) and the Kinarom River run north to south. Kg. Kotud is located along the logging road on the slope of a mountain lying between the Kinarom and the Pongopuyan Rivers.

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[1] As reported before, the Model Area, which were defined posterior to the commencement of the second phase field survey, happened not to include any of the first-phase survey villages. Therefore, another socio-economic baseline survey was conducted in the second phase in addition to the field work originally envisaged.

Kg. Polipikan is located along a logging road on a hillside on the right bank of the Kinarom River.
These villages can be reached by the logging roads, except the western part of Kg. Sunsui (on the left bank of the Kinarom River), which makes it difficult for an access by vehicle in the rainy season. In particular, the eastern part of Kg. Sunsui and Kg. Polipikan, which are located on the right bank of the Kinarom River, become inaccessible by vehicle in the rainy season when the river rises. The only way to get there is to cross the suspension bridge and, thereafter, walk along the logging road[2].

2) Population and Language

Demographic data of the survey villages are shown in table I-15. These villages are average in population size in Marak Parak Consolidation.

Table I-15 Demographic Data of the Survey Villages (1996)

	Population			No. of households	No. of people/ households
	Total	Male	Female		
Kg. Sunsui	215	112	113	50	4.3
Kg. Kotud	250	N.A.	N.A.	45	5.6
Kg. Polipikan	214	117	97	47	4.6

Source : Kota Marudu District Community Development Office

Most of the villagers comprehend Malay, while some of the elderly speak only Dusun dialects; that is, Dusun Pongopuyan in Kg. Sunsui and Kg. Kotud, Dusun Tinagas in Kg. Polipikan.

3) Social and Economic Infrastructure

On the whole, social and economic infrastructure of the villages are minimum or less than minimum.
A gravity piped water system available at all the villages has been broken in Kg. Polipikan since 1983. The Polipikan villagers have to depend on the river for their drinking water. A community hall in Kg. Kotud was blown down by a heavy wind a few years ago and has not been rebuilt yet: the villagers have to look for other meeting place in the home of the Ketua Kampung (or the former Ketua Kampung). There is no electricity in all the villages. There is no clinic, either. As for educational facilities, there is a primary school, one of the three in the Consolidation, in Kg. Sunsui, at which the Polipikan children study. Many people can read and write except for the elderly.

4) Extension Activities

Extension agencies that are currently active are SRFB, SAFODA and KPD. SRFB is most active in every village: rubber is an important income source for the villagers' program. SRFB assists the villagers in developing the rubber plantations through its smallholder. It also purchases the latex from those who grow rubber for themselves. SAFODA/PTF are active in Kg. Sunsui and Kg. Polipikan but in a small-scale. KPD

[2] As of March 1997, it was impossible to cross the river by vehicle as the riverbed has been left disturbed since the heavy rain in the previous rainy season.

is active in Kg. Sunsui, which is relatively easily accessible by vehicle; a farmers' group (for males) has been formed for the contract farming.

5) Development Needs

The village representatives consider improvement of social and economic infrastructure highly important. First of all, improvement of an access to a main road. Kg. Sunsui and Kg. Polipikan are especially interested in having a bridge for vehicles over the Kinarom River. Clinics and schools are also important. In Kg. Polipikan, there is a need for the repair of the gravity piped water system.
For individual villagers, security of food as well as cash income is very important.

Table I-16 Outline of the Survey Villages

	Kg. Sunsui	Kg. Kotud	Kg. Polipikan
Population	215	250	214
Dialect	Dusun Pongopuyan	Dusun Pongopuyan	Dusun Tinagas
Location (Distance from Kota Marudu)	flat area-hills (24km)	hilly area (14～16km)	hilly area (26km)
Access from JKR road	Eastern part of Kg area: suspension bridge/logging road(Western part of kg. area located along the JKR road)	logging road	suspension bridge/logging road
Basic Infrastructure	·community hall ·gravity piped water ·mini-bus stop ·elementary school ·SIB church	·gravity piped water ·SDA church	·community hall ·gravity piped water (broken since 1983) ·SIB church
Extension Agencies that are active	·SRFB ·SAFODA/PTF ·KPD	·SRFB	·SRFB ·SAFODA/PTF

2-6-2 Land Use/Ownership in the Model Area

1) Overview

Major points concerning the land-use/ownership made by the communities/people in the Model Area are similar to the findings of the first-phase survey (refer to Section 2-4). Furthermore, there is no distinguishable difference in land use/ownership between the State and the Alienated Land Model Zones.
In both of the Model Zones, most of the lands within the village boundaries, besides the common lands (such as settlement areas, cemeteries and grazing lands), have been already distributed to individual villagers through the respective JKKKs or Ketua Kampungs. For most of such customary farmlands and a portion of the common lands, applications for the legal titles were filed in 1970s~1980s. Some of the applications have been already reviewed and are in the status of approved/surveyed

LAs (*de facto* alienated lands) or native title lands. However, with regard to the degree of the alienation, there is a significant discrepancy between the information obtained from Land and Survey Department (i.e. standard sheets) and the claims of the communities[3]. According to the latter, sizable alienated/de facto alienated lands exist in the state land zones indicated in the sheets; conversely, unprocessed LAs (de jure state land) in the alienated land zones. A total area with such inconsistency in each village ranges from some hundred to some thousand acres. Although the communities/people are aware that the legal rights cannot be claimed to the unprocessed LAs, they insist that these LAs should be acknowledged as "*de facto*" alienated lands whose approvals are being delayed only due to lack of proper administration. As such, from their standpoint, there is no "empty" state lands available for the industrial plantation project, in either the Alienated or the State Land Model Zones.

Farmlands are generally used for shifting cultivation, orchards and rubber plantations. In the meantime, a sizable area of unutilized/under-utilized lands exist, most of which are planned to be developed into small estates (rubber or oil palm) one after another, at the initiative of JKKK or Ketua Kampung[4]. These unutilized/under-utilized lands are not necessarily located in the shrub zones: some are located in the low/middle forest zones. Establishment of rubber plantations is actually underway with an assistance from SRFB through its smallholders' programme, whose cycle is in accordance with that of the five-year plan. For the programme for the period of the current five-year plan (1996-2000), a total number of the participants from the survey villages is 88 and a total area of 263.6ha is planned to be developed into the rubber plantations[5].

Table I-17 SRFB Rubber Plantation
- Village Plan and the Approved Programme for the period of SRFB[6]

	Village Plan (no timetable)	Approved Programme (1996-2000)	
	Area (ha)	Area (ha)	No. of participant
Kg. Kotud	approx. 200	83.39	30
Kg. Sunsui	approx. 180	78.94	23
Kg. Polipikan	approx. 720	101.21	35

Kg. Kotud has already decided to convert all the lands in the village, except for some farmlands for shifting cultivation, into the rubber plantations. Kg. Sunsui and Kg. Polipikan also expect an assistance in developing the lands that are found not suitable for rubber and oil palm on the condition that their landownership is retained. According to the communities/people, there is a scope for forestry activities on some of the alienated lands while a large-scale industrial plantation project on the state land is not possible.

3) The State and the Alienated Land Model Zones were defined based on the locations and the sizes of the relevant surveyed LAs/Native Title Lands plotted on the standard sheets (as of 1996). However, the claims of the communities/people on the locations and sizes of the alienated land (including *de facto* alienated land) are apart from those indicated on the standard sheets.

4) Even in Kg. Kotud and Kg. Sunsui, whose land status is supposed to be "the state land" according to the standard sheets, there exist sizable alienated lands, which are the pre-conditions for receiving extension services.

5) In mukim Marak Parak, 420 villagers participate in the programme and as many as 1061.86ha is planned to be converted into rubber plantations.

6) Rubber plantations developed through the programmes prior to the year 1995 are not included.

2) Land-Use Pattern in the Survey Villages

(1) State Land Model Zone 1 - Kg. Sunsui

The total area of Kg. Sunsui is approximately 5,000 acres (see Attachment 22). The Kinarom River flows in the middle of the village and the Marak Parak Road runs on its west. Most of the lands in Kg. Sunsui, except for the common lands (i.e. settlement area, cemetery and grazing land), have been divided among the individual villagers (15 acres per person on average), for all of which the Native Titles have been already applied. So far, only a total of 80 acres has been given the Titles. The other lands (i.e. LAs) are claimed to have LUC's approvals; some of them have been already surveyed. According to the community, almost all the lands are de facto alienated lands.

A total area of about 1,800 acres occupies the west of the Marak Parak Road. The northern portion of the area, about 450 acres of surveyed LAs, is planned to be developed into the SRFB's rubber plantations in three phases. As for the southern portion covering some 950 acres, there is no community plan: each landowner uses the land at will for rubber plantations, orchards, shifting cultivation, etc.. Applications for the Titles were filed in 1970s-80s, about a half of which are surveyed LAs. Of a total area of around 3,600 acres on the east of the Marak Parak Road, a plot of 1,000 acres has been granted a communal title for grazing land. The others are under-utilized; only partly used for *A. mangium* plantations and shifting cultivation on a small-scale. Of these, 1,000 acres were planned to be developed into the SRFB rubber plantations; nevertheless, SRFB has expressed disapproval due to lack of an access road to the area (on the east of the Kinarom River, in particular) and high costs associated with construction of new roads there. Four-hundred acres, lying near the settlement area, were once submitted to FELCRA for development of an oil palm plantation, which was turned down. Kg. Sunsui expects an assistance from some other government agency in developing this land.

According to the community/people, there is no "empty land" that can be used for a large-scale industrial plantation but under-utilized land exists (especially, on the east of the Kinarom River, which is far from the main road), where they are interested to see forestry development on condition that they retain their landownership. For a possible project site on the east of Kinarom River, a total area of 400 acres, where a request for development of oil palm plantation has been rejected by FELCRA, was indicated. Another candidate is the area where SRFB is hesitant to give assistance due to lack of proper access road. Of the common lands, a portion of the grazing land (about 300-400 acres) was indicated as a possible site, but it should be noted that a consensus of the community people is required for a change in the original land use. Some part of the lands on the west of the Marak Parak road are under-utilized, where some of the landowners may be interested in tree planting.

(2) State Land Model Zone 2 - Kg. Kotud

Kg. Kotud is located on the north of the Study Area and not all the land within the village boundaries is included in the Model Area (see Attachment 22). Although it is not clear at which point a boundary line of the Study Area traverses the village area, by and large, the southern portion of the village area is presumed to be covered by the Study Area. The total area within the boundaries is about 1,100 acres, of which about 300 acres in the east is an enclave of neigbouring

Kg. Goshen. Therefore, the area exclusively belonging to Kg. Kotud is about 800 acres. According to Ketua Kampungs of Kg. Kotud and Kg. Goshen, all the lands, except for the common lands such as settlement area and grave yard, have been already divided among individual villagers (about 15 acres per person). As for legal status, applications for Native Titles were filed in 1978-79; some of the lands are approved/surveyed LAs.

Of the 800 acres which exclusively belong to Kg. Kotud, most of the lands except for the common lands are claimed to be approved/surveyed. The village land-use plan centers around development of the rubber plantations and 100 acres (surveyed LAs) have already been converted into the SRFB rubber plantations. As to the other lands, many farmers grow rubber for themselves (SRFB buys the collected latex). Of these, a total of 500 acres (approved/surveyed LAs) is planned to be developed into rubber plantations with assistance from SRFB, with which an application has been already registered. Adding the existing plantations to this, a total of 600 acres, about three-fourth of the village area, will become rubber plantations in future.

The lands in the enclave of Kg. Goshen are mainly used for rubber as well. Goshen people grow rubber without participating in the SRFB's programme. (Rubber is planted not only on the approved/surveyed LAs but also on the lands owned through local adat). Nevertheless, SRFB purchases the collected latex from the tree growers.

According to Kg. Kotud and Kg. Goshen, there is no "empty" state land that can be used for a large-scale plantation: they would stand against its implementation within their village boundaries. As for development of the alienated lands, they have already decided to convert all into the rubber plantations: they are not interested in other projects at this point. At the same time, they recognize a risk in depending on mono-culture of rubber for their living, with possible fluctuations of price and demand in future. They may become interested in planting other tree species in 25 years, when rubber trees become too old to produce enough latex for them.

(3) Alienated Land Model Zone - Kg. Polipikan

Kg. Polipikan is located on the east of the Kinarom River (see Attachment 22). Its settlement area is situated on a slope whereto one must walk along a logging road for about 20 minutes from a suspension bridge over the Kinarom. Until September 1996, Kg. Polipikan and its north-east neighbour, Kg. Natu, had been practically one village with having the same Ketua Kampung. Since October the same year, they have started to have their own Ketua Kampungs, but the boundary is not yet well-defined: there is a portion of land where it is not clear which village it belongs to.

A total area of about 1,800 acres in the western part of Kg. Polipikan, a legal right to which had been originally acquired for a logging license by the then Ketua Kampung, has been divided among the villagers (both men and women) since the logging was over. All the lands are claimed to be approved LAs. This area was occupied by the rubber plantations and developed with the SRFB's assistance, about 70 % of which have been destroyed by the forest fires in 1973, 1983, 1986 and 1993. Currently, the lands are used for shifting cultivation, orchards, and *A. mangium* plantations as well. The community plan to re-establish rubber plantations and have requested an assistance to the SRFB. Another 1,800 acres in the north-eastern part is a surveyed LA for a communal title. Of these, 1,000 acres in the north are practically owned by 40 village men (i.e. the heads of the households) who resided in the village when the application was filed. This 1,000 acres are covered by the "middle forests" and the soil is fertile; therefore the villagers think about developing the area into a FELCRA's oil palm plantation. They are aware that the forests would be cleared once development of the oil palm plantation is approved. The felled trees would be shared by the 40 landowners. In the mean time, about 1,300 acres in the north-western part have been distributed among individual villagers . Applications for the legal titles were registered in 1996 but none of them have been approved yet. The area is planned for oil palm, rubber, shifting cultivation, etc.

In Kg. Polipikan, an interest in the forestry project on the alienated lands is greater than the other two villages since there exist the alienated lands which cannot be developed by themselves and an assistance for which has been turned down by other agencies (in particular, SRFB and FELCRA). A possible project site includes a total area of 1,000 acres for which FELCRA's assistance is being sought for. If the request for the assistance is rejected, the villagers are interested in planting industrial species (for timbers and pulp), provided that their landownership is kept.

3) Community Land Use and Watershed Conservation

Forests in the Study Area on the whole are degraded. It is necessary that the Forestry Development Plan includes a land use plan as well as a forest management plan which promote conservation of the watershed. In this regard, it should be noted that each community in the Model Areas has its own land-use plan, which includes utilization of the unutilized/underutilized lands at the initiative of the respective JKKK/Ketua Kampung. However, their plans have been made, focusing on the productive aspects of the land/forest but the environmental aspects such as watershed conservation. For instance, Kg. Polipikan think about clearing the "middle forest" lands (claimed to be surveyed LAs) remaining on the slope for an oil palm plantation. In Kg. Sunsui, which claims that the total village area of 5,000 acres are mostly approved LAs, only 200-300 acres are planned to be left as the "community forest reserve" (whose purpose is extraction of forest products and not conservation of watershed). As for the other part, including the slope areas and remaining "good forest" lands, the community/people plan to have some type of development-farmlands, plantations for rubber, oil palm and industrial species ,etc..

2-6-3 Forest Use in the Model Area

1) Productive Aspects

As reported in the Section 2-4-2, the communities/people in Marak Parak Consolidation in general depend on exploitation of the surrounding forests for their livelihood. It holds true in cases of Kg. Sunsui and Kg. Polipikan but the situation is different in Kg. Kotud.

In Kg. Kotud, where most of the lands are being converted into rubber plantation as mentioned previously (2-6-2), very little forest remains within its boundaries. From the remaining forests, the villagers do not collect/hunt forest products (e.g. timbers, food, medicinal herbs and firewood) any longer. Instead, timbers, when necessary, are obtained from the neigbouring villages; fruit trees are grown on their farmlands and/or in their homegardens; and firewood is gathered from the rubber plantation.

On the other hand, Kg. Sunsui and Kg. Polipikan make extensive use of the forests. For instance, as for the natural trees, trunks and branches of Selangan batu (*Shorea*), Kapur (*Dyrobalanops*), Seraya (*Shorea curtisii*), Kuruing (*Dipterocarpus*), Jelutong (*Dyera costulata*) are popularly used for building materials and household items; wild fruit trees such as durian, mangosteen, rambutan and longan for food; and barks and roots of Mandahasi and Urat mata (*Parashorea*) for medicine. In addition, all of the above are also used as firewood (Attachment 23). It was pointed out that, in implementing a large-scale plantation project, the communities should be consulted to identify which tree species are valuable for them and, therefore, should be left intact in clearing the forests.

2) Religious Aspects

The villagers in the Model Areas used to believe in pagan (i.e. traditional religion), when forests had a religious value. There were sacred trees and sites. However, since most of the population have become Christians, taboos concerning the forests seem to have disappeared now.

3) Environmental Aspects

While the villagers recognize environmental aspects of the surrounding forests based on experience, they do not seem to be interested in conserving them for environmental purposes only. Productive aspects are far more important; therefore, setting aside some portion of the forest lands for extractive purposes is more common.

4) Causes of Forest Degradation

It was indicated that major causes of the forest degradation in the area were logging activities and forest fires. As for the logging, not all the impacts were negative: logging roads were constructed and logged-over forests could be developed into the farmlands. Nevertheless, the communities would oppose to the logging of the remaining forests. Kg. Polipikan, which has "middle forests", has blocked off a logging road in the village so that illegal loggers cannot enter the surrounding forests. Breakout of the fires which destroy not only the forests but also the farmlands and the houses is a problem. Serious fires have swept through the area in 1973, 1983, 1986 and 1993 in recent years. Big fires normally break out in a prolonged dry season: it was said that burning of the secondary forests by shifting cultivators was not a major cause of the fires as it takes place at a different time of the year. As for a fire caused by the burning, which is occasional, the communities make it a rule that an individual should not be held blamed for it. The communities/people do not regard a repeated land use by shifting cultivation as a cause of the forest degradation, either.

2-6-4 Tree Growing in the Model Area

1) Experiences

(1) Overview

In the Model Area, various trees are planted around the houses and on the farmland. Fruit trees[7], rubber, coconut palm, rattan, bamboo, and *A. mangium* are popular trees, which are grown for sales, food and building materials (Attachment 24). Of the economic species, rubber is most extensively planted. As reported previously, some people participate in SRFB's programme; others grow rubber for themselves. In Kg. Kotud, where most of the land is planned to be developed into rubber plantation, the number of tree species that are important for planting cited by the informants was distinctively lower than the other two villages.

(2) Industrial Species

A. mangium, to be promoted by the proposed project, is the only industrial species that is planted in the Model Areas. It is promoted by SAFODA/PTF. The planted area is smaller than rubber, however. Twenty-five farmers from Kg. Sunsui and Kg. Polipikan in total participate in the PTF; nobody from Kg. Kotud. The total planted area is 41.25ha (Table I-8). The planted area per participant ranges from 0.45-5.95ha with more than 70% being below 2ha. The reason that the maximum is below 6ha is presumably because the seedlings are not provided for free of charge for the area over 6ha. Neither Kg. Sunsui nor Kg. Polipikan plans to further expand the planted area and they have basically stopped new planting.

Table I-18 Participation in PTF Programme in the Survey Villages in the Model Area

Village	Year 1989-91		Year 1992-95		Total (as of end 1995)	
	No. of participant	Planted area (ha)	No. of participant	Planted area (ha)	No. of participant	Planted area (ha)
Kg. Sunsui	1	5.95	5	12	6	17.95
Kg. Polipikan	-	-	19	24.30	19	24.30

Source: SAFODA/PTF

PTF Programme has a basic problem on marketing which *A mangium* cannot be sold; if sold, at a very low price. This is a major cuase to restrict the more development of PTF Programme, besides the Programme inheres another problem which SAFODA has not paid its full attention to local people. Issues of the PTF Programme in the Model Area is shown in Attachment 26 in detail. In brief, the following factors have fermented distrust in SAFODA (PTF, in particular) among the communities/people.

① Lack of sales efforts regarding the trees at the harvesting age
② Lack of proper technical instructions and extension services
③ Lack of communications and interactions with the communities and people.

In order for the project to promote *A. mangium* in the area, it is essential that the confidence in SAFODA, the proposed implementation agency, should be gained back. For gaining back the confidence, the following points would be the

7) Rambutan, tarap, langsat, belunu, guava, durian, mango, jack fruit, star fruit, mangosteen, longan, bambangan, lime, banana are popular fruit frees. As for growing of some fruit trees and coconuts, Kg. Sunsui, where Agriculture department and KPD are active, could receive extension services such as obtaining good quality seedlings. Farmers in the other two villagers, without such government services, collect seeds from wild trees or the others, and grow them for themselves.

subjects to be buckled down to henceforth.

① Development of utilization of *A. mangium*
② Arrangement of plantation with marketing strategy
③ Establishment of system to promote mutual understanding with local people

2) Needs

The communities/people in the Model Area are interested in raising their income by utilizing the idle lands: it can be said that there is a need for growing of the economic tree species. Major factors influencing their incentive mechanisms seem to be risks and prices. Among the trees currently grown, needs for rubber and fruit trees are higher because they have ready markets and will bring about some income without fail. Among the fruit trees, there is a greater demand for a tree with a relatively high cash value such as durian, longan, langsat, jack fruit, mango, rambutan, tarap, etc. (Attachment 24). Farmers are also interested in growing estate crops other than rubber such as oil palm.

The main reason of a marked interest in rubber is because the growers could gain income with a minimum risk. Rubber has a ready market and, what is more, SRFB staff would come and buy the latex every two-three weeks. The growers, thus, know for sure that they could get cash. In addition, SRFB broadcasts information on rubber, including its market price, on the radio five times a week, which enables the growers to decide whether or not they should continue growing the tree. Moreover, if one participates in the smallholders' programme, SRFB will subsidize the costs associated with initial investments (e.g. land preparation, seedlings of hybrid species and tools, etc.) and will pay for the maintenance of the plantation for a few years until the latex becomes ready to be extracted. In addition , in 25 years or so, when the trees become too old for latex collection, SRFB will introduce a contractor who would buy the trees as timbers to the farmers. With regard to income, those who grow hybrid species through the SRFB programme could earn more than RM500, sometimes as much as RM1,000, per month, whereas those who grow for themselves could earn RM 200-400.

As for industrial species, some farmers are interested in teak which is said to be sold at a high price. Among the natural trees in the surrounding forests, they are interested in planting Selangan batu, Kapur, Seraya, Singtang, Merabau, etc., which, though having relatively long gestation periods, have ready markets. An interest in *A. mangium*, which is envisaged to be promoted by the Project, is low or negative under the present conditions. It was indicated that the farmers listed the favored/preferred species based on experiences and rumors only and would be interested in getting information on other species for their consideration.

Besides economic benefits such as increased tree products for consumption and sales, tree growing brings about improvement of agricultural productivity through restoration of soil fertility by planting of nitrogen-fixing trees and through reduction of erosion by planting on steep areas; however, the farmers in the Model Area are not interested in tree growing for soil improvement/conservation of the farmlands. Major reasons could be that the present level of degradation is not perceived as a threat by the farmers; and that, due to lack of education and extension services, the farmers do not know about a relationship between tree growing and land productivity as well as relevant methods and techniques. Moreover, without any pilot projects having carried out in the area, actual degree of improvement in agricultural productivity by planting trees is unknown, which makes their perceived risk higher. Furthermore, increased agricultural productivity does not necessarily lead to increased income since the farmers may not be able to sell the surplus crops due to lack of access to the market: an incentive can be too little compared to the perceived risk.

2-6-5 Participation in the Large-scale Plantation Project on the State Land

1) Issues from the Communities/People's Perspective

The Communities/people in Marak Parak Consolidation in general have expressed their opposition to the industrial plantation project. As reported in the first chapter, a number of unprocessed LAs exist in the area. They pointed out a possibility that these LAs will be canceled because of the project; and that the lands (forests) available for them may substantially decrease. Especially, they are afraid that they may not be able to continue the traditional land-use pattern and livelihood strategies based on it any longer; and there may be no more land available for new applications for the Native Titles (especially for their children)[8].

Basically, the large-scale plantation project is not supported in the Model Area, either. In particular, the survey villages in the State Land Model Zone (i.e. Kg. Sunsui and Kg. Kotud) claim that most of the areas which are said to be suitable for the plantation are in fact covered by approved LAs and therefore cannot be used for the project. They are suspicious that unprocessed LAs may be unanimously rejected because of the project, although the project is independent of the appraisal of the LAs, which is carried out through normal administrative procedures. For example, in the villages in the Model Area (in Kg. Tangkol and Kg. Kotud, in particular), a number of villagers insisted that their villages should be excluded from the socio-economic survey because they were afraid that being included in the survey itself might adversely affect the appraisal of their LAs and land applications in future[9]. Some even indicated that the Study Team should be held responsible for a delay and rejection of their applications. The communities/people suggested they would "fight back" if the industrial plantation project was approved and implemented. It was hinted that they would fight not only through official channels such as JKKK but also through use of force.

Some villagers also mentioned that they could not have confidence in the socio-economic benefits promised by the project which is to be implemented by SAFODA. A major reason of losing confidence is that it has not fulfilled its promises with the communities/people in the settlement scheme in Bengkoka as well as in the PTF programme (or they so heard).

Meanwhile, the communities/people are interested in development of infrastructure and creation of employment opportunities by the project. Some expressed their support to the project, provided that the existing LAs and land rights for future generation are recognized.

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[8] Please see the minutes (Attachment 26) of the workshop that was held in the beginning of the second phase study.

[9] In Tangkol, implementation of the survey had to be given up as it was impossible to solicit their understanding and cooperation in a given time.

2) Employment

Virtually, there are no employment opportunities in the villages in the Model Area. The villagers would be interested in the opportunities offered by the project (provided that their land rights are secured). Labour supply available would depend on a type of work, working conditions including wage, distance from the villages to the site. There would be a seasonal fluctuation. Not a few farmers regard the wage labor as a sideline in the off-season and, therefore, want to give priority to on-farm activities in the agricultural season. The villagers think that they are suited for a simple work under a supervisor. Most of them think that a simple work with light responsibility is good enough for them, but some are interested in and capable of assuming leadership with proper training by the project.
It was suggested that people living in the communities that would be directly affected by the project should be given priority in recruitment. In case of labor shortage, the workers could be recruited from the neighboring villages. Recruitment of workers from outside the area should be considered only when the local labor supply has reached its limit. Even then, the communities/people would object to recruitment of foreign workers. It was also suggested that labor recruitment could be done through the communities.
In general, both men and women are positive about women's working outside the home. It was indicated, however, that they should be offered a relatively light job and should be able to work at a site close to the village. Men have more chances to earn income through the project but women do not consider it as disadvantageous to them. First, within a family, any income irrespective of who earns it is regarded as a family income. Second, men and women decide on the use of family income together and, in most cases, women are practically the decision makers.

3) Fire Control

Large-scale fires have been frequent, which have destroyed the farmlands and the houses. Extinguishing a fire is done in gotong royong. Without equipped with any type of fire extinguishers, people normally slash the trees to make a fire break. In a prolonged dry season, they make the fire break as a precaution. After a serious fire in the past, volunteers formed a group to go out on a fire patrol in Kg. Sunsui. It is not practiced any more since nobody could tell when a fire breaks out.
The communities/people would be interested in being hired by the project for a fire patrol. It was also proposed that each community should establish a fire control committee to work with the project in planning and implementing a fire control programme. The project is expected to assist the committees in spreading and training of fire prevention and control measures, and in provision of basic equipment necessary for initial extinguishment.

4) Nursery Production and Management

People in the survey villages want a nursery to be established near the plantation site. First, they expect the employment opportunities at the nursery. Being a light job, not only men but also women are interested in working. Second, they are afraid that transporting seedlings to the site would be time and energy consuming if the nursery is too far. This would not be an issue once access roads to the site are put up/improved. They are not very interested in nursery production and management by the community by contract at present as they think that associated risks are high and responsibilities are heavy. They would rather work as wage labors at first to secure steady income. When they become confident, they may want to consider a contract system. It was emphasized that an assistance from the project, including technical training, free provision of seeds and plastic bags as well as a piped water system, would be a pre-requisite for such a contract.

2-6-6 Participation in the Plantation Project on the Alienated Land

1) Basic Approaches

Unutilized/under-utilized lands exist on a large-scale in the Model Area. The communities/people are interested in developing the lands with assistance from government agencies in order to raise their income. In view of the above, the needs for economic species are great. However, the priority of growing industrial species is low compared to rubber or oil palm. It was suggested that industrial species could be planted on the lands where these estate crops cannot be grown (i.e. mostly the lands where SRFB and FELCRA have shown disapproval of establishing plantations due to lack of access roads, poor soil fertility, steepness of the area, etc.). Nevertheless, they have little interest in or negative attitude to growing *A. mangium* on their lands, which is to be promoted by the proposed project. It is because the species cannot meet their need for increased income as matters stand (or so they believe).

It is clear that direct beneficiaries of the plantation project on the alienated land should be landowning farmers and that the project cannot succeed if its design fails to meet the farmers' needs. It is important that the project, whether its objective is production of industrial materials or conservation of watershed, is so designed that growing of *A. mangium* will bring about increased income to the farmers. If such a project is not feasible technically or financially, then an introduction of other industrial species must be considered.

As possible ways of raising their income through the growing of *A. mangium*, the following two approaches will be discussed: (1) farmers will grow the trees on their lands and will earn income by selling them to the project (sales profit approach): and (2) farmers will rent out their lands to the project for tree growing (land rent approach).

(1) Sales Profit Approach

Under the "sales profit approach", farmers will plant *A. mangium* on their own lands by themselves and profits from selling the standing trees will become their income. Income for the project will come from a margin between the stumpage and millget price (or FOB, etc.). For the farmers, it is basically the same approach that SAFODA/PTF currently takes, which, as mentioned earlier, has not led to increased income in Marak Parak Consolidation as the tree growers have not been able to gain sales profits. Causes that the farmers cannot obtain income (or sales profits) by this approach as well as ways for improvement are discussed in the following (For details, see Attachment 26).

Direct causes that *A. mangium* growers cannot gain profits (or so they think) are: (1) "*A. mangium* cannot be sold"; and (2) "if sold, the stumpage is lower than expected" (as summarized in Fig. I-17). In other words, for the growers to gain sales profits from *A. mangium*, the trees at the harvesting age must be able to be sold and the stumpage need to become higher than the present one.

Major causes that *A. mangium* grown in the area is not sold are: (1) contractors are not interested in the trees in the area; and (2) there is no marketing agreement. The reasons why contractors are not interested could be: (a) access to the plantation sites is difficult (or impossible) due to lack of proper roads and bridges; and (b) a purchase of *A. mangium* brings about little profit (or none, sometimes a loss) to them. Causes of the latter could be classified into: (i) an issue of plantation form (harvesting costs would be high because individual plots are too small and scattered); (ii) an issue of distance (transportation costs to a sawmill would be high because Marak Parak Consolidation is located in a remote area); and (iii) an issue of the price of *A. mangium* (the costs cannot be recovered because the millget price is too low). The proposed project, which would plan to purchase the trees from the farmers directly (or through a middleman), would be faced with the same problems.

On the other hand, the main cause of low stumpage is low millget price. When the contractor uses a middleman, who takes a commission, the stumpage will become even lower. In addition, there is a possibility that commercial value of a standing tree may be lower than it should be because of inappropriate tree management due to lack of proper technical instructions.

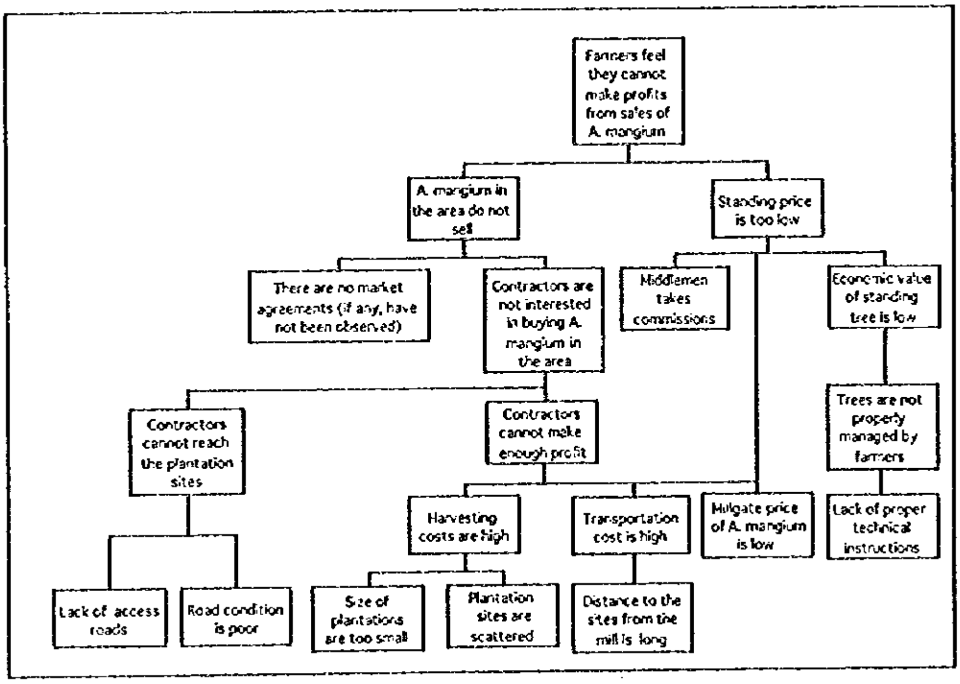


Fig. 1-17 Causes that farmers cannot gain profits by sales profit approach (or so they believe)

Possible project interventions for improvement of the problems are proposed below (an issue of the price of *A. mangium* is not discussed here):

First: to grow the trees on grouped farmlands in order to decrease harvesting costs. Grouping of the farmlands would require a consensus of those who hold the land rights. There is room for grouping of the farmland in the area since unutilized/under-utilized lands exist on a large-scale. In addition, the farmers are familiar with the group farming through the SRFB's programme. It would be easier for the project to undertake extension activities as well.

Second: to establish a sawmill near the area so that transportation costs could be decreased.

Third: to advise the farmers and to ensure that the trees will be planted near an access road and/or to improve road conditions in order to facilitate an access to the plantation sites. However, as for the former, it is likely that the farmers may end up in growing *A. mangium* on the lands far from the road as they tend to plant rubber near the access road. Construction/maintenance of access roads may be more effective intervention. Development of infrastructure such as roads and a sawmill would also satisfy the development needs of the local people (in terms of improved access and employment opportunities), but the associated costs are estimated to be great. If the plantation project on the alienated land is undertaken simultaneously with the large-scale industrial plantation, the infrastructure developed by the latter can be used: there would be no additional costs for the project on the alienated land.

Fourth: to make a formal contract with the farmers, including a marketing agreement (e.g. purchase guarantee, purchase time, etc.), in order to lower their perceived risk.

Fifth: to ensure that the tree growers could directly deal with the contractors (without the middlemen) in order to minimize the commission and to maximize their profits. Alternatively, the project could purchase the trees from the growers directly. The tree growers need to be organized and their negotiation ability must be enhanced.

Sixth: to provide appropriate technical assistance to the farmers so that they will be able to produce the trees with higher values. This cannot be achieved by the present form of PTF's extension service, in which the staff visit a village only once in 2-3 years and do not inspect the plantation sites. Improvement is necessary. In this regard, the human and financial resources necessary to carry out the tasks should be provided.

It is advisable to consider all the items mentioned above to be project strategies. For example, even if a plantation with a certain size is established through grouping of the farmland and economic value of the standing trees is increased, without an access to the plantation site and/or with high transportation cost to a sawmill, nobody would come and buy the trees and, therefore, income of the tree growers would not increase.

<Advantages and Disadvantages>

One advantage of the "sales profit approach" for the farmers is that their income increases as the price of *A. mangium* increases. Incentives for growing the tree is also expected to increase, which would lead to expansion of the planted area to the advantage of the project. The main disadvantage, on the other hand, is that sales profits would be influenced by the market situation and a risk for the farmers is high. Needless to say, their perceived risk concerning the sales profit approach is already high as growing of *A. mangium* through the PTF programme has not brought about any profits yet (or so they believe). A marketing agreement such as a purchase guarantee could be an incentive which would reduce their risk; however, such an agreement would result in higher risk for the project. In addition, under this approach, the project costs associated with development of infrastructure (when the large-scale plantation project is not carried out at the same time) and establishment of proper extension system may become high. If development of infrastructure is not feasible from financial point of view, the project approach should be re-examined.

(2) Land Rent Approach

Under the "land rent approach", the project will rent the land from landowning farmers, on which it will establish *A. mangium* plantation. Land rents will be determined based on the size of the land. A landowner will receive a fixed rent regularly. Alternatively, a portion of the net benefit that the project gains at the harvesting period could be paid to the landowner as a one-time rent ("profit sharing" option). Plantation labors will be recruited from the villages where the plantations are located. The landowning farmers will be given priority. In a shortage of labour, workers would be recruited from the neigbouring villages, and no foreign workers should be hired, as with the project on the state land.

As in the case of the "sales profit approach", the following conditions need to be satisfied for the "land rent approach" to succeed: (1) reduction of harvesting costs through grouping of lands; (2) growing trees near the existing roads and/or construction and maintenance of access roads for (easier) access to the plantation sites; (3) reduction of transportation costs by installing a sawmill nearby; (4) increase in commercial value of the standing trees. If the tree growing on the alienated land is to be carried out alone (without the large-scale plantation on the state land), it would be essential that the Project would produce enough benefits to recover the costs associated with development of necessary infrastructure.

<Advantages and Disadvantages>

One major advantage of the "land rent approach" is that, compared to the "sales profit approach", a risk for landowning farmers is minimum. First, a landowner would receive a land rent regularly, which is not influenced by the state of the growth of *A. mangium* and/or its market . (For those who are more risk-taking, a profit-sharing option would be available). What is more, the rent is unearned income. Since the main reason of the presence of unutilized/under-utilized lands in the Model Areas is lack of manpower as well as capital, this approach should be attractive. The farmers can also earn wage income if they decide to work as plantation workers. Moreover, with retaining their landownership, they are free to change the land-use pattern, if they so desire, after the contract period is over. An advantage for the project is that all the sales profits would become its revenue in principle. Management of the plantation as well as quality control would be easier.

A disadvantage is that, compared to the income that the farmers are expected to receive at the harvesting age under the "sales profit approach", the aggregated income (i.e. land rent and wage, if any) over the same period may be low[10)]. For the project, the costs for rents and wages, in addition to the costs associated with development of infrastructure such as roads, bridges and a sawmill (in a case where the project on the alienated land is carried out alone), may not be negligible.

[10)] It depends on an expected value of sales profit (for guaranteed price)

2) Plantation Sites and Watershed Conservation

In the project on the alienated lands, trees would be grown, in principle, on the lands where the landowning communities/people expect to see development. At the same time, however, it is important to reforest the lands which have been degraded for the conservation of the watershed. As previously mentioned, in Kg. Kotud, where most of the lands are planned to be developed into rubber plantations, it was insisted that there was no scope for the project intervention; whereas, in Kg. Polipikan and Kg. Sunsui, where unutilized/under-utilized lands (which are claimed to be the alienated lands) whose uses have not yet been decided are said to exist on a large-scale, ways of utilization are being sought for by the villagers, including respective JKKKs/Ketua Kampungs. However, the lands which they are interested in developing in order to raise their income do not necessarily coincide with the shrub areas, which need to be reforested for the watershed conservation. Most of the unutilized/under-utilized lands exist far from the access roads and/or adjacent to the forest reserve: some of them are likely to be included in the midium high forest areas, where reforestation activities are not necessary. On the other hand, a sizable portion of the lands that were identified as shrubs seem to be being (or planned to be) used as farmlands or rubber plantations, leaving little room for forestry activities under the present conditions (establishment of rubber plantations could be beneficial to the watershed conservation depending on the planting method since the trees would cover the lands for a long period (i.e. 25 years)). However, it is doubtful if all these lands could actually be developed into farmlands or rubber plantations: there is a good possibility that a portion of the lands currently planned to be used as farmlands and rubber plantations may be offered for growing of *A. mangium*, provided that the landowning farmers are convinced that the project will bring about increased income without fail.
Before selecting the project sites, it is advisable that, through collaboration between the project and the community members including the JKKK and the Ketua Kampung, an appropriate community land use (e.g. zoning) be discussed and agreed for each community, taking into account both economic aspects (i.e. increase of income) and environmental aspects (i.e. conservation of watershed). The plantation project should be discussed as an option for the land use. Not only the project and the community members but also the relevant government agencies (i.e. Forestry Department, Agriculture Department, KPD, SRFB, FELCRA) should actively participate in development of the community land-use agreement. Relevant project activities may include drawing the present community land-use pattern/plan into the land use/vegetation map (or the topographical map). Training of key persons in map reading, etc. would be necessary for this exercise. In order to encourage the villagers who cannot read a map to participate in the discussion, a three-dimensional map may be made.

3) Pilot Introduction of Trees in the Farming System

When the communities/people use or plan to use the lands that need to be covered by forests for the conservation of the watershed, for the purposes other than afforestation (for shifting cultivation, in particular), it is advisable to consider the conservation measures which could accommodate agriculture, a major occupation of the area, and tree growing. In introducing trees in the farming system (i.e. agroforestry), it should be noted that agroforestry techniques based on *A. mangium* (or other industrial species) are new to both local farmers and local extension agencies (forestry as well as agriculture). Neither research nor demonstration activities have been carried out in the area, which makes a risk for a full-scale introduction high: it would be appropriate to begin with a pilot project. Examples of agroforestry systems that may be worth introducing would include managed (improved fallow), taunya, alley cropping (hedgerow intercropping) and apiculture. Specific characters of these systems in a case of applying in the field are shown in Attachment 27.

2-7 The Present Status of Land Use

With regard to the Kota Marudu district, which includes this study area, statistics on the detailed classification of land-use is not available. The outline of such classification is shown in Table I-19.

Arable land accounts for 10% of the total. "Others" lands probably include some arable land (land for slash-and-burn), but such arable land is fluid in terms of area. At any rate, the area of permanent farmland is considered to be extremely small. This may be one of the reasons why the area is called an underdeveloped district. Most of the areas under SAFODA's administration are considered to be plantations. Forest reserves account for 18%. Urban areas and private land included in "Others" are negligible and most are state-owned forests (excluding reserve forests) or fields. This is not productive use of land, and in fact, such land is idle.

As a result, land-use in the Kota Marudu district on the whole is inefficient with some exceptions (parks, arable land and plantation). Accordingly, there is room for future development in this district.

Table I-19 Land-use Classification in the Kota Marudu District

Unit: 1,000ha

Land-use Type	Areas
Forest Reserves	35
National Parks	17
Military Land	
Arable Lands	19
SAFODA	2
Others	119
Total	192

Source: Data from SAFODA materials and Yearbook of Statistics in 1994.
Note: Others include forest land (state-owned forest), fields (devastated land), urban areas, rivers and roads.

The Marak Parak consolidation, for which the study was conducted, is 50,523 ha in area, accounting for 26% of the total area of the Kota Marudu District. The study team surveyed land-use and vegetation in this area by interpreting aerial photographs. The results are shown in Table I-20.

2-8 The Present Status of Local Industries

2-8-1 Agriculture

Area under cultivation of major crops in the Kota Marudu district as of 1994 is shown in Table II-21.

Table I-20 Land-use Classification in Marak Parak Consolidation

Land-use Type	Areas (ha)	Proportion (%)
Forest		
Natural Forest	47,089	93
High Forest	(663)	(1)
Medium Forest	(19,396)	(38)
Low Forest	(10,527)	(21)
Shrubs	(16,503)	(33)
Man-made Forest	87	-
Subtotal	47,176	93
Non-forest		
Mixed Plantation including Fruits	2,396	5
Grassland	447	1
Rubber Plantation	230	-
Villages	215	-
Paddy Fields	26	-
Farmland	17	-
Others	17	-
Sub-total	3,347	7
Total	50,523	100

Note: 1) This table is based on Land Use and Vegetation Maps.
2) The coverage of the study area was changed from 54,000 ha to 50,523 ha because the boundary of Forest Reserves adjacent to the study area was rectified.
3) The shrub forest includes some areas supposed to be fallow, however it was impossible to classify them by interpreting aerial photograph.

Table I-21 Areas Under Cultivation of Major Crops (Kota Marudu District) in 1994

Classification / Crop	Small-area Owners	Small-scale Plantation	Large-scale Plantation	Private Farm	Co-op	Other Governmental Organizations	Total
Rubber	3,978	-	-	-	-	-	3,978
Oil Palm	38	-	2,621	28	-	-	2,687
Cocoa	934	-	-	-	-	-	934
Coconuts	3,459	752	-	-	17	-	4,228
Wet paddy(in season)	3,085	-	-	-	-	-	3,085
Wet paddy (out of season)	3,058	-	-	-	-	-	3,058
Hill padi	208	-	-	-	-	-	208
Kendinga padi	41	-	-	-	-	-	41
Maize	93	-	-	-	-	130	223
Other vegetables	103	-	-	-	-	-	103
Ginger	1	-	-	-	-	-	1
Bananas	91	-	-	-	-	-	91
Citrus fruits	30	-	-	-	-	-	30
Pineapples	24-	-	-	-	-	-	24
Watermelons	4	-	-	-	-	-	4
Other fruits	253	-	-	-	-	47	300
Coffee	159	-	-	-	-	-	159
Cassava	56	-	-	-	-	-	56
Sweet potatoes	15	-	-	-	-	-	15
Yam	1	-	-	-	-	-	1
Peanut	5	-	-	-	-	-	5
Cashew nuts	1	-	-	-	--	-	1
Tobacco	5	-	-	-	-	-	5
Sugarcane	1	-	-	-	-	-	1
Total	15,643	752	2,621	28	17	177	19,238

Source: Estimated crops hectareages by districts, Sabah, 1994

In the Kota Marudu district, crops which are cultivated in a large area include: paddy rice (accounting for 32% of the total land under cultivation), coconuts (22%), oil palm (14%) and cocoa (5%). These crops account for 94% of the total cultivated land. Other crops include fruits, corn, dry-land rice, coffee and vegetables. In 1991, the total cultivated land decreased by 4,012 ha from 23,250 ha to 19,238 ha. Coconut fell 2,603 ha, cocoa shrank by 498 ha, and paddy rice declined by 462 ha. On the other hand, oil palm increased 480 ha and rubber expanded by 103 ha. Coconut plantations decreased because only a few old coconut plantations were replanted and most had been abandoned or replaced with other crops, due to a fall of the coconut oil price in the world market. On a management scale, almost all oil palms are cultivated in large-scale plantations. The other crops are cultivated by smallholders. In general, because the Marak Parak consolidation has a scarcity of flat land, coconut and oil palm which are major crops in the Kota Marudu District are not cultivated in this area. Rice paddies are small in area. Dry-land rice and corn produced in slash-and-burn farming are the major crops. Other crops which include yams, cassava, sweet potatoes, fruits and vegetables are grown mainly in subsistence farming. As for cash crops, rubber is important and popular, and fruits, peanuts and vegetables are also cultivated.

2-8-2 Others

Livestock is common among other industries.
Estimated numbers of livestock in Sabah are shown in Table I-22.

Table I-22 Trends in Estimated Numbers of Livestock in Sabah

Unit: number of heads

Year	Cattle	Water buffalo	Pig	Goat	Sheep
1990	38,000	43,870	113,000	37,000	2,000
1991	39,000	44,700	115,856	38,000	2,000
1992	40,000	43,200	116,000	39,000	2,000
1993	31,585	47,521	109,199	27,796	1,065
1994	38,911	48,625	182,772	29,538	2,783

Source: Yearbook of Statistics, Sabah, 1994.

According to the Yearbook of Statistics, Sabah, 1994, cattle, pigs, goats, sheep, chickens and ducks in Sabah have been increasing in number since 1990 (except for 1993). However, the consumption of such livestock is also increasing year by year, outpacing production. With the exception of chicken, the gap is filled with imports .

In the Kota Marudu district, a majority of livestock are kept by smallholders as domestic animals. There is no large-scale management in the livestock industry in this district. The same is true of the Marak Parak consolidation; raising a small number of livestock as domestic animals is common.

According to materials from the Department of Fisheries, Sabah, the catch of natural marine products is 160,000 tons and the total sales are RM398.95 million as of 1994.

Kota Marudu district faces the southernmost part of Marudu Bay and small-scale fisheries are engaged there. According to the statistics published by the Department of Fisheries on catch in Sabah, which were broken down by district and product, the total catch of 28 kinds of marine products in the Kota Marudu District stands at 2,851 tons as of 1994. Jellyfish is the product most caught, at 2,205 tons, followed by shrimp at 266 tons.

There are no fisheries dealing with marine products in the Marak Parak Consolidation, because this area is located inland.

2-9 Forestation and Plantation Industry

2-9-1 Plantation

Large-scale industrial afforestation in Sabah, which started during the 1970s, is mainly being implemented by three organizations: Sabah Softwoods Sdn. Bhd (SSSB), Sabah Forestry Development Authority (SAFODA), and Sabah Forest Industries Sdn. Bhd. (SFI). There is 113,194 ha of plantation in Sabah as of December 1995, 80% of which has been planted with fast-growing species. Tables I-23~24 show plantation area in Sabah by organization and by species.

Table I-23 Plantation Area in Sabah (ha) by Organization - December 1995

	Fast-growing species	Rattan	High Value species	Total
SSSB	33,942	-	-	33,942
SAFODA	34,363	9,263	-	43,896
SAFODA's PTF Scheme	2,057	-	-	2,570
SFI	12,139	-	-	12,139
SFI's Smallholder Scheme	1,596	-	-	1,596
a) ICSB-Huasong	-	7,457	712	8,169
b) ICSB-Danum	-	-	479	479
Koprosa Sdn. Bhd.	1,258	-	-	1,258
Boonrich Sdn. Bhd.	1,230	-	-	1,230
Lak Sdn. Bhd.	495	-	-	495
Sejati Sdn. Bhd.	2,096	1,546	174	3,816
Sime Darby Plantations	130	-	-	130
Kebun Singa Sdn. Bhd.	121	-	-	121
Empat Bersaudari Sdn. Bhd.	-	114	-	114
Kebun Sg. Balung	1	20	-	20
Jeroco Plantation Sdn. Bhd.	-	1,825	-	1,825
Forestry Department	600	20	300	920
Total	90,027	20,605	2,049	113,194

Source: Forestry Department

Table I-24 Plantation Area in Sabah (ha) by Species- December 1995

Species	Planted Area (ha)
Acacia mangium	56,072
Paraserianthes falcataria	12,049
Gmelina arborea	10,142
Eucalyptus deglupta	5,728
Pinus Cribaea	696
Other Eucalyptus (grandis, urophylla, camaldulensis, globulus)	786
Rattan (Calamus sp.)	20,763
Tectona grandis	1,704
Other species (Dipterocarps, Swetinia, Khaya, Pterocarpus, Araucaria, Pinus sp. Etc)	5,254
Total	113,19

Source: Forestry Department

SSSB is a 60/40 joint venture established in 1974 between Sabah Foundation, which is a quasi-governmental institution with its objectives to promote education and social welfare of the State's residents, and North Borneo Timbers Sdn. Bhd (NBT). 60% of Sabah Foundation's share is currently owned by Innoprise Corporation Sdn. Bhd. (ICSB). SSSB has approximately 60,000 ha of forest land in Brumas and Luasong near Tawau in southwestern Sabah, where it plants fast-growing trees. SSSB was the first company to pursue large-scale industrial forestation in Malaysia. SSSB first planted Pinus caribaea, a softwood (conifer), but eventually stopped planting softwoods and switched to hardwoods for forestation. Current major species planted by SSSB include *Paraserianthes falcataria* (20%), *Gmelina arborea* (10%) and *Acacia mangium* (60%).

SFI was established in 1982 as a fully state-owned company, but today an 80% stake is held by Lion Group (80%). This company has an integrated pulp and paper mill in Sipitang in southwest of Sabah, as part of the national investment policy aimed at promoting development and diversification of the economy and technology in Malaysia. The Sabah government has allocated approximately 300,000 ha of natural forest for this pulp and paper mill project. Trees more than 30 cm in diameter are cut and sold to sawmills or plywood mills, while the rest - a mixture of tropical hardwood trees - are used as materials for pulp. Forestation activities started in 1985 and the plantation area is said to exceed 12,000 ha as of the end of 1996. About 95% of the trees planted are *Acacia mangium*, and the rest are *Gmelina arborea*, *Eucalyptus grandis*, *Eucalyptus urophylla* and *Eucalyptus globulus*. The company's target for plantation area is 60,000 ha. SFI also encourages farmers in the vicinity to plant trees by providing seedlings as well as technical advice.

SAFODA, the only public entity carrying out plantation activities in northern Sabah, was established by law in 1976. The purpose of its establishment was to plant trees on degraded or agriculturally marginal land, carry out forestry settlement, and improve socioeconomic conditions of local people by means of forestry. Most of its plantation areas are located in the west and north of Sabah. Trees for forestation are mainly fast-growing species, mostly *A. mangium*. SAFODA started two forestry settlement projects, one in Bengkoka and the other in Karamatoi in 1983 and 1984, respectively. The settlements consisted of provision of houses as well as land and infrastructure to help improve the welfare of local people.

Private Tree Farming (PTF) is a forestry program for farmers administered by SAFODA. The objectives of this program are: 1) to encourage participation from all communities in tree planting industry and to improve socioeconomic conditions of local people through forestation; 2) to rehabilitate degraded land and improve the environmental condition of rural areas; and 3) to increase timber production through man-made forest. SAFODA provides complimentary seedlings for up to six hectare plantation to the farmers who SAFODA considers qualified. SAFODA also provides participants with technical assistance.

It has been nine years since PTF was initiated (1988) in northern Sabah. Although both the number of participants and the planted area steadily increased during the first six years of the program, both figures have been declining since 1994 as the tables below (1-25~26) indicate. The major reasons for the decline are the scarcity of the land qualifying for the application of PTF (surveyed land) and the poor sales prospect of *A. mangium*. Although SAFODA's PTF pamphlet states that marketing agreements are to be made by SAFODA, no market has been identified so far by SAFODA.

Table I-25 Planted Area under PTF in Northern Sabah (ha)

Year	Kudat	Kota Marudu	Kota Belud	Pitas	Tuaran	Total	Area Damaged by Fire	Balance
1988	15.00	8.63	7.71	-		31.34	2.94	28.40
1989	149.86	84.93	71.44	17.78		324.01	2.40	321.61
1990	121.36	112.17	81.72	45.75		361.00	2.00	359.00
1991	167.22	137.26	309.40	154.2		768.11	2.58	765.53
1992	99.33	80.83	133.10	75.67		388.93	89.33	299.60
1993	85.17	229.46	93.53	68.33		476.49	4.50	471.99
1994	11.88	114.42	31.09	17.38		174.77	1.00	173.77
1995	31.88	72.77	23.70	13.40	15.34	157.09	7.00	150.09
Total	681.70	840.47	751.69	392.54	15.34	2,681.74	111.75	5,569.99

Source: PTFP SAFODA, Ulu Kukut

Table I-26 Number of Participants in PTF in Northern Sabah

Year	Kudat	Kota Marudu	Kota Belud	Pitas	Tuaran	Total
1988	21	21	24	-	-	66
1989	106	29	82	-	-	217
1990	26	79	47	30	-	182
1991	74	167	46	72	-	359
1992	42	70	55	27	-	194
1993	35	86	224	65	-	410
1994	14	18	93	28	-	153
1995	16	32	16	2	16	82
Total	334	324	587	502	16	1,663

Source: PTFP SAFODA, Ulu Kukut

2-9-2 Production of Plantation Logs

Because of the decrease in available natural wood and the ban on log exports since 1993, log output from natural forests in Sabah decreased from 11.6 million m^3 in 1992 to 6.3 million m^3 in 1995. On the other hand, log output from man-made forests increased from 0.23 million m^3 in 1992 to 0.35 million m^3 in 1995. As a result, the share of log production from man-made forests in total Sabah log production increased significantly from 2% to 5%. The following table (I-27) shows the log production from natural and man-made forests.

Table I-27 Log Production from Natural and Man-made Forests in Sabah (m^3)

Year	Natural Logs	Plantation Logs
1990	8,442,735	188,842
1991	8,163,408	225,184
1992	11,632,596	228,892
1993	9,291,020	256,173
1994	7,951,763	303,513
1995	6,319,989	346,521

Source: Forestry Department, Sabah

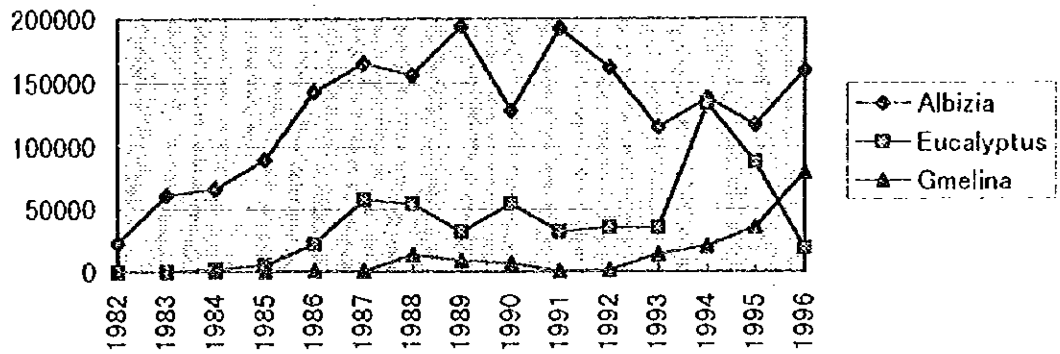
Plantation logs are produced mainly by SSSB, SFI and SAFODA. The production of plantation logs by producer is as Table I-28:

Table I-28 Production of Plantation Logs by Producer (m^3)

Year	SSSB	SFI	SAFODA	Others	TOTAL
1990	188,842				188,842
1991	225,184				225,184
1992	227,919	226	719		228,892
1993	221,369	29,817	4,987		256,173
1994	292,810	1,382	9,321		303,513
1995	246,255	99,041	180	1,045	346,521
1996	247,615	25,042	562	20,081	293,360

Source: Forestry Department, Sabah

Currently *P. falcataria*, *E. deglupta* and *G. arborea* are sold on a commercial basis, while *A. mangium* has been sold or used only on a trial basis. The following graph shows the yearly production of *Albizia*, *Eucalyptus* and *Gmelina* from 1982 to 1996, mainly by SSSB.



Source: Processed Data from Forestry Department, Sabah

Fig. I-18 Production of *P. falcataria*, *E. deglupta* and *G. arborea* in Sabah (m^3)

2-9-3 Current Market for Plantation Wood from Sabah

Some plantation wood is exported in log form, while the rest is processed into sawn timber or chipped to be used for pulp. The following table, I-29 shows the evolution of export volume, FOB value and unit price of plantation logs.

Table I-29 Export Volume and Value of Plantation Logs from Sabah

Year	Export Volume (m^3)	FOB Value(RM)	Unit Price(RM/m^3)
1990	106,114	7,954,613	75.0
1991	179,739	13,327,897	74.2
1992	132,404	9,494,990	71.7
1993	127,705	10,976,959	86.0
1994	140,386	11,548,412	82.3
1995	111,074	10,135,417	91.2

Source: Forestry Department, Sabah

The overseas market for Sabah's plantation logs is small and not expanding. Most of the plantation logs are exported to Taiwan, Japan and Indonesia. The following table, I-30 shows the export volume of plantation logs by destination and species in 1996.

Table I-30 Export Volume and FOB Price of Plantation Logs from Sabah by Species in 1996

	A. mangium	P. albizia	E. deglupta	G. arborea
Taiwan	3,945 m^3 (RM 61 / m^3)	25,617 m^3 (RM 107 / m^3)	18,015 m^3 (RM 85 / m^3)	35,451 m^3 (RM 67 / m^3)
Japan	117 m^3 (RM 74 / m^3)	307 m^3 (RM 152 / m^3)	4,087 m^3 (RM 132 / m^3)	200 m^3 (RM 149 / m^3)
Indonesia	3,907 m^3 (RM 63 / m^3)	-	-	2,800 m^3 (RM 62 / m^3)

Source: Forestry Department, Sabah

According to the Forestry Department in Sabah, Taiwan is also the major destination of plantation sawn timber from Sabah, importing 17,948 m^3 or 93% of Sabah's plantation sawn timber in 1996. Most of the plantation sawn timber exported to Taiwan was presumably in blockboard. Its 1996 FOB price averaged RM 685 / m^3.

2-9-4 Perspective of Plantation Activities in Northern Sabah

Wood-based industry in Sabah has played an important role in the state economy. However, the share of forestry and logging in the state's GDP decreased from 10% in 1992 to 8% in 1994. State revenue from the forestry sector also peaked in 1992 and has significantly decreased since then. The following Table shows the Sabah government's total and forestry sector revenues from 1990 to 1994.

Table I-31 Sabah Government's Revenues (Total and Forestry Sector)

	1990	1991	1992	1993	1994
Sabah State's Total Revenues (RM '000)	1,619,924	1,479,960	2,004,693	1,332,284	2,237,900
Revenues from Forest Sector (RM '000)	818,075	699,815	856,541	702,804	686,739
Share	51%	47%	43%	53%	31%

Source: State Treasury, Sabah

As forest sector revenues have declined, Sabah State has also decreased its budget for plantation activities. State government grants to SAFODA for plantation development peaked at RM 15 million in 1994. The amount has decreased to approximately RM 7 million in 1997 and the state government intends to further slash the SAFODA budget allocation. Furthermore, the state government is requesting SAFODA to repay its RM 40 million debts, part of which are already overdue but which SAFODA fails to service. It should also be noted that the cabinet of the state government made a decision in 1996 to corporatize SAFODA, although the deadline for the corporatization is not specified. Corporatization of SAFODA will require that plantation management be commercially viable.

The biggest problem for continued plantation activities in northern Sabah is that outlets for plantation wood have not yet been established in this region. In other words, SAFODA has not yet succeeded in developing its own sources of revenue. Given the state's budget constraints, sustainable forest development in northern Sabah cannot be achieved without identification and/or creation of markets for plantation wood. If the situation is left as it is now, plantation activities will be eventually suspended. Marketing strategy for plantation species in northern Sabah will be discussed later in Chapter III Section 4.

3. Preparation of Topographic Map

3-1 Outline of Works

The contents of survey works were to prepare the topographic map at a scale of 1:20,000, covering 505 km^2, using the aerial photos (scale: 1/25,000) taken by the JICA in 1993. Interval of main contour lines was 20m however, in flat area, supplemental contour line was drawn at 10m interval.

The survey works involved field survey, aerial triangulation, stereo plotting, compilation, etc. These works were conducted by contracting with a competent local surveying company in Malaysia.

3-2 Field Survey Works

3-2-1 Field Survey

1) GPS Surveying

(1) GPS Observation

The stations to be observed by GPS were selected using the Forest Base Map at a scale of 1:50,000 and aerial photos prepared by JICA, together with field reconnaissance, GPS observations were conducted.

GPS observations were carried out according to the differential positioning method, and those observations were conducted simultaneously at three (3) points, during a two-hour period when the GPS receivers could receive signals from more than five (5) satellites simultaneously.

GPS observations were conducted based on the three (3) existing triangulation stations as given points which were established by the Land and Survey Department in Sabah.

(2) Analysis and Computation

Observed data were processed by a GJPS analysis software referenced to the ellipsoid of the WGS 84 geodetic system. The accuracy of points was ascertained by analyzing the baselines between each stations surveyed.

The Trimnet Program in the GPS software for computation of network average was used to control the base line analysis of the existing triangulation stations.

The net adjustment for newly established photo control points was carried out based on the results of base lines by using the GPS software.

Finally, the existing triangulation point G 01722-91 was fixed to the datum station for the study area, and the coordinates of the photo control points were computed on the Modified Everest Ellipsoid which was used in Sabah and Sarawak. Then, the coordinates of the photo control points were converted to Borneo Rectified Skew Orthomorphic-BRSO-GRID.

The survey standards used for analysis and computation were as follows:

* Reference ellipsoid for GPS : WGS 84
* Ellipsoid adopted in Sabah : Modified Everest
* Protection : Borneo Rectified Skew Orthomorphic-BRSO-GRID.

  (Origin; 4°00'N, 115°00'E of Greenwich)

  Scale factor at origin; 0.99984)
* GPS Receiver : Ashteck

The list of the photo control points are shown in Table I-32. The distribution of photo control points are shown in Fig. I-19.

2) Leveling

Leveling route of about 100 km was surveyed based on the existing bench marks, to obtain the orientation of aerial triangulation heights and plotting heights. Spot heights were pricked on the photos at 2 km intervals to guarantee the height accuracy in the plotting stage. Some accessible GPS observation points were also connected by leveling

As for leveling accuracy, allowance was 6 cm x $\sqrt{L}$, where L is the observed distance in km.

3) Field identification

Documentation names of villages, rivers were gathered, and annotations, marginal information, sheet index, etc. were discussed with the Forest Study Team and SAFODA.

3-2-2 Plotting and Outputs

1) Aerial triangulation

Aerial triangulation was conducted to determine the planimetric coordinates and elevation of tie points and pass points required for plotting, on the basis of the results of the ground control point survey.

Volume of works and specifications were as follows:

* Number of models : 74 methods,
* Adjustment computation : Block adjustment, independent models method,
* Pricking : Wild-PUG 4,
* Observation : Wild-AMH (digital)

2) Plotting and compilation

Contour lines, rives, road, villages etc. were plotted with the digital mapping instruments which are generally adopted in Malaysia. After checking and correcting the topographic features on the monitor screen, annotations, map symbols etc. were compiled.

Digital plotting of the map manuscripts was conducted using an ink jet plotter. The draft map was thorough fully checked and final results were prepared.

The main instruments and softwares were as follows:

* Scanner	: Agfa Horizon Ultra 1200 dpi Scanner,
* Plotter	: Digital Analytical Plotter Wild-AG1,
* Ink jet plotter	: Hewlett Packard Design Jet HP 650C,
* Plotting software	: Diap Softcopy Mapping System (ISM),
* Compilation soft	: Micro Station PC Version 5.0

3) Outputs

Following final results were submitted to SAFODA

①	Draft Map Manuscript (polyester base)	1 set (4 sheets)
②	Duplicate of Map Manuscript (polyester base)	1 set (4 sheets)
③	Blue copy (paper)	2 sets (8 sheets)

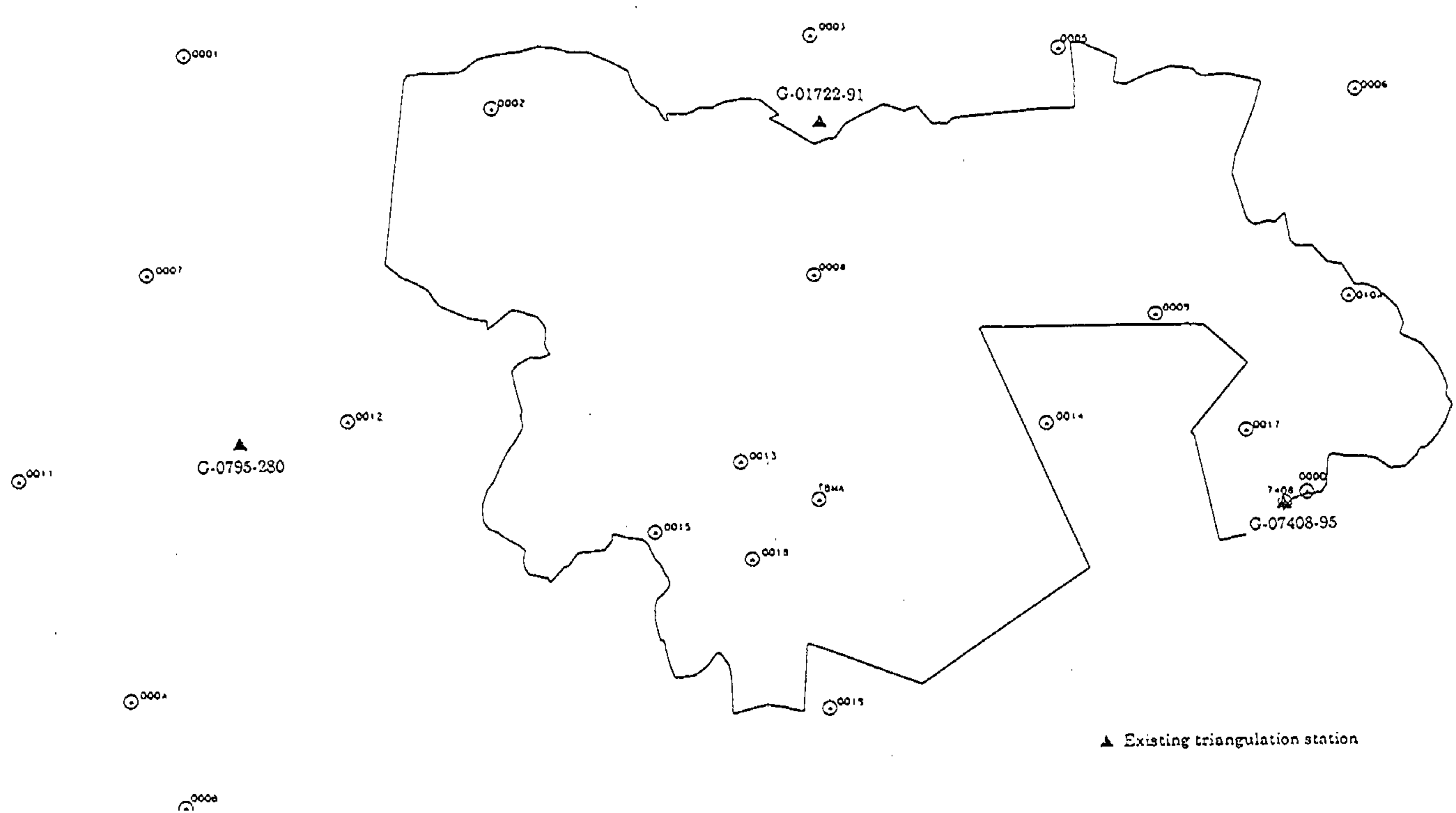


Fig. I-19 Distribution of Photo Control Points

Table I-32 List of the Photo Control Points

Station No.	X Coordinate	Y Coordinate	Height m
TK0001	714884.265	761531.308	93.714
TK0002	712951.458	772747.406	392.532
TK0003	715601.867	784093.424	81.460
TK0005	715080.654	793058.588	17.554
TK0006	713627.409	803680.562	749.027
TK0007	707013.663	760258.190	55.275
TK0008	706922.757	784283.043	116.787
TK0009	705394.273	796533.903	857.065
TK010A	706109.836	803468.162	785.106
TK0011	699492.442	755819.206	54.045
TK0012	701654.053	767628.658	417.858
TK0013	700023.041	781694.957	127.289
TK0014	701448.875	792704.295	610.405
TK0015	697473.314	778624.682	169.107
TK0017	701202.016	799796.788	695.195
TK0018	696449.556	782122.561	256.657
TK0019	691070.602	784913.461	635.391
TK000A	691479.399	759821.812	234.846
TK000B	687472.582	761802.455	492.499
TK000D	698935.154	801995.331	746.623

Grid:Borneo Rectified Skew Orthomorphic-BRSO-GRID

STATION	T I M B A L A I 4 8		
No.	L A T	L O N G.	E.HEIGHT(m)
TK0001	N6° 27' 13."62244	E116° 33' 13"87551	93.714
TK0002	N6° 26' 08."73679	E116° 39' 18"59538	392.532
TK0003	N6° 27' 32."97358	E116° 45' 23"36961	81.460
TK0005	N6° 27' 14."33895	E116° 50' 20"08359	17.554
TK0006	N6° 26' 24."99804	E116° 56' 05"54389	749.027
TK0007	N6° 22' 57."61112	E116° 32' 31"08767	55.275
TK0008	N6° 22' 50."37767	E116° 45' 32"94688	116.787
TK0009	N6° 21' 53."32197	E116° 52' 11"36237	857.065
TK010A	N6° 22' 20."28687	E116° 55' 57"17458	785.106
TK0011	N6° 18' 53."51016	E116° 30' 05"34954	54.045
TK0012	N6° 20' 01."84230	E116° 36' 30"01264	417.858
TK0013	N6° 19' 06."21867	E116° 44' 07"45714	127.289
TK0014	N6° 19' 50."59527	E116° 50' 05"98642	610.405
TK0015	N6° 17' 43."76627	E116° 42' 27"02408	169.107
TK0017	N6° 19' 41."20820	E116° 53' 56"74694	695.195
TK0018	N6° 17' 19."79739	E116° 44' 20"71742	256.658
TK0019	N6° 14' 14."15738	E116° 45' 50"53851	635.391
TK000A	N6° 14' 31."94882	E116° 32' 14"21569	234.846
TK000B	N6° 12' 21."15547	E116° 33' 17"96019	492.499
TK000D	N6° 18' 26."98016	E116° 55' 07"85521	746.623

4. Forest Survey

4-1 Classification of Forest Vegetation

When forest vegetation is defined to be land where trees grow in a group, the forest in the study area will be measured in 47,176 ha. In this study, the forest vegetation is widely divided into two categories, natural and artificial forests and the natural forests are subdivided into four categories: High, medium, low and shrub forests. (see I-5-1, "Aerial Photograph Interpretation".) Shrub or low forest areas are found mostly in suburban areas of villages or along roads, and are considered to be vegetation that has gradually deteriorated through excessive use of the land in addition to logging. Most of these forests appear to be land abandoned or the fallow after shifting cultivation. Except for shrub forests, the forests are measured in 30,673 ha.

All forest areas within the study area are secondary forests and most of them are located between 300 m to 900 m above sea level. There are very few high forest which are composed of *Dipterocarpaceae* trees, a indigenous species. The study area falls within a state forest area (convertible to any other uses) other than forest reserves designated by the Sabah State Forest Department to be permanently kept as forests. Accordingly, logging has been carried out widely, so much, in fact, the forest vegetation has deteriorated to the extent that high forests only account for as little as 1 % of the entire forest area (Table I-33). High forests only remain on the mountainous slope with difficult access.

The medium high forest and low forest areas make up a large portion of the forest vegetation. These forests are also distributed on poorly accessible mountainous areas far from villages. They are considered to have been mainly transformed from high forests to medium high forests due to excessive logging. In the medium high forests, *Dipterocarpaceae* species are mixed and some of them are mature trees which are able to produce seeds. The medium high forests are considered to be a forest type that would enable to expect a natural regeneration by suitable forest management. However, in areas with favourable geographical and topographical conditions, shifting cultivation has entered and it causes further forest degradation. Low forests are a forest type in which forest degradation has progressed further because of cutting for commercial logging, shifting cultivation carried out after the cutting, or forest fires. It is also a stand which is now regenerating with light-demanding trees after cultivation or fires. Although a sapling of tolerant species is sometimes found because seeds drop from groups of high trees that are found in surrounding areas, the forest stands consist mostly of the pioneer species of light-demanding trees. Natural forest regeneration seems to require a considerable amount of time. In places where favourable geographical conditions exist such as along roads, it is desirable that the establishment of plantations be performed artificially.

Shrub forests are often found in areas around roads where there tends to be accessibility to villages. They are, on the whole, considered to be regenerated forests, produced by repeated shifting cultivation. Actually, areas are often found which seem to have been left as fallow after cultivation. For shrub areas other than those which are fallow land, the establishment of forests needs active reforestation as natural regeneration requires a great deal of time.

Examining forest conditions by basin, the Manuradiang Basin (see Fig. I-20), is relatively close to villages in spite of its harsh topographical conditions, and thus logging is carried out at locations close to these villages, however, some high forests exist, in extremely inaccessible remote areas. Rubber planting and shrub forests which developed after cultivation are distributed near the villages, and show a contrasting forest type to forests in the remote areas.

In the Bandau and Pangapuyan Basins, cutting was carried out in the past and few high forest areas can be found. Forest degradation, however, has not progressed so far and medium high forest areas are distributed throughout the regions. Shrub forest areas, that seem to have developed after cultivation had been abandoned, extend around mountain in the remote areas. Compared with other regions, forest devastation has not progressed so far in these basins.

In the Kinarom basin, development has progressed due to easy accessibility, and severe degradation of its forests areas has occurred. Grassland, shrub forests, low and medium high forests extend from the lowlands to the hilly and mountainous districts. Only in the remote mountainous districts are some high forests found. Grassland and shrub areas which will be target for reforestation, are most densely concentrated in this area.

In the Bengkoka Basin, many flat areas of land exist and logging has consequently occurred, no high forest can be found. Only a small number of people have entered the region. The area of shifting cultivation following this logging is small in scale, and the forest devastation has not progressed very far in this area. Medium high forests are distributed throughout the basin.

Table I-33 Vegetation Types by Basin

	Bandau	Pangapuyan	Kinarom	Manuradiang	Bengkoka	Total
1) Forest	5,900	6.727	26,522	1,796	6,231	47,176
High Forest		(127)	(415)	(121)		(663)
Medium high forest	(3,537)	(2,936)	(7,631)	(156)	(5,136)	(19,396)
Low Forest	(1,119)	(1,511)	(7,143)	(577)	(177)	(10,527)
Shrubs	(1,244)	(2,153)	(11,253)	(935)	(918)	(16,503)
Man-made Forest			(80)	(7)		(87)
2) Non-forest	126	18	3,059	118	26	3,347
Total	6,026	6,745	29,581	1,914	6,257	50.523

4-2 Basin Characteristics

The study area is composed of a mainly flat central area which includes Marak Parak village and the mountainous districts that surround it. A river flows from a southern area towards the northeastern part of the study area before flowing into the Marudu Gulf. Watersheds, including the study area, can be divided into five areas (Fig. I-20). These watersheds are the Bandau, Pangapuyan, Kinarom, Manuradiang and Bengkoka basins. The study area covers a portion of these basins. The Major topographical characteristics of these basins are shown in Table I-34.

A description of the basins is given below:

a. Bandau Basin

This region's topography was formed from the erosion of a mountain mass by the Bandau River, which flows northeastward directly in the middle of the watershed. The river has two tributaries in its upper reaches. The steep topography that can be found on both banks of the mountain torrent, is being eroded by short streams in the smaller valleys. The relative height of the basin is about 1,100 m and the length of the main stream is 15.5 km. Although the average grade of the main stream is 5.5%, the stream bed suddenly gets much steeper in a remote section, with the grade exceeding 10%. This remote section is a fan-shaped catchment formed by the two tributaries, and rainwater from the basin pours into the Bandau

River, after which the grade moderates. The peak flow is raised , because rainwater from this basin concentrates into one channel. For this reason, it is expected that rain flows out quickly and raises the risk of local flooding. The tributaries tend to erode downwards, so that the picking up and sediment transport is expected. However, since the main stream has a gentle grade and is less able to transport sediment, the sediment seems to be accumulating on the stream bed at curved sections of the channel.

In this region, a comparatively large area of forest remains with a 59% forest ratio. However, it should be noted that these are devastated secondary forests. Although no high forests can be found, few inhabitants have entered the region and forest deterioration has not progressed very far. Medium high forests cover the whole region. The basin is dotted with villages around its mouth, but no villages are found in the remote sections.

This region, as well as the Pangapuyan basin below, has been used by Kudat and Kota Marudu as the source of their domestic water supply.

b. Pangapuyan Basin

Similar to the Bandau basin, this area is also covered by mountainous terrain, with the Pangapuyan River winding its way through the middle. Steep topography formed by downward erosion can be found on both banks of the main stream. Steep streams in the smaller vallyes carve out the topography. The main stream length is 25.8 km and its average grade is 2.8%, indicating a comparatively gentle incline, but in the mountain districts near the source of the stream, the grade is very steep at 5.0%. Precipitation, however, seems to discharge gradually with a controlled peak flow rate, since the basin has a slender shape. Characteristics of sediment production and transport are the same as those in the Bandau Basin.

The forest ratio is 45%, with a few high forests remaining on parts of ridge sections. Inhabitants have entered the region in an area with a comparatively gentle topography around the basin mouth and on remote ridge sections with comparatively easy slopes.

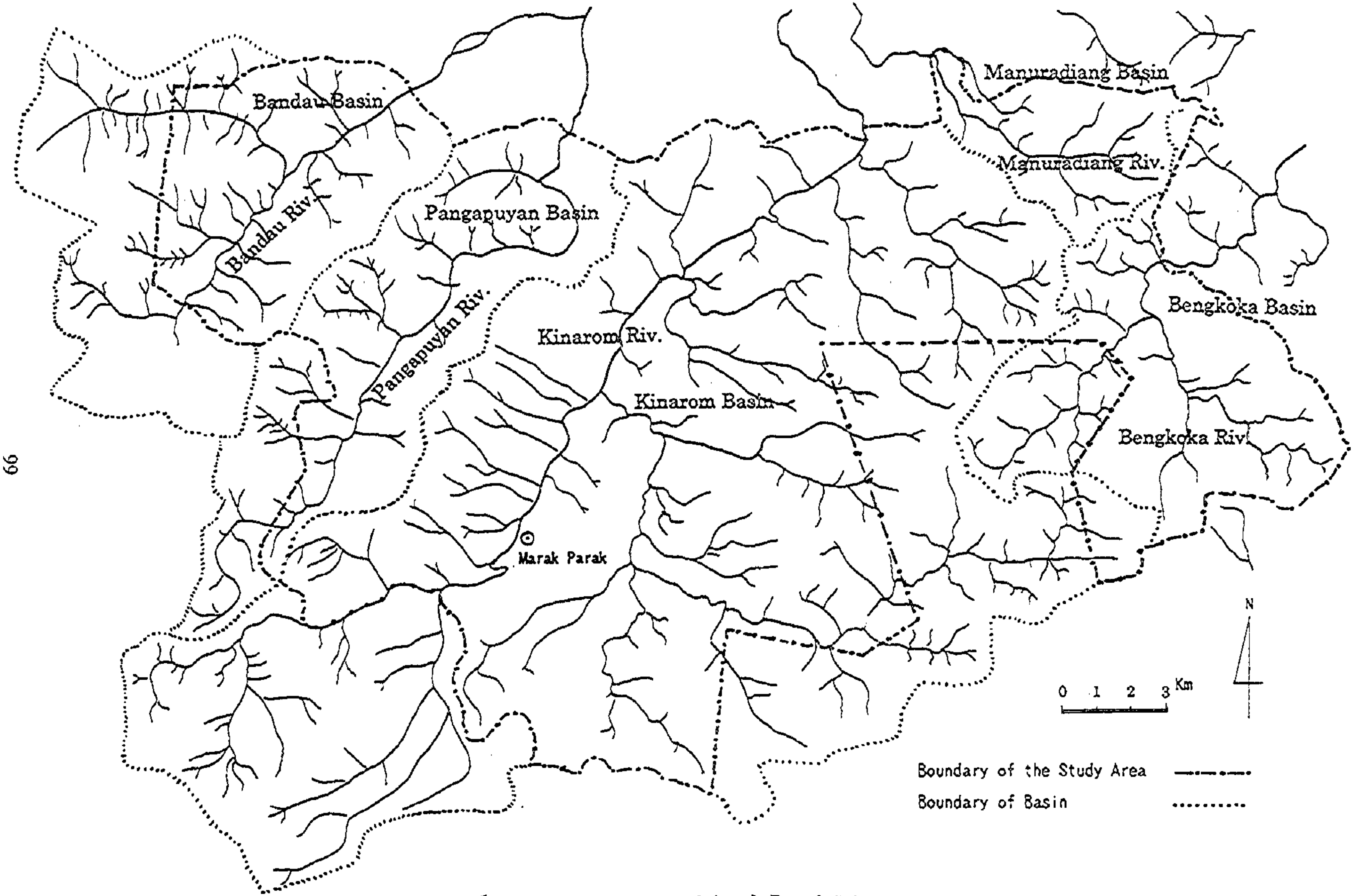


Fig. I-20 Division of the Marak Parak Watershed

c. Kinarom Basin

This is the largest basin within the study area. Many inhabitants have entered this area, and development has progressed the furthest here. The outskirts of the basin are surrounded by steep mountain areas. The Kinarom River flows through the middle of the basin, and an alluvial basin extends alongside it. On the left bank there is steep mountainous terrain, while on the right bank there is some hilly ground next to the alluvial basin. Deep in the remote sections, the topography becomes very steep, forming mountainous terrain. An area stretching from a plain to a hilly zone is dotted with villages and the development of land cultivation has occurred in the area.

With its source located on Mt. Tambuyukon (2,581 m above sea-level), the Kinarom River flows swiftly down through steep mountain areas to reach the basin, where it then winds more slowly. The river is quite long measuring 37.5 km. The tributaries on the left bank are of the short and steep torrents. The tributaries on the right bank flow along steep channels in the remote mountainous sections, but begin to meander down more slowly after reaching the hilly zone before joining the Kinarom River. This basin is fan-shaped and rainfall from the drainage basin of each tributary pours simultaneously into the main stream, increasing the peak flow. The main stream, however, stretches over a long distance and winds its way across a gentle slope. Similar to the main stream, the tributaries meander. It is supposed that the basin has a functions in such a way that the channel flows at a slow walking pace. The forest ratio here is the lowest, at only 34%. Some high forests remain on steep land in remote sections. For this reason, localized flooding is expected to occur due to rainfall that quickly flows out from the mountainous districts.

Villages have been built on flat districts and zones with gentle slopes close to the main stream and its tributaries. Cultivation is being carried out on the flat areas and the gentle slope of the hilly area. In addition, along the left bank where few flat districts are found, shifting cultivation is being undertaken, even though this area is nearly 700 m above sea-level.

d. Manuradiang Basin

Within the study area, this is the smallest basin. It was formed by the downward erosion of a mountain mass. Since this basin has a short depth and a relative height of 900m, it consists of steep mountainous terrain. The Manuradiang River, which flows along the middle of the basin, is a steep stream with average grade of 8.5%. Although grades of 18.8%, which occur in remote sections, gradually lessen and become much more gentle, the grade is still 3%, even downstream. Rainfall within the drainage basin flows very rapidly down to the downstream areas in this river system. The stream flows not at a walking speed, rather than at running pace. Compared with other basins, the time lag of peak discharge is assumed to be very short. Taking the grades of stream beds into consideration, the capacity of sediment transport is expected to be so high.

The forest ratio is low at 14%. Since this basin is adjacent to Kota Marudu farmland, it is easy for local people to get access to it. Accordingly, the half area near to the basin mouth, is under cultivation. In remote sections, however, no utilization or development has taken place and large areas of high forests remain, due to the steep terrain in these areas.

The area around the basin mouth is dotted with many villages.

e. Bengkoka Basin

This is the basin in which the source of the Bengkoka River is located. The basin has a flat topography that extends over about 700 m above sea-level. It is surrounded by mountainous terrain at the edges. The relative height is about 300 m. Although the stream in the mountainous districts has a slightly steep grade, the main stream flows slowly with a gentle slope.

In the most remote sections of this basin, logging is carried out because the topographical conditions are not harsh. As a result, high forests have disappeared and poor secondary ones are found. The basin is mainly covered with medium high secondary forest.

Few inhabitants have entered the basin due to its lack of accessibility.

Table I-34 Topographical Features by Basin

Basin Factors	Bandau	Pangapuyan	Kinarom	Manuradiang	Benkkoka
Area (1,000 ha.)	6	7	30	2	6
Altitude range (m)	90~1,190	90~1,070	15~2,440	15~900	670~980
Relative Height (m)	1,100	980	2,42	885	310
Main stream length (km)	15.5	25.8	37.5	9.9	10.0
Average grade of main stream (%)	5.5	2.8	4.8	8.5	1.6
Forest ratio (%)	59	45	27	14	82

Note: Forest ratios have been calculated using high forests and medium height forests.
Section profile of stream bed is shown in Attachment 5.

4-3 Forestland Productivity

A Forestland productivity survey was conducted to quantitatively estimate tree growth and volume for certain land, using environmental land factors of topography, soil and vegetation. To confirm the results, the tree growth (dominant height is used here) of plantations was investigated in the study area. It is classified into site indices which had been fixed previously, and environmental factors affecting such plantations (site indices) were deduced using a quantification method. Next, the tree growth of planted trees was estimated, based on the previously mentioned environmental factors.

4-3-1 Decision of Site Indices based on Plantation Survey

In the Marak Parak and Piso villages, there exist some small-scale plantations of *Acacia mangium* which were planted through a PTF initiated by SAFODA in 1988. Out of these plantations, 13 sites which are accessible and well managed (refer to Fig.I-21) were selected at random, and measured their tree growth. To ascertain these growth, a square plot of 20 m x 20 m in size was set up and 15 sample trees in the plot were chosen, and then the tree height and the diameter at breast height (DBH) were measured to establish the relationship between them. For the remaining trees within the plot, only the DBHs were measured and then the tree height of each tree, estimated using the above relationship. Based on the tree heights measured in the plots, the top 20 tree heights were averaged for each plot, and designated as the predominant mean height for each plot.

When deciding on site indices, the *A. mangium*'s site index curve[1] was used, which Mr. Mitsuo Inose, who was dispatched in 1991 as a short-term expert of the Sabah Re-afforestation Technical Development and Training Project (JICA), prepared using data from SAFODA's periodical measurements. Site classification obtained from the relationship between the top tree height (upper-story) and stand age is shown in Fig.I-22, and the contrasting table of site indices and top tree heights for each age is shown in Table I-35.

In the *A. mangium* sample plot survey, the relationship between the obtained tree height and DBH is shown in Attachment 19, and the site index of each plantation estimated from predominant mean height, using Table I-35, is shown in Table I-36.

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1) Mr. Mitsuo Inose (the present General Manager of the Management Division, Hokkaido Branch, General Forest Research Institute) prepared the site index curve of *A. mangium* using 219 data measurements from SAFODA's plantations.

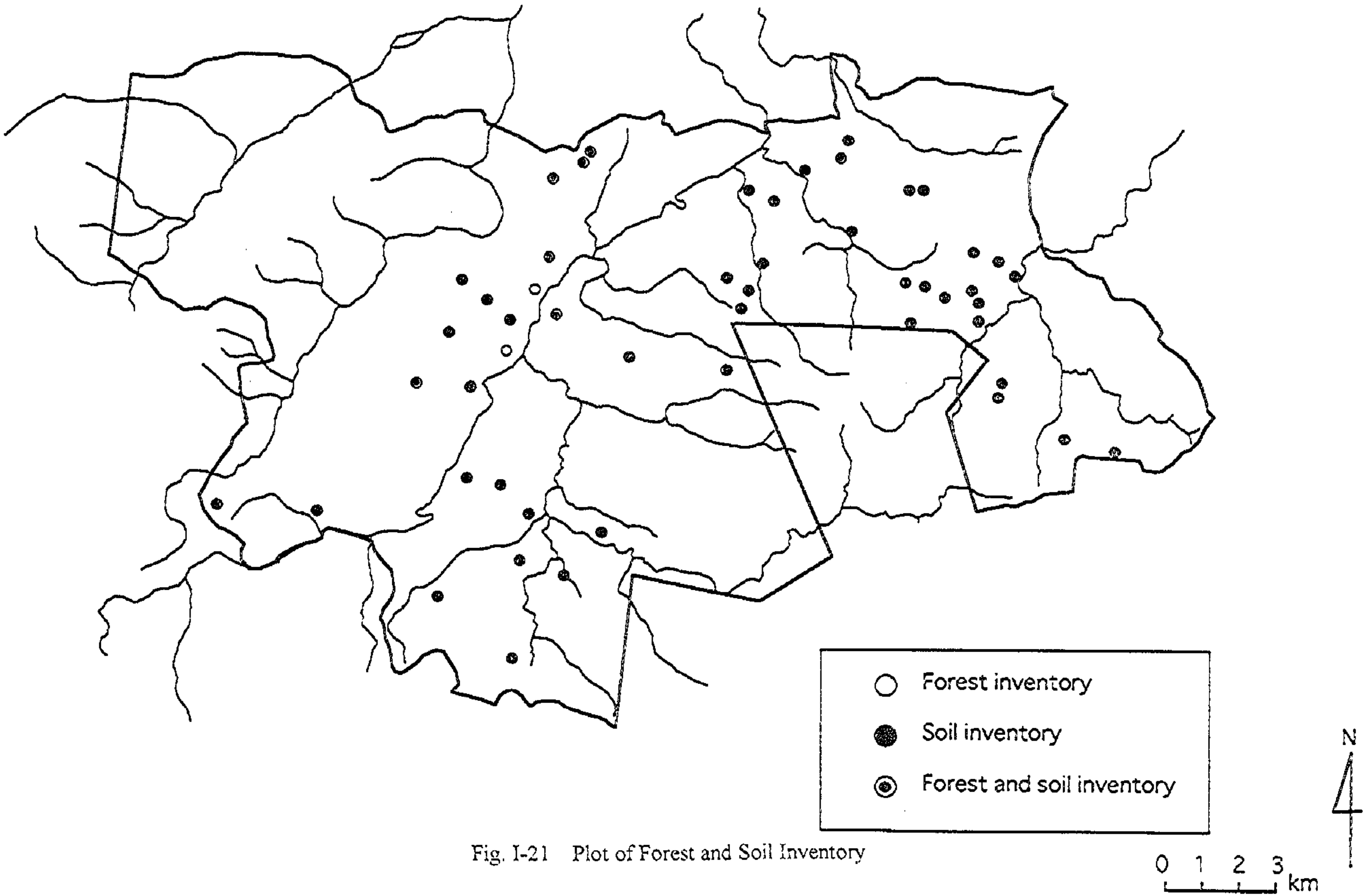


Fig. I-21 Plot of Forest and Soil Inventory

4-3-2 Sampling Environmental Factors Using Mesh Analysis

In addition to the plantation survey, a mesh analysis was carried out, using a topographical map, land-use map and soil map for selecting the environmental factors that are considered to be closely connected to the growth rates of planted trees in the study area.

The selected environmental factors are as follows:

① Altitude
② Maximum angle of inclination
③ Valley density
④ Topographical classification
⑤ Vegetation
⑥ Soil type

Among the above factors, those related to topography (altitude, maximum angle of inclination, valley density and topographical classification) were sampled using a 1/50,000 topographical map. For the altitude, 1), it was measured to draw diagonals within a mesh and read the altitude on crossing point, and that value was designated as the representative altitude of the mesh. The maximum angle of inclination, 2), was calculated by comparing the altitude value obtained in 1) and that of an adjacent mesh. For the valley density, 3), the number of valleys that touch the mesh is counted. For Topographical classification, 4), the classification is first carried out on a topographical map, and the factor was extracted by applying a mesh. Regarding vegetation, 5), a 1/20,000 land use vegetation map, which has been prepared through aerial photograph interpretation is reduced 1/50,000, and the factor is extracted. For soil type, 6), the factor is extracted by applying a mesh to a 1/50,000 soil map that has been prepared through the field survey.

Each of these environmental factors was further classified into a number of categories. For instance, in the case of altitude, any 0 m to 1,100 m altitudes found within the study area were classified into each 100 m categories.

The size of the mesh is 1 cm x 1 cm, and the number of meshes amounted to 2,153. Meteorology and geology are usually used as factors. However, both factors are almost unchanged over the study area and so these were excluded from the mesh analysis.

The mesh map of each environmental factor obtained through the above method is shown in Attachment 6.

4-3-3 Quantification

Since the locations of the plantations mentioned in section 4-3-1 exist in the study area, they can be plotted on the mesh chart. Therefore, by adopting the site index of each plot obtained in this plantation survey as an external standard, scores for each environmental factor category in the study area were calculated, using Quantification I. The main point of the calculation is shown by the following two expressions.

$$\hat{Y} = X_1 + X_2 + \cdots + M \qquad (1)$$

$$\sum_{i=1}^{n} (Y_i - \hat{Y}_i)^2 = \min. \qquad (2)$$

Where, Y: estimated site index

$\hat{Y}$: actual site index

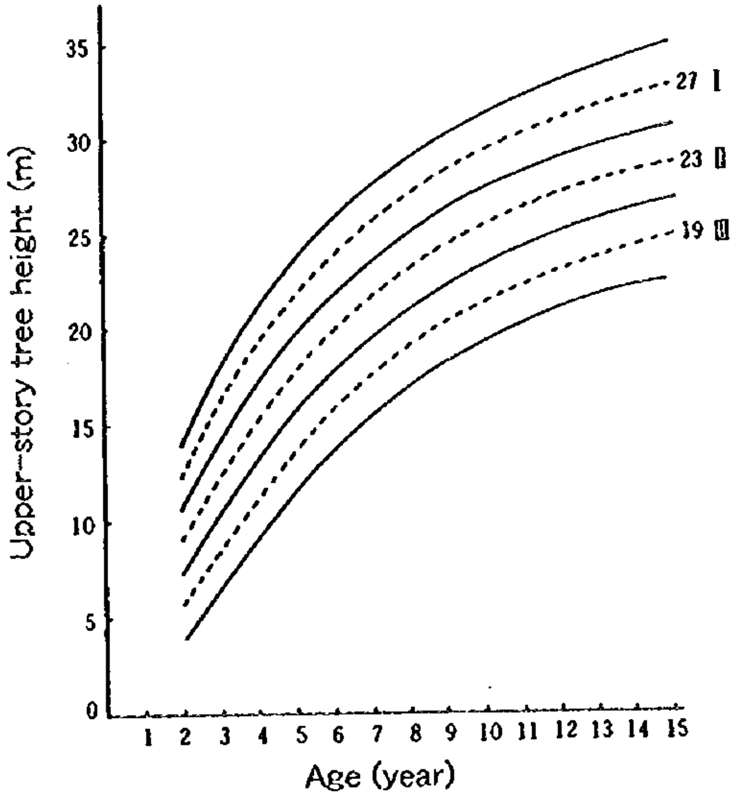


Fig. I-22 Site Index Curve

Source : Mitsuo Inose et al. (1992) Growth analysis of *Acacia mangium*. Boreal forestry,Vol.44,No.5

Age	Site index												
	17	18	19	20	21	22	23	24	25	26	27	28	29
1	2.5	2.9	3.3	3.6	4.0	4.4	4.8	5.2	5.6	6.0	6.3	6.7	7.1
2	3.9	4.8	5.6	6.4	7.3	8.1	8.9	9.8	10.6	11.4	12.3	13.1	13.9
3	6.6	7.6	8.5	9.5	10.5	11.4	12.4	13.3	14.3	15.2	16.2	17.1	18.1
4	9.3	10.3	11.3	12.3	13.3	14.3	15.2	16.2	17.2	18.2	19.2	20.2	21.2
5	11.7	12.7	13.7	14.7	15.7	16.7	17.7	18.6	19.7	20.7	21.7	22.7	23.7
6	13.8	14.8	15.8	16.8	17.8	18.7	19.8	20.7	21.8	22.8	23.8	24.7	25.7
7	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5	23.5	24.5	25.5	26.5	27.5
8	17.0	18.0	19.0	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0
9	18.3	19.3	20.3	21.3	22.3	23.3	24.3	25.3	26.3	27.3	28.3	29.3	30.3
10	19.3	20.3	21.3	22.3	23.3	24.4	25.3	26.3	27.3	28.3	29.4	30.3	31.3
11	20.2	21.2	22.2	23.2	24.2	25.2	26.3	27.2	28.2	29.2	30.2	31.2	32.2
12	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0	31.0	32.0	33.0
13	21.7	22.7	23.7	24.7	25.7	26.7	27.7	28.7	29.7	30.7	31.7	32.7	33.7
14	22.2	23.2	24.2	25.2	26.2	27.2	28.2	29.2	30.3	31.2	32.2	33.2	34.2
15	22.7	23.7	24.7	25.7	26.7	27.7	28.7	29.7	30.7	31.7	32.7	33.7	34.7

Table I-35 Site Index and Upper-story Tree Height of Each Age

Source : Mitsuo Inose et al. (1992) Growth analysis of *Acacia mangium*. Boreal forestry,Vol.44,No.5

Table I-36 Planted Year, Average Tree Height, Top 20 Av. Tree Height and Site Index of Each Plot

Plot.No.	Planted year	Years	Average Tree height	Top 20 Ave. Tree height	Index	Class
1	89	7	15.99	20.97	23	II
2	89	7	18.80	20.48	22	II
3	93	3	11.80	12.75	23	II
4	93	3	11.60	12.73	23	II
5	92	4	11.80	13.84	21	II
6	88	8	22.10	24.35	24	II
7	91	5	17.93	20.53	26	I
8	92	4	17.17	20.39	28	I
9	91	5	13.16	15.09	20	III
10	90	6	19.81	22.83	26	I
11	89	7	19.39	23.64	25	I
12	92	4	14.59	16.65	24	II
13	89	7	17.76	19.97	21	II

$X_1, X_2, \cdots X_m$: each applicable category score for m factor items.

n: number of plots used for external standard

min: minimum value

Results of the calculations are shown in Attachment 21.

4-3-4 Estimation of Forestland Productivity

An estimated site index for each mesh was obtained through the accumulation of scores for each environmental factor category. In addition, a partial correlation coefficient obtained simultaneously, enabled the discovery of which environmental factors were contributing to tree growth. In the present score table, the partial correlation coefficient of soil factor is high and it shows that soil factor has a considerable connection to tree growth.

The estimated forestland productivity results for the study area are shown in Attachment 21.

4-4 Soil Survey

A soil survey is necessary to understand the soil conditions in the survey area, and to use soil factors as one of the environmental factors for determining forestry productivity. In addition, it can also serve as useful index for selecting, for the feasibility study (F/S), tree species to be introduced into the study area.

The soil survey was carried out using three methods. The first, 1), by observing the soil profile using a trench cut, the second, 2), by looking at a soil layer using a boring stick, and lastly, 3), by measuring the hardness of the soil using a portable penetrometer.

The following are brief descriptions of the survey methods. To observe the soil profile using a trench cut as mentioned above, 1), the soil profile was exposed for about one metre by cutting a slope through the trench cut. In this case, we checked (1) horizons, (2) colours, (3) humus, (4) gravel, (5) textures, (6) structures, (7) hardness, (8) moisture, (9) leaching and accumulation, (10) mycorrhizae and hyphae, (11) root systems, and (12) pH (only partial). Also, a simple sketch was drawn and the profile photographed was to record it.

Using a boring stick in, 2), above, to look at the soil layer is a shortcut substituting for the trench cut, 1), making it possible to observe soil down to a depth of 1m. This method was used to quickly conduct the survey within the limited time available. When a boring stick is used, (1) horizons, (2) colour and (3) texture observation is possible.

To measure the internal hardness of the soil, the portable penetrometer, which can measure soil hardness of below 1m, is used. The soil hardness obtained in this way enables us to deduce to some degree the easy with which the root system of planted trees. This can also serve as one relevant index to understand tree growth rates and hence potential forestry productivity.

The portable penetrometer used this time, as illustrated in Fig. I-23, a cone consists of a rod, a weight (5 kg), a guide rod , and a knocking head. The cone has a 25 mm diametre and has a 60° angle to the tip. Measurements are indicated by the number of knocks required to cause the cone to penetrate into the soil 10 cm (the number being expressed as Nc value). The knocks are generated by the free fall of the weight from a height of 50 cm. In this instance, the survey of the plot was judged complete when the maximum number of knocks or the penetration of the rod had reached 30 times or three metres, respectively. The reason for this is that the root systems of planted trees, especially *A. mangium*, are not straight and extend to a depth of less than three metres from the surface, and that virtually very few elongation of the root systems can be expected at an Nc value of 20 or more.

As mentioned above, if the survey is conducted by combining methods 3) and 2), conditions within the soil can be understood to some degree, even without conducting the trench cut mentioned in 1).

The results of the soil survey are shown in Attachment 20, 1/50,000 soil map was prepared by combining a land-use vegetation map and a topographical section map, which had been prepared from an aerial photography interpretation. In order to make this soil map usable as an index which could be applied when judging forestry productivity, the study decided to show the distribution of effective soil depth on the map. With regard to this decision, the following judgment was made. Since the 1/250,000 soil map prepared in 1974 by the British ODA (Overseas Assistance Office) clarified that the survey area consisted of an almost uniform tropical mountainous soil, it is more effective to prepare a map showing the distribution of effective soil depth, which makes it possible to actually determine forestation qualities, rather than to subdivide the soil map further.

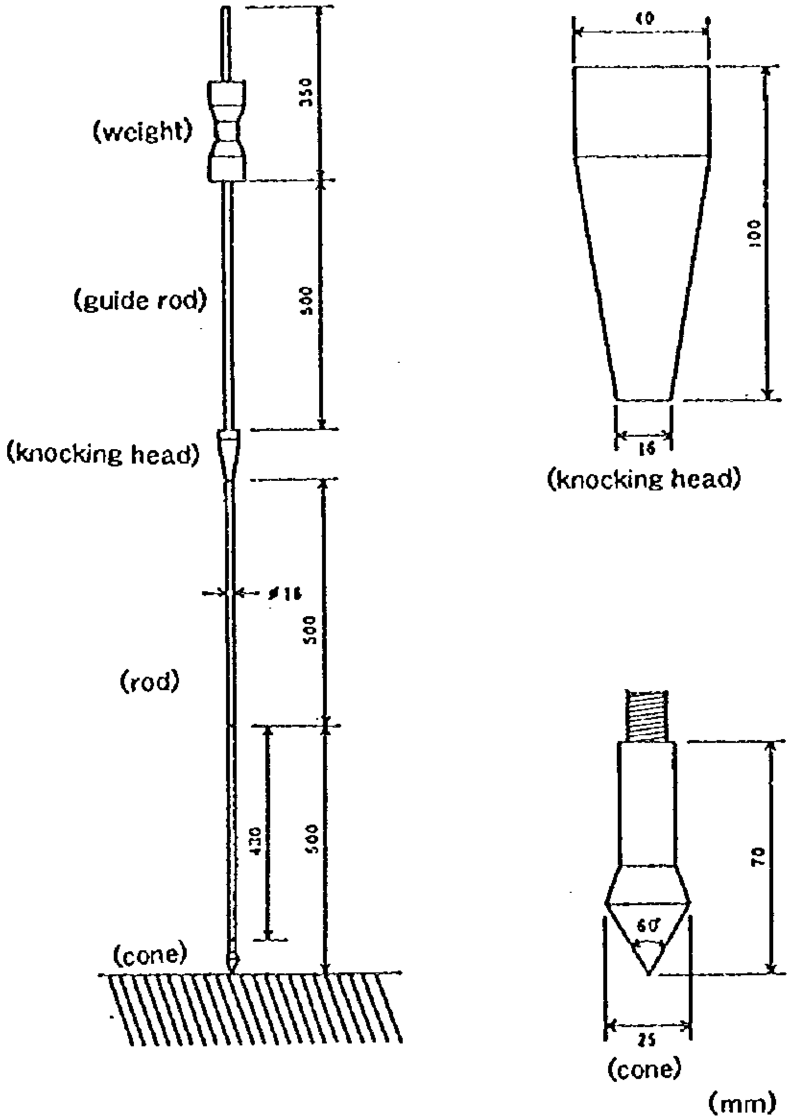


Fig. I-23 Components of Portable Penetrometer

5. Survey of Land Use and Vegetation Status

5-1 Aerial Photograph Interpretation

Using aerial photographs (photographed at a scale of: 1/25,000, 115 sheets) which cover the Marak Parak consolidation of 54,000 ha., the current land-use, vegetation and forest type are surveyed.

As a result of the preliminary interpretation of the aerial photographs and field surveys, the latest aerial photographs, taken in March 1996, were used because the areas of shifting cultivation and logged areas had expanded, and land-use and vegetation in the study area had changed considerably over time.

The criteria for analysis which were used at the time for such interpretations of the M/P was basically applied in this survey. However, new category of "landslide sites" was added in the criteria for the analysis of the aerial photographs, and several categories were deleted because there is no occurrence of subcompartment blocks such as dense high forests, mangrove forests, oil palm forests, coconut palm forests or swamps (Table I-37).

For low forests (F2) and shrub forests (F3) as types of forest vegetation, which will be under enrichment operation, they were subclassified by crown density as shown in the following table to use as data for the preparation of the enrichment operation plan and compilation of the forest inventory book.

Code	Vegetation Class	Tree Height	Crown Density
F 2-1	Closed low forests	6 to 14	50% or more
F 2-2	Open low forests	"	Under 50%
F 3-1	Closed shrub forests	5m or less	70% or more
F 3-2	Open shrub forests	"	Under 70%

5-2 Preparation of Land Use and Vegetation Maps

With regard to land-use and vegetation maps, topographical maps a scale of 1/20,000 which was prepared in the Stage 2 study, were used.

Based on comparisons between land-use/vegetation confirmed in the field survey and the images seen on aerial photographs, block lines were entered on contact photographs using the criteria for analysis of the said aerial photographs, inspected the results in the field, and revised as necessary.

The revised block lines were transcribed onto a 1/20,000 topographic map, and a polyester-based original drawing (scale: 1/20,000) was prepared by making a fair copy, after inspection by the survey staff. Finally, the preparation of the land-use and vegetation maps was completed after they underwent a final inspection by the survey staff.

5-3 Compilation of the Forest Inventory Book

A forest inventory book detailing the present land-use and vegetation was compiled and lists compartment No., sub-compartment No., area, present land-use type, site condition, forest description, etc. as shown in the following form.

Compartment No.	Sub-compartment No.	Area (ha)	Land-use code	Location factors			Forest description				
				Height above sea level (m)	Slope	Soil type	Forest type	Tree age	Ave. height	Volume ha. (m^3)	Total volume (m^3)
001	1	100	F3-1	1,900	2	16	N				
	2	50	D2	2,600	3		N			35.6	1,780
	3	20	f	1,300	1		A	8	20	158.0	3,160

Items examined and contents specified in the forest inventory book are as follows:

a. Division of Forests

- Compartment
  Forests were classified using a base size area of 400 ha., taking into account land forms such as ridges and valleys. Furthermore, compartment is sub-divided into subcompartments based on the classification of land-use and vegetation.

- Area
  Area was measured using a planimeter, and fractions of 0.5 and over were counted as a unit while fractions below 0.5 were not included.

b. Land-Use
The land-use and vegetation map was read for land-use classes of subcompartments, and the codes used on the map were copied onto the table.

c. Location Factors

- Height above sea level

- The height above sea level was measured in blocks of 20 m for each zone based around the centre point of the subcompartment.

- Slope
  The average slope for each subcompartment was measured in a circle delineated on the topographical map. The diameter of circle is 1 cm for small size and 2 cm for large size of subcompartment. Slopes were classified into the following three categories.

Category No.	1	2	3
Class	Gentle	Medium	Steep
	15° or less	16 to 25°	26° or more

- Soil
  The type of soil dominant inside a subcompartment, estimated using the soil map (Scale: 1/50,000), was considered as the subcompartment soil type.

d. Forest Description

The forest description was specified only when the present condition of the land use fell into the forest category.

- Forest type

  Forests were classified into artificial forests and natural forests (high forests, medium height forests, low forests and shrub forests).

- Tree volume

  The tree volume per hectare of both artificial forests and natural forests was calculated using the results of the forest survey and collected data.

  Each forest category, which was classified according to forest composition and type, was multiplied by the tree volume per hectare, and the results were totalled to obtain the compartment volume.

Table I-37 Criteria for Analysis of Aerial Photographs (Classification of Land Use and Vegetation)

Class of Land-Use & Vegetation			Codes	Criteria for Analysis
Forests	High Forests	Crown density of 50% or more	D1	Species of *Dipterocarpaceae* with a tree height of 30 m or more are dominant. The colour is a slightly light whitish-gray.
		Crown density of 30 to 49%	D2	
		Crown density of 10 to 29%	D3	
	Medium High Forests		F1	Species of *Dipterocarpaceae* with a tree height of 30 m or more and with crown density of under 10%, along with *Dipterocarpaceae* with a tree height of 15 to 29 m are dominant. The colour is a slightly-light whitish-gray.
	Low Forests	Crown density of 50% or more	F2-1	Average tree height is 6 to 14 m. The colour is a slightly-light whitish-gray or gray.
		Crown density of under 50%	F2-2	
	Shrub Forests	Crown density of 70% or more	F3-1	Average tree height is 5 m or less. The colour is a slightly-light whitish-gray or gray.
		Crown density of under 70%	F3-2	
	Man-made Forests		Af	These consist of plantations of *Acacia mangium*, planted in rows. The colour is light to medium black.
Non-forests	Paddy Fields		P	Fields are clearly separated by ridges or levees and distributed on flat lowlands. The colour is light gray or light black, and they are located mainly around villages.
	Farmland		F	Clearly separated but the areas are not as small as those of the paddy fields. The colour is a slightly-light whitish-gray or a light gray, and they are located mainly around villages.
	Rubber Plantations		R	The tree height is almost uniform. Trees of a single species or a rubber-dominant mixture are planted in rows and the colour is a medium to deep gray.
	Mixed Plantations		Mp	Rubber trees, coconuts and fruit trees are planted near villages, either separately with each in a small portion of land, or are intermingled. The colour varies from light gray to medium black.
	Grassland		G	The colour varies from light gray to light black. Those which are located on flat lowlands and which look light black are semi-swampy or swampy areas that are used for grazing.
	Villages		S	Classified according to the density of dwellings
	Institutes (such as for plants)		I	Mainly located near villages.
	Lakes		W	The majority are distributed in the swampy area. The colour is medium black.
	Landslide sites		L	These are mostly found on steep or extremely steep slopes. The colour varies from white to gray.

* As the names of rivers are inserted onto the basic chart, classes and codes for them are omitted.

6. Forest Infrastructure

6-1 Forest Roads

The study area is located at the southern part of the Kota Marudu district. The 28 km road from Kota Marudu town to Marak Parak village, located almost at the centre of the study area, and another, 18 km long from the village to a remote border area, a total of 46 km in all, are public roads under the control of Jabatan Kerja Raya (JKR). The roads are covered with gravel throughout and are satisfactorily maintained and managed to the extent that there are no obstacles to traffic. They are important trunk roads for Marak Parak Village and the surrounding settlements. A severe flood caused by heavy rain two years ago has left residue of landslides, collapsed closed conduits, and damage to the road surface everywhere but there are no obstacles to traffic for the moment because restoration work such as the construction of temporary roads has been completed. However, just beyond Marak Parak village, a bridge, which was washed away by the flood, has not been repaired, preventing automobile traffic. Accordingly, residents of villages located beyond the site of the bridge are compelled to walk along the road.

In addition, the loss of the bridge has prevented the repair of damage of road surfaces as well as the removal of residue from landslides in areas beyond the bridge. Although the prompt restoration of the bridge is urgently desired, it seems to take a considerable amount of time. It is feared that any delay in the restoration of the bridge will place not only a serious obstacle in the way of future survey plans but also in the carrying out of forestation activities in the future. The road to the Gana district located at the southeastern part of Kota Marudu town is a logging road, and its maintenance is under the logging contractors as logging is now actively being carried out. As long as logging continues, movement of vehicles along the road is likely to run smoothly. However, the movement of vehicles will become difficult during the rainy season because it is a logging road and has not been paved with gravel.

Since within the study area, both in the past and at present, logging has been carried out in the Kinarom and Bengkoka basins, a network of logging roads has been established. Among these roads, those still in use are maintained and managed satisfactorily but unused ones are hard to use because their rapid construction leads to frequent collapses and landslides.

Table I-38 shows the current road density including logging roads (conventional logging roads being dominant) by basin.

Table I-38 Road Density in Marak Parak Consolidation

Basin name	Trunk Road (km)	Logging Road (km)	Total (km)	Basin Area (1000 ha)	Road Density (m/ha)
Bandau		44.8	44.8	6.0	7.5
Tuaran		9.8	9.8	7.0	1.4
Kinarom	56.5	256.6	313.1	30.0	9.8
Manuradiang		5.6	5.6	2.0	2.8
Bengkoka	40.8	57.1	97.9	6.0	16.3
Total	97.3	373.9	471.2	51.0	9.2

Road density is highest in the Kinarom and Bengkoka basins, which are considered to form the heart of forestry activities in this study. This shows that logging has been carried out repeatedly in the past.

In this study, a priority was given, as far as possible, to making the best use of existing roads in preparing a implementation plan, and the new roads were avoided to the utmost from the viewpoint of watershed conservation.

However, since on logging roads that are not in use at present, most bridges have been damaged or have collapsed and vehicular traffic is impossible, owing to damage of the road surfaces and landslides, it is understood that improvement and repair are required.

Forest roads are mostly those running over the ridges, and a closed conduit and bridge are installed at a valley crossing two ridges and cutting sites. Also, an overflow bridge is prepared at a place where a river is wide and the volume of water is comparatively small. (When the river has risen after a rainfall, it becomes impossible to use the ford.) No forest roads have been paved with gravel, meaning that the passage of vehicles becomes impossible immediately after rainfall.

6-2 Nursery

In the northern part of Sabah state, SAFODA's seedling production is being carried out at two directly managed nurseries and two places of two contractors. Around the study area, seedling production has been conducted at one directly managed nursery and two consignment production sites in Ulu Kukut.

The directly managed nursery in Ulu Kukut has a site area of 2 ha and a production scale of 1.5 million seedlings a year based on two rotation of the nursery bed. However, actual production was limited to 0.7 million in 1995 and 0.8 million in 1996 (scheduled). Regarding the management of the nursery, important operations such as the procurement of seeds and seeding are managed directly by SAFODA, but simple operations such as soil packing for pot, transplanting, weeding and watering are carried out by contractors. In addition, seedling transportation and planting are also put out to contract. A nursery operation period is seven months for teak and three to four months for *Acacia*. Seedlings are raised in pots except for Teak. Plantable size of seedling is height of 30 cm. To procure seeds, those of special tree species are purchased, but seeds for other species are collected from plantations in the Bengkoka basin.

With seedling production by contractor, only the production of *Acacia mangium* is consigned to privately operated small-scale nurseries. In this survey, one contract nursery was examined and it was found that nursery beds for pots at this facility were prepared by putting up a 1 m x 10 m mesh wire net with an over level ground. Seeds were prepared by SAFODA, and the series of operations from seeding to hauling were contracted out. Production is 0.4 million based on two rotation a year in the nursery. Transportation of seedlings to the planting site is also put out to contract as is done in the case of a directly managed nursery.

The production cost per seedling is MR 0.24, and almost the same unit price is paid for production contracts.

At present there is excess production capacity at the Ulu Kukut nursery. When a plantation programme based on this study is implemented, however, it will be desirable to execute, under contract, road-side production close to scheduled plantations, in order to shorten the transportation distance of seedlings and thus reduce the amount of damage from transportation. As six contractors who are skilled in the seedling production exist around Kota Marudu town, it is judged that road-side production will become possible by conducting technical training.

6-3 Countermeasures against Forest Fires

Forest fires are the greatest threat to forests. If one forest fire occurs, the effort and funds that have already been used are reduced to ashes. Even in natural forest regeneration, fires prevent progress, vegetation deteriorates because of repeated fires, and the forest changes into grassland. In particular, preventative measures against forest fires are an important to the plantation business.

In SAFODA's afforestation project in Bengkoka, it has been recognized that the dry season is harsh and measures against forest fires are important. Accordingly, a watch tower has been installed at every important position, and a fire brigade associated with tank cars has been organized. In addition, during the period when the danger of forest fires is greatest, the staff responsible are arranged into shifts and take measures suited to the occasion. Despite these measures, forest fires continue to cause damage every year.

In the study area, a firebreak, consisting in part of a forest road has been arranged strategically when a plantation was established. In addition, once a forest fire occurs, nursery workers also engage in fire-fighting operations. However no special facilities and equipment have been prepared as was done in Bengkoka. In the Kota Marudu area, the dry season is not as harsh as in Bengkoka, but damage from forest fires has also occurred. Forest fire prevention requires measures to prevent the occurrence of fire, as well as measures to minimize damage should one occur. For this purpose, the cooperation of native residents in checking the spread of fires from slash-and-burn shifting cultivation, is an absolute necessity. Further education and public relations efforts regarding forest fire prevention, seems to be necessary.

In this study, large-scale forestation is planned, and feasible measures to prevent forest fires that will include local residents was considered.

6-4 Bridges

The main road (public road) in the study area allowing access to Ranau Village via Marak Parak village runs over the Pamaitan River. However, a bridge that existed at this point has not been replaced since it was washed away by a strong flood two years ago. With regard to the plantation project, the loss of the bridge is considered a serious obstacle to the future transportation of nursery stock, workers, and felled trees. Since this area is located at the inner part of Marak Parak village, its importance might be rated slightly lower. Although the rapid replacement of the bridge is desired, there is little hope of it happening. Accordingly, flexible measures such as a possible detour was examined in this study.

In the study area, many logging roads have been constructed as mentioned in 6-1 "Forest Roads", and many simple bridges and overflows have also been placed on these roads. However, most of them are not usable unless repaired or rebuilt. Materials for repairing the bridges cannot be procured on the spot because of overcutting trees around there. Therefore, the use of concrete or corrugated pipes cannot be avoided.

7. Environmental Assessment

7-1 Description of the Project

This study aims to formulate an environmentally friendly and sustainable forestry development program. It includes forestation as a basis for watershed conservation and for forestry activities participated by the local people. Basically, it is to be an environmental improvement project through the establishment of forests. As a result of the project, biomass will be increased, environments will be improved and conserved by foresting the forest vegetation areas which are at present devastated, thus the project would have few factors which may harm the environment. As part of the conservation of water and soil resources conserving forests is an essential requirement. However, forestation with the aim of timber production may devastate the forest, if carried out improperly.

This project aims to establish industrial plantation project. If forestation is carried out on a large-scale, it can be expected that some impact, which is not negligible, will be exerted on the vegetation, rivers, and local people's socio-economic environments in the region. In particular, even the forest establishment process itself involves development activities such as the construction of forest roads, logging, reforestation after cutting, and the establishment and maintenance of facilities related to the project.

It is necessary to understand this project, not as a temporary forestation activity, but as a long-term and comprehensive project, and it needs to examine the environmental impact from natural and socioeconomic viewpoints, and several suitable measures to prevent any negative impact are examined in this study.

7-2 Site Condition of the Project

The following are the site environments within the study area, outlined from the viewpoint of the natural and social environment.

1) Natural Environment

(1) Valuable Species and Ecosystems

In the study area, forest cutting has taken place to produce logs and to use land for agricultural purposes, to such an extent that the virgin vegetation has entirely disappeared. The existing forests are all secondary forests. High forests including *Dipterocarpaceae* spp. only remain on limited and steep areas of land. The virgin forests has changed to vegetation composed mainly of grassland, low forests and medium high forests. No characteristic species or ecosystems have been confirmed. According to Dr. Payne at the Sabah Office of the World Wildlife Fund (WWF), there exist no biological resources to be particularly protected. However, a part of the Kinabalu National Park is adjacent to the study area, where the park's accomodation facilities are maintained and managed. Accordingly, attention needs to be paid to the preservation of the surrounding natural environment, and therefore consideration in forest operations is required when this project is being established.

(2) Soil and Land

Since the study area is within a tropical rain forest climate (Af) zone, soil generally found in such a wet tropical zone is present. Generally soil in the study area is of a reddish-yellow system. Acrisols, Cambisols and Luvisols are distributed in mountainous and hilly areas, and Luvisols, Eutric Fluvisols and Gleysols of hydromorphic soil, are distributed on plains and on lowland areas.

Little development of a humus or A Layer in which aggregated structure has developed, is found. Soil and vegetation show that surface runoff due to rainfall is liable to occur, and surface erosion is found wherever vegetation is weak. In addition, many logging roads constructed in the Kinarom and Bengkoka basins cause soil runoff. The soil (pH) is weakly acidic, which is generally suitable for afforestation.

Landslides are found on steeply sloping terrain. Where topographical conditions are severe, landslides, attributable to the generation of unstable soil due to excess water content in the soil, can be expected to occur.

In the tropics, for soil at locations where vegetation is weak, the surface temperature differences caused by exposure to direct sunlight in the day and the fall at night, and the obstruction and acidification of the physical properties due to drying of the soil, are accelerated. For this reason, in the Kinarom basin, where the forest vegetation has been devastated, the restoration of the vegetation cover is desirable to conserve the soil.

The construction of logging roads has caused secondary landslides. The development of forest roads needs to be carried out, taking into consideration the topography and vegetation.

(3) Hydrology and Water Quality

Forests reduce the surface runoff of rainwater and increase the infiltration rate, as well as reduce the maximum runoff outflow (peak flow rate) during flooding. This is the flood control function of forests.

Although this flood control function has been recognized, the function of forests during the dry season has been debated. This is because forests increase their infiltration rate, but simultaneously have a transpiratory function, in which soil water is drawn up and is charged to the air. However, in the Marak Parak consolidation, where annual precipitation exceeds 2,000 mm, positive forest function such as flood control and erosion control have come to outweigh negative ones, such as water consumption. Accordingly, it is believed that a substantial contribution to watershed conservation will be brought about through forestation in the study area, where forest vegetation is presently devastated.

The study area is divided into five basins. The Kinarom basin occupies about 60% of the entire area. Cutting has progressed furthest in this region, and the cutting is centered around the tributary basins (Polipikan and Pamaitan) of the Kinarom River. When it rains, tributary streams become muddy immediately, while the main stream is kept clean. There is virtually no time lag in rain water runoff, and the peak flow rate is high. In the tributary basin, this function needs to be improved through forest establishment.

In the Bandau and Pangapuyan basins, water quality has been satisfactorily protected, because the forest condition is inferior, even so it has been maintained. Both basins are used as the source of irrigation and drinking water for the cities of Kudat and Kota Marudu. Consequently, attention needs to be paid to any forestry operations there.

(4) The Sustainability of Forest Resources and their Functions

Forest lands in the study area can be converted to other purposes. Accordingly, agricultural development and cutting are under progress without any limitations. The continuous decrease in the forest resources in the area is more than likely to be a matter of course. If all the forests within the study area, disappear, the forests remaining in the watershed including the study area, would be small. The results can be easily imagined. It goes without saying that the watershed conservation and the natural environment requires a certain volume of forests.

For development carried out in areas where topographical conditions allow such actions and where soil conservation is taken into account, there are no particular problems. However, in practice, cutting and farming are under way even in mountainous districts with severe topographical conditions. In the existing circumstances, if these developments are allowed to continue, problems such as flooding, erosion and deterioration of environment will appear in the future.

2) Social Environments

(1) Social Lives

The survey area contains 32 villages scattered across every region. The total population is about 7,000. Looking at the population by basin, the villages are mostly located in the Kinarom basin, which is easily accessible. The largest settlements are Marak Parak and Melangkap Darat villages, each with a population of 600 or more. Around 23 of the 32 villages, forest vegetation has been deteriorating, showing that shifting cultivation is widely used.

From an industrial point of view, no distinguishable industry that offers employment opportunities exists around the villages, and inhabitants are mainly engaged in agriculture. Small-scale fixed arable land is cultivated around houses, and fruit and rubber trees are grown. However, the cultivation is based mostly on shifting cultivation. Recently, the culture of rubber trees has become more popular in some regions. The careless shifting cultivation is said to have caused a decline in land productivity owing to the deterioration of the soil attributable to the repeated use of this technique. In addition to the land conditions, the small volume of marketable crops keeps farmers' livings below Sabah state's poverty line. Their average monthly income is RM 100 to 200 , while that of rubber-tree growing farmers, though only on a small-scale, is at RM 200 to 300 (see I-2-3-3).

A traditional land-use system based on customary law has existed for a long time. Under the control of the village head, inhabitants have used land in an orderly fashion. This is a system in which during a period of continuous cultivation, the land concerned temporarily belongs to the cultivator. Subsequently, a land system was introduced by modern law (1913), which guarantees native customary rights and proprietary rights to traditional land. The style of land ownership is shifting from temporary ownership based on customary law to private ownership termed Native Title. In addition, in state-owned forests, native inhabitants have been granted customary forest use rights for collecting forest products.

When the forestry development program from this study is established, it is necessary to adjust the relationship between the program and the rights to land use which conflict with native inhabitants.

(2) Health and Sanitation

Many people in the study area are using river water as household water.
Although cutting is in progress at present, no particular problems seem to have been raised concerning the domestic water supply. In the course of any forestry activities, close attention needs to be paid to protecting the river source so that no river contamination occurs due to water pollution caused by chemicals use.

(3) Historic Spots, Cultural Heritage, and Landscape

As mentioned in the previous section (1), there are no natural environments, except for the area surrounding the national park, which need to be especially protected.

7-3 Environmental Factors

This study aims at establishing a forestry development program. When the program is considered as a long-term comprehensive project, development activities such as forestation, seedling production, forest road construction, the cutting of planted trees, natural regeneration, and wood processing are necessary. In the Stage 3 study, when the forestry development programme was formulated, the environmental impact assessment was conducted.

Besides, the forest development programme was prepared with attention paid to each of the items described in the above 7-2 (1) and (2).

Chapter II Basic Ideas of Forestry Development Plan

1. Concept of Land Use

1-1 Basic Ideas of Land Use

The study area is designated as an area for large-scale forestation under the Master Plan formulated in November 1994. This area, which belongs to zones that are not forest reserves, can be converted for uses other than forests depending on the natural condition in the field. As discussed in Chapter I (2-6. Present State of Land Use), non-forest use accounts for only 7% of the total area. Extensive use prevails; except for limited flat land, land in the area is used for shifting cultivation with a short fallow period. The area is not suitable for agriculture because of its bad conditions of soil and topography. Therefore, a large part of the area is covered with forests. Many of these forests are of degraded and inferior physiognomy with high forest accounting for only 1%. On another front, this area has been inhibited by many people for many years. Although a large part of the area remains unused, the area contains many pieces of land that residents have acquired or applied for native titles to as their customary land. In addition, each village has its own plans for land use, regardless of whether it has titles to the lands.

Be it the state-owned land or private land (alienated land), this watershed is a very important water-source for domestic supply of Kota Marudu and Kudat, major cities of North Sabah, with agricultural zones such as paddy fields downstream. Therefore, the study area is an important conservation area for the downstream basin.

Against this backdrop, important issues for land use in the study area as the upstream area are not only the securing of a water source, flood control, and erosion control for the downstream area, but also appropriate management of the entire watershed including private land use. More specifically, it is important to promote environmentally-sound land use with appropriate watershed management by way of conservation of existing forests, restoration of degraded forests/forest land, and the adoption of cultivation system that takes into account soil and water conservation for local residents in the watershed. To this end, it is necessary for all the institutions involved in community development, including development of rubber plantations, to unite for the future.

1-2 Details of the Development of Land Use

The study area is an important water source for the Kota Marudu region. At the same time, forests in the area are vital for flood control and the prevention of soil erosion. It is also important to note that many people live in the area. Therefore, land use and development in the area must take into account the improvement of the socio-economic condition as an important issue.

When considering land use, it is necessary to satisfy two conflicting requirements of watershed conservation and land use/development at the same time. Land must be used in such a way as to harmonize conservation and utilization/development. It should be remembered that many people live in lowlands and that forests cover the highlands, where the higher the land, the more rugged the topography and the greater the necessity for soil conservation.

From this viewpoint, priorities should be basically placed on conservation for highlands and utilization/development for lowlands while paying attention to the characteristics of each basin in the study area. It is desirable to plan and implement land use such that the higher the land, the more limited the utilization/development.

With this context, the land use standard will be as follows:

Basin	Use for Agriculture	Use for Forest
Bandau/Pangapuyan	Use as arable land will be limited on flat land.	Prohibited as protection forest
Manuradiang	① Cultivation will be limited on existing farm lands. ② Methods of cultivation will be those that consider soil/water conservation.	Same.
Kinarom	① Cultivation will be limited to land below the altitude of 250-300m. ② Methods of cultivation on sloped land will be those that consider soil/water conservation.	① Rehabilitation of devastated vegetation ② Limited use of forests according to the altitude
Bengkoka	Cultivation will be limited on flat lands.	Restrictive use

2. Concept of Forest Management

2-1 Classification of Forest Management

In the proposed area for forest/forestry, forest management will be conducted in consideration of the importance in watershed conservation and the use of forests, and based on the principle of harmonizing conservation and utilization. Forest management in the area will also follow the ideas below:

① In consideration of the location of forests, the expected forest functions will be the conservation of the environment, water conservation, and the prevention of soil erosion.
② Forest operations in which forest functions can be exhibited will be performed in consideration of the features of the watershed.
③ The higher the land, the more limited forest utilization will be, aimed at harmonizing the conservation and utilization of forests.

Based on the above, the basic classification of forest management is given in the following:

Basin	Expected Forest Functions	Cutting Methods	Regeneration Methods
Bandau Pangapuyan	Water conservation Erosion control	Ban on felling	-
Manuradiang	Erosion control	Ban on felling	-
Kinarom			
Areas adjacent to the Park	Environmental conservation	Ban on felling	-
500m or more above sea level	Water conservation Erosion control	Selective Cutting Selective cutting	Natural regeneration Planting
Less than 500m above sea level	Water conservation	Selective cutting Clear cutting	Natural regeneration Planting
Bengkoka	Water conservation Erosion control	Selective cutting	Natural regeneration

2-2 Forest Operation System

Forest operations will be conducted according to the classification of forest management as shown in Section 2-1. Regarding areas other than those where felling is prohibited, specific forest operations will be settled on according to the forest vegetation types in the relevant areas.

It is reasonable to conduct a forest operation according to the following rules depending on the actual conditions of the forest vegetation:

High Forest.....................	Natural regeneration	Vegetation class code	D1～3
Medium High Forest	Natural regeneration	〃	F1
Low forest			
Closed	Natural regeneration	〃	F2-1
Open	Artificial regeneration	〃	F2-2
Shrub Forest	Reforestation	〃	F3-1~2
Grassland........................	Afforestation	〃	G

The zone classified as high forest, which consists of stands dominated by *Dipterocarpaceae* trees more than 30m tall, has quasi-original vegetation, including climax, judging from their composition of species. Therefore, silvicultural operations in this zone should be care/tending of the existing succeeding trees according to the conditions of stands with an emphasis on conservation. For this purpose, it is necessary to regenerate commercial forests (natural regeneration) while maintaining the ecosystem of the original vegetation. This will contribute to the conservation of the natural environment in the entire area.

The zone classified as medium high forest has been transformed from high forest by excessive logging. This zone is secondary forest mixed with *Dipterocarpaceae* trees. Though partly covered with pioneer species, the zone is thought to be in the process of transforming into open high forest. Regarding such stands, useful species including *Dipterocarpaceae* should be cared/tended by way of natural regeneration. This will regenerate commercial forests while maintaining the diversity of species composition, leading to environmental conservation in the area.

The zone classified as low forest is where the forest has been further degraded. This zone is dominated by pioneer species with no succeeding *Dipterocarpaceae* trees. This stand contains trees that will be commercially used when they reached a certain size in the future. This is why its economic value cannot be ignored. Therefore, it is effective in terms of forestry to quickly develop sparse stands (F2-2) into economically-efficient ones by active planting (line planting).

The zone classified as shrub forest is covered with extremely poor stands degraded by shifting cultivation after logging or forest fires. Because these stands do not have mother trees/seed trees, they have already lost the autonomous function to recover the original forest; it is impossible to regenerate the forest without some artificial manipulation. Therefore, regarding such stands, it is necessary to regenerate forests soon through reforestation. This will contribute to effective use of land and environmental improvement in the area.

The zone classified as grassland has been abandoned after repeated shifting cultivation and has been transformed into lalang except for the land used as grazing. Greening is hoped for in this zone also in terms of soil/water conservation. This zone is also a target area for reforestation.

3. Forest Management Plan

3-1 General Plan for Forest Management

In formulating the forestry development plan, which is the purpose of this study, it is necessary to study the classification of land use and the general plan for forest management in the watershed as a whole.

The study area, which is state land excluding forest reserves, can be converted to non-forest. Residents in the area have the right to apply for the acquisition of land title. Based on this, many such applications have already been submitted. As the examination for these applications proceeds, pieces of land are being converted from state land into private land (alienated land). Therefore, the boundaries between state land and private land can move on a daily basis according to the progress of the examination procedure: the area consists of state land and private land. In other words, the boundaries marking private land are mobile and not stable.

On the other hand, the classification of land use that has taken watershed conservation into account basically does not change in accordance with the type of land ownership. Still, it is impossible to change the present state of land use. Therefore, it is realistic to accept the reality as it is and study the classification of land use that pays attention to watershed conservation. Here, land use is roughly classified as follows based on the present classifications of land use and vegetation (Fig. II-1) and according to the concept of classifications of land use and forest management as discussed above (1 and 2):

① Bandau, Pangapuyan and Manuradiang basins
The areas will be classified as forest except for villages and the existing cultivated land (including rubber plantations).

② Kinarom basin
A. Villages and the existing cultivated land (including rubber plantations) will be excluded from the forest.
B. Of the existing forests, the massed zones that satisfy the following conditions will be excluded from the "forest" classification
   a. Lower than the altitude of 250-300m
   b. Gentle slopes (roughly 30%)
   c. Topography with minor folds
   d. Zones without stream beds
   e. Soil types in relatively good conditions

③ Bengkoka basin
The Kota Marudu district has a plan of integrated development in this area. The target area of this plan should be excluded from the "forest" classification. However, this area is not excluded here because the detailed information was not available at the time of this study.

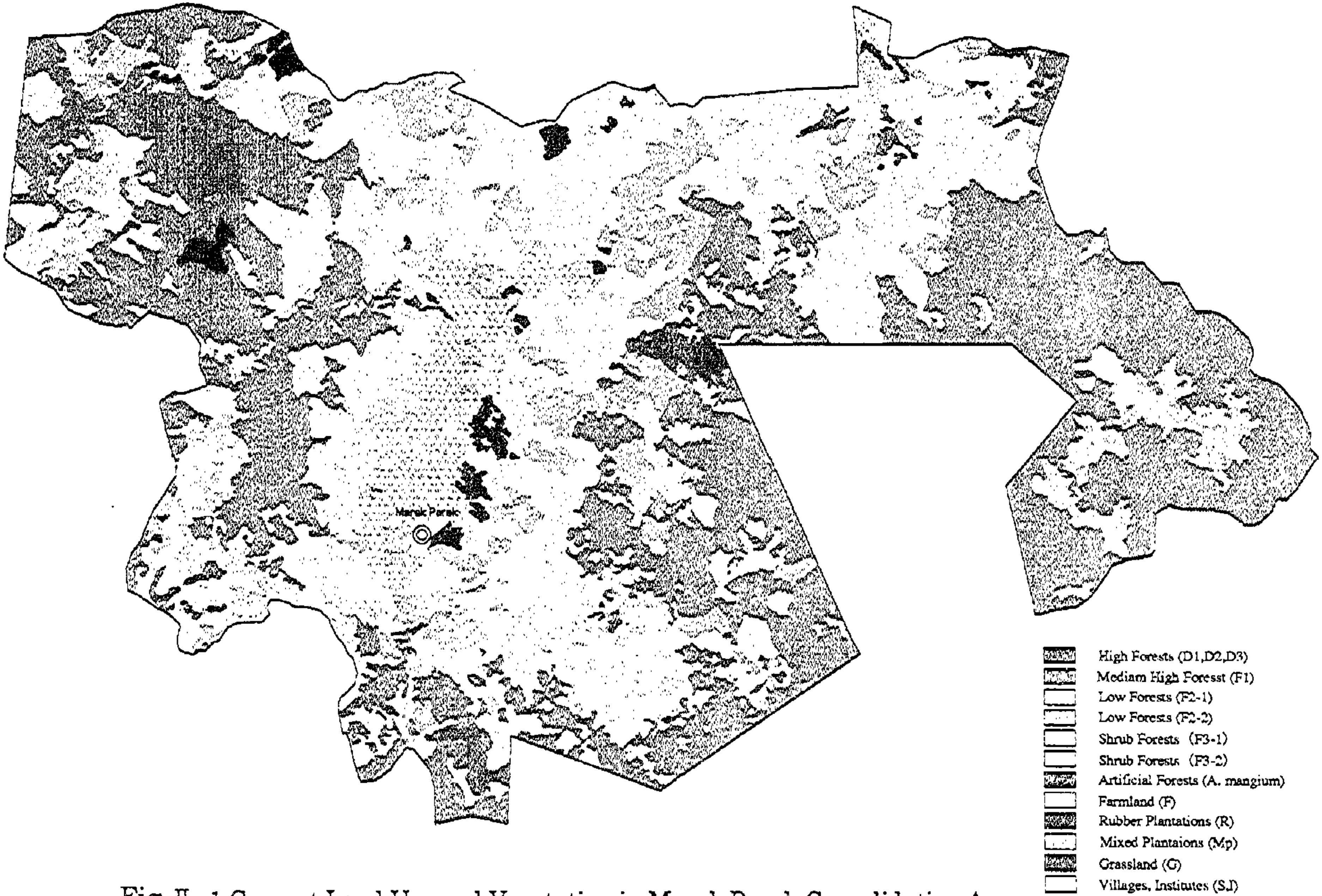


Fig. II - 1 Current Land Use and Vegetation in Marak Parak Consolidation Area

In this way, rough classification of land use is shown in Table II-1.

The study area is classified into 44,921 ha for forest use and 5,602 ha for non-forest use

Table II-1 Classification of Planned Land Use

unit: ha

Current state of land use	Present area	Classification of land use	
		Non-forest	Forest
Non-forest	3,347	3,347	0
Forest	47,176	2,255	44,921
Plantation (private land)	(87)	(0)	(87)
Natural forest	(47,089)	(2,255)	(44,834)
Total	50,523	5,602	44,921

Note: Since the target area of the integrated development plan in Bengkoka was unavailable, it is not excluded from the forest classification.

The forest management plan is formulated for 44,834 ha excluded the private plantation from the said forest use area based on "2. Concept of Forest Management," and it is shown in Table II-2.

The Bandau and Pangapuyan basins, which are used as sources of domestic water supply in Kota Marudu and Kudat, and the area adjacent to the national park in the Kinarom basin will be treated as protection forest (areas with a ban of felling). The area of (30,937) ha excluding these protection forests will be classified as production forest. Of such production forests, shrub forests and glassland cannot be rehabilitated if left as they are. These areas will be rehabilitated soon by re-afforestation, and the clear cutting system should be applied. Regarding open low forests, natural regeneration will be applied, and the quality of such forests will be improved soon by artificial regeneration while the remaining trees are activated. For other types of vegetation, natural regeneration will be applied. Such forests will be restored with the remaining natural trees, and selective cutting will be conducted.

These are illustrated in Fig. II-2.

Table II-2 Classification of Forest Management

Unit: ha

Classification		Area	Component ratio(%)
Forest Management Area	(a)	44,834	100
Protection Forest (ban on felling)	(b)	13,897	31
Production Forest	(c) = a-b	30,937	69
Re-afforestation		(12,913)	(29)
Artificial Regeneration (Enrichment)		(2,401)	(6)
Natural Regeneration		(16,623)	(34)

Moreover, the State Water Department is formulating the water conservation program within the study area, separately from this project. The target areas have not been fixed yet, however it will cover the protection forests shown in Table II-2. Since the protection areas are excluded from the forestation area, it seems to be reasonable measures in view of water conservation.

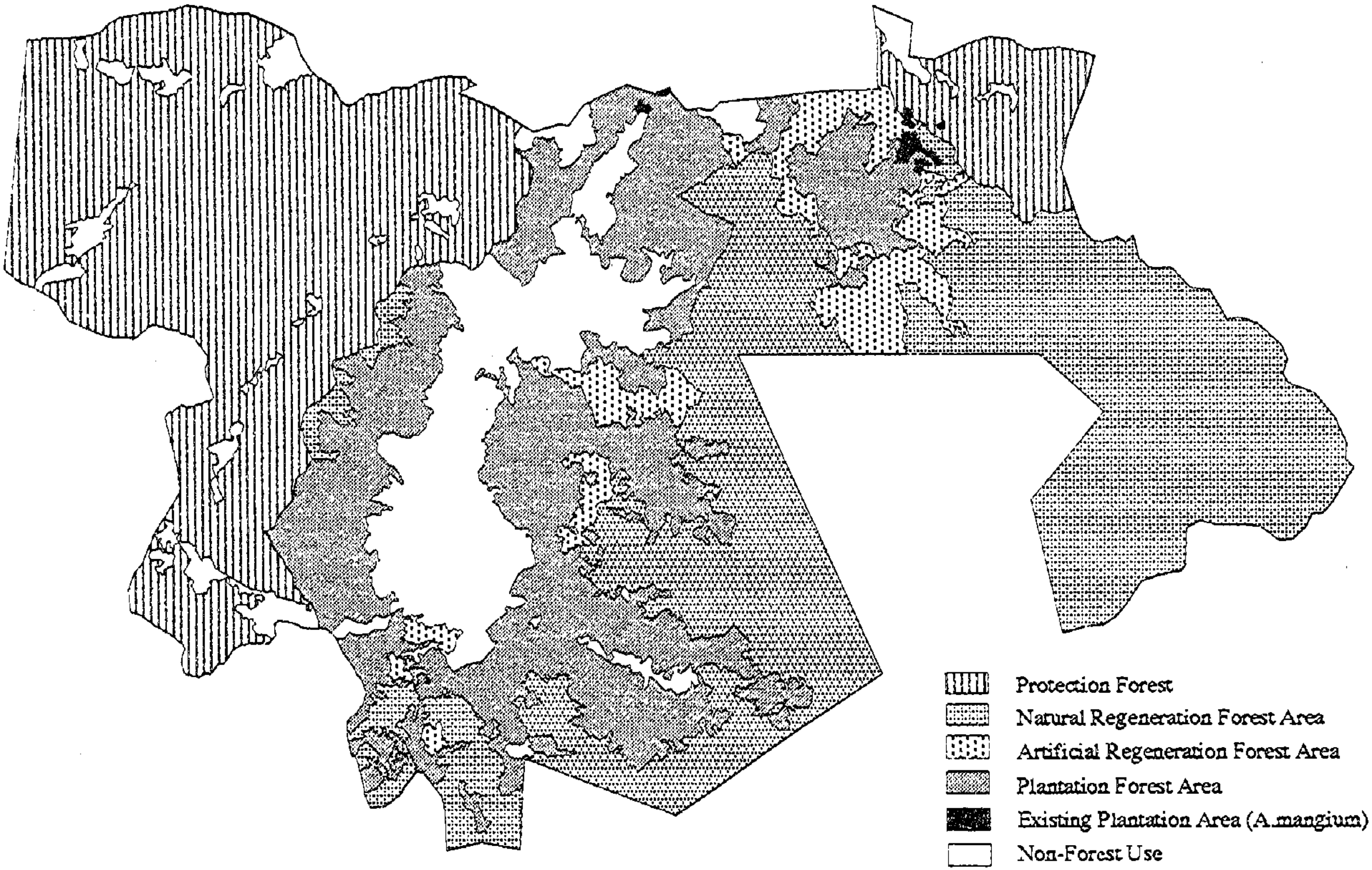


Fig. II—2 : Forest Management Plan

3-2 Forest Operation System

Protection forest is forest land conserved without any artificial manipulation for maintaining the water conservation function and the environment. Production forest is designed to produce timber and is the forest proposed for forest operation aimed at forest rehabilitation. Forest operation designed to rehabilitate devastated forest vegetation is divided into three types.

The following is a summary of each type of forest operation:

① Re-afforestation

It is impossible or it takes a considerable amount of time to let natural succession of vegetation happen in grassland and shrub forest. The remaining vegetation, mainly consisting of pioneer species, is extremely low in economic value if left as it is. It is urgent to restore forest in terms of effective land use and watershed conservation. To this end, all the existing vegetation will be cut, and the forest will be restored soon by planting fast-growing species in concert. In formulating the forestation plan, it is necessary to incorporate measures to avoid intensive forestation in a wide area, such as scattering forestation areas.

② Artificial Regeneration

Artificial regeneration will be conducted in areas corresponding to stands with low crown density in low forest type (Vegetation classification code: F2-2). Low forest, which consists of stands where the forest type has been further degraded, is dominated by pioneer species with no or a small proportion of succeeding *Dipterocarpaceae*. Enrichment planting will be introduced into such stands in consideration of the conservation of the environment and the watershed. Useful species that form the climax of the original vegetation will be planted to grow stands whose economic value will be high in the future. Line planting will be applied to ensure appropriate tending/care.

③ Natural Regeneration

Natural regeneration will be conducted in stands where forest vegetation is generally good. The target stands are high and medium forests other than those specified in ① and ②. Medium high forests also contain *Dipterocarpaceae* species and some of such trees are mature with flowering or fruiting. Rehabilitation of natural forest with high economic value would be expected to result from natural regeneration through appropriate forest management. In the future, a selective cutting system with a fixed cutting cycle will be adopted for sustainable forest management.

Chapter III Forestry Development Plan

1. Preconditions for Formulating the Plan

The existence of forests is the most essential element for the study area in light of the fact that the area is an important watershed. For this reason, the entire area except zones necessary for the local residents should be basically conserved as forest if this does not present any problems to watershed conservation. Non-forest accounts for only 7% of the whole area. Yet, apart from the actual land use, the study area can be classified as state land or private land (hereinafter referred to as "alienated land") in terms of ownership. The state land can be transferred to residents if they apply for the native title to it. The study area has many pieces of the state land for which residents have applied for the native title (hereinafter referred to as LA). Although some pieces have been transferred to residents, many are awaiting examination due to a delay in clerical procedures. No one knows what the future development will be, except for the irreversible trend that the ownership of the state land will be transferred to residents, expanding the scope of alienated land. The situation of land ownership is volatile.

In this study, it is difficult to clearly define the boundaries between state land and private land for formulating the forestry development plan. Therefore, this study establishes Model Area that correspond to different land status, and works on the forestry development plan while examining the current situation. The Model Area meets the following conditions: (1) the area is relatively large, (2) the area has different types of land ownership, (3) the area has more than one village, and (4) the location of the area is relatively favorable. Fig. III-1 shows the selected Model Area. In the study area, the forestry development plan deals with the following two cases. The forestry development plan here covers re-afforestation and artificial regeneration.

A. Plan based on the current situation (at Stage 2 Field Survey)[1)]
The forestry development plan will be formulated based on the demarcation of state land and alienated land as of the time of the Stage 2 Field Survey (as of October, 1996). The land ownership in this case is just temporary. State land zone, which is the target for large-scale forestation, is in the process of transforming into alienated land and accounts for the largest share in this case. The state land will gradually decrease until it reaches a certain level. In this case, the possibility of the implementation system of large-scale forestation will be examined. In the alienated land zone, small-scale forestation plans will be studied based on the residents' own plan of land use while paying due attention to watershed conservation.

B. Plan based on social surveys
Regardless of legal rights, indigenous people has been customarily using areas surrounding their villages. Socio-economic survey shows that each village has its boundary of such surrounding areas and its own plan of land use. Indigenous people do not have the idea of state-own land; for them, every piece of land belongs to some village. On another front, they have also applied for native title based on modern law. With

[1)] The classification of land ownership, i.e.; state land and private land, is determined by the Standard Sheet as of October, 1996. The Standard Sheet is prepared by the Land Survey Bureau of the State government every time the legal ownership of a piece of land is determined (for which the land title has been issued and the land survey has been completed).

these realities in mind, the forestry development plan will be studied based on residents' own plan of land use while paying attention to the public benefit of watershed conservation. This case is a method to identify the boundaries of land ownership and it was proposed at the discussion of Inception Report (see Detail of the Study, Section 5). In this case, there is no room for the existence of state land.

The above cases represent two opposite extremes. After the land problem is settled, the forestry development plan will rest between these two extremes. The application for native title is handled with due respect to the customary rights, but it aims at just land use by indigenous people in the specific area. Whether or not the specific land use is appropriate will be determined, needless to say, in light of the public benefits, including conservation of the watershed and the environment. Therefore, the realistic scenario will rest between that described in plan A and that described in plan B if the application for native title is handled in terms of appropriate land use.

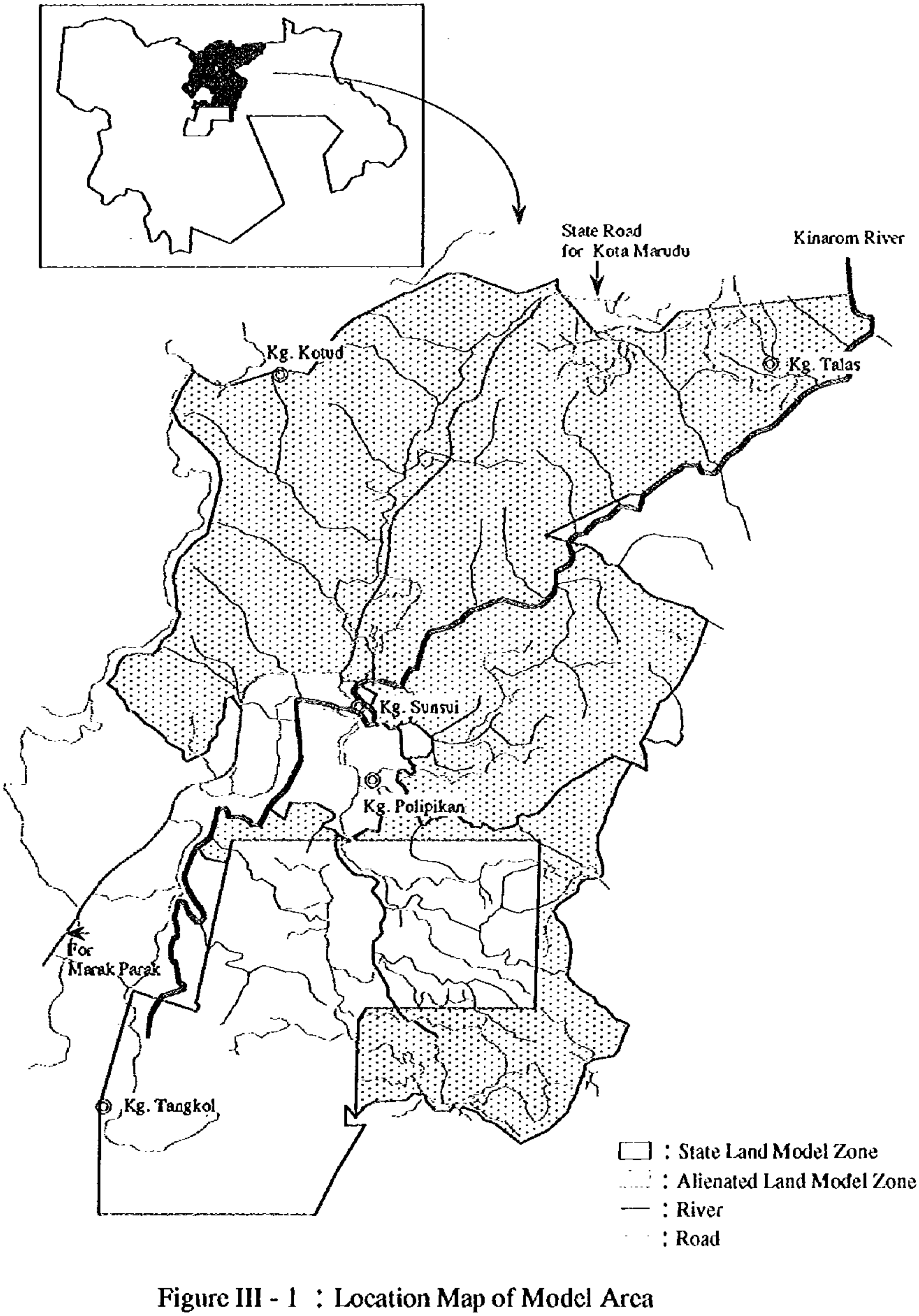


Figure III - 1 : Location Map of Model Area

2. Forestry Development Plan-A

2-1 Framework of the Plan

This is the forestry development plan for the Model Area based on the boundaries between state land and private land (alienated land) determined at the time of the Stage 2 Field Survey conducted last year (October, 1996). The target area consists of the state land model zone and the alienated land model zone (Fig. III-1). The forest development plan will be formulated for the two areas based on the principle of such a plan discussed in Chapter II.

Regarding the state land model zone, a large-scale forestation plan will play a major part. The forestation plan for the entire state land in the study area will also be studied based on the forestation plan in the model area.

The alienated land model zone is virtually regarded as private land for which deeds have been issued. Villages have their own land use plan in the area (see Chapter I, 2-6). Based on such plans, an appropriate land use plan will be studied with respect to watershed conservation. A small-scale forestation plan will be formulated for residents. Yet it is perceived difficult for residents alone to carry out forestation in terms of infrastructure such as forest roads. Rather, it is appropriate to link such small-scale forestation with a large-scale plan and implement the whole forestation plan at the same time. The plan will see to it that local residents carry out small-scale forestation on their own while engaging in the field work of a large-scale plan. It is possible that local residents implement a small-scale forestation while receiving technical guidance in the process of implementing a large-scale plan.

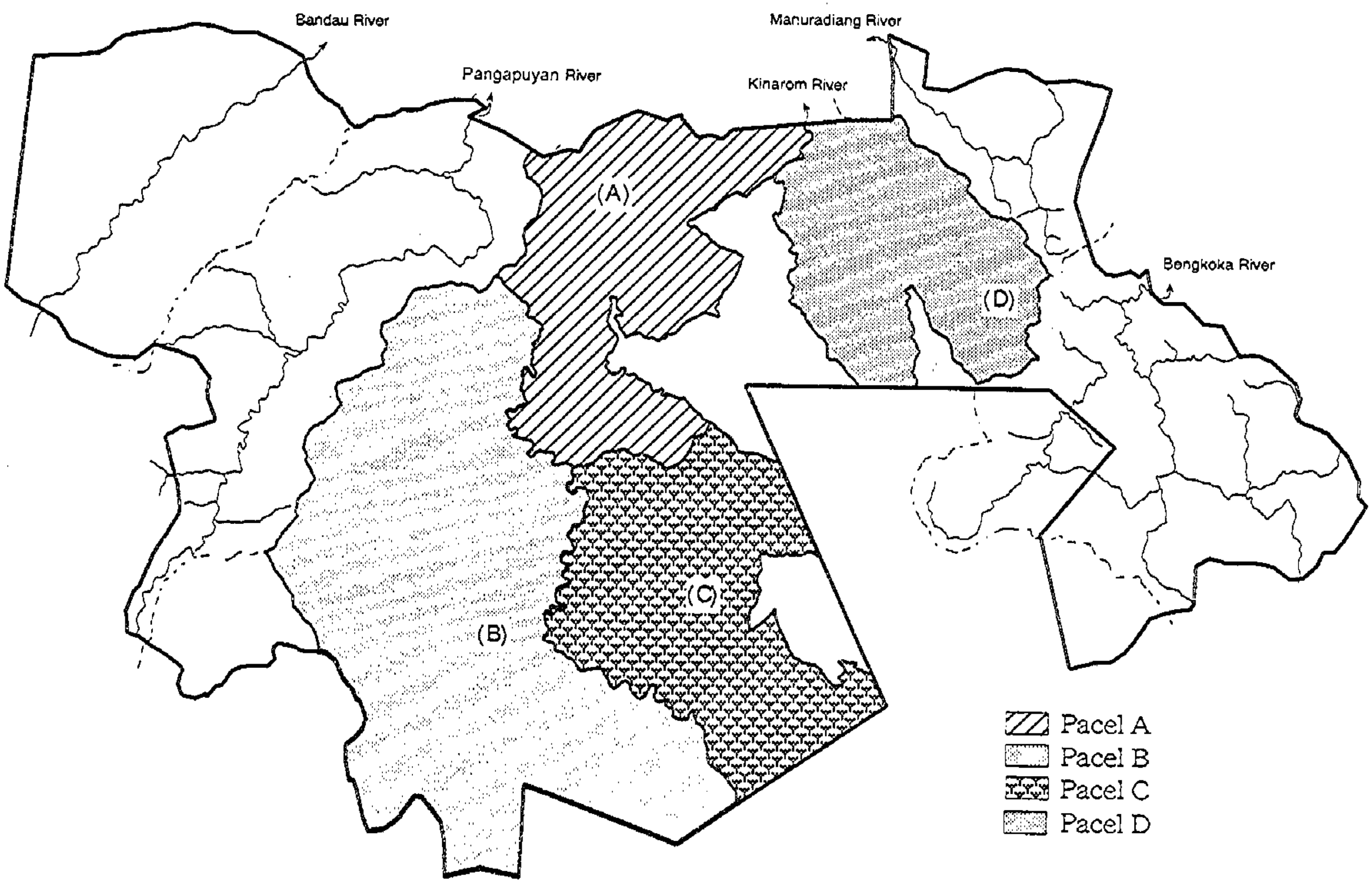


Fig. III-2 Forestation Area Divided by Parcel

2-2 Large-scale Forestation Plan

2-2-1 Forestation

1) Proposed Forestation Area

The State land model zone within the Model Area has been designated as forestation area in the large-scale forestation plan. Most of this proposed forestation area is owned by the State, although it also includes small pieces of alienated land. Shrub forests predominate the area, while some medium forests are also observed. Although there are some areas where shrub, low and medium forests are mixed rather randomly, a uniform forestation method was applied to these areas to achieve an efficient work schedule.

The entire study area was divided into four parcels (see the figure III-3) and a detailed forestation plan was established for Parcel A - the State land model zone.

Parcel A is composed of 10 compartments defined as M-131, M-132, M-139, M-140, M-141, M-179, M-180, M-181, M-182 and M-183 in the Forest Inventory Book, and its total area is 4,810.25 ha. Parcel B is composed of 18 compartments (11,187.40 ha), Parcel C 11 compartments (5,209.00 ha), and Parcel D 9 compartments (3,929.25 ha).

(1) Areas excluded from the forestation area

The following areas in each parcel where it is not appropriate to apply forestation were excluded from the forestation area:

① Alienated (private) land
The land on which native titles were given and the surveyed land

② Residential areas, farmland, etc.
The land whose vegetation type and land use are classified as residential areas, rubber plantation, tree plantation, mixed plantation, reservoirs, etc. These areas are considered to be de facto alienated lands used by local people.

③ Natural regeneration system
The land whose vegetation type and land use are classified as high forests (D), medium forests (F1) or closed low forests (F2-1). These areas are considered to be subject to natural regeneration system.

After the sizes of each parcel and the areas mentioned above are measured, total size of the forestation area was obtained. The proposed forestation area consists of re-afforestation areas and artificial regeneration areas. Enrichment planting is applied to open low forests (F2-2) in this project as artificial regeneration.

The proposed forestation area was obtained as a result of the above procedures, as shown in Table III-1.

Table III-1 Proposed Forestation Area (ha)

Parcel	Size of Parcel	Areas excluded from Forestation	Forestation Area	Re-afforestation Area	Artificial Regeneration Area
A	4,810.25	1,600.97	3,209.28	2,880.24	329.04
B	11,187.40	6,719.81	4,467.59	4,104.66	362.93
C	5,209.00	3,455.39	1,753.61	1,511.74	241.87
D	3,929.25	1,848.20	2,081.05	613.63	1,467.42
Total	25,135.90	13,624.37	11,511.53	9,110.27	2,401.26

(2) Re-afforestation Area

The size of plantable area in Parcel A was obtained by deducting the size of areas for roads and reserved belts from the re-afforestation area of Parcel A. And the plantable areas by species were decided taking into consideration the results of the soil survey, vegetation and topography. The same ratio between the forestation area and plantable area by species was used to obtain the plantable areas by species in other parcels.

① Road areas
It is necessary to rehabilitate existing roads and also construct new roads in order to implement the forestation in Parcel A. The improvement of roads will also be beneficial to local people. State road area were designed at 50 m width. Main roads area which should be mainly constructed at ridges were designed at 10 m width, sub road area at 4 m width and existing roads at 10 m width. The length of the roads was measured on the map and the total area was obtained by multiplying the length by the width of the roads, which amounted to 52.45 ha.

② Reserved Belts
To protect forest areas from wind and fire, the width of reserved belts at main ridges was designed at 100 m with the ridges in the middle of the belts, while the width of reserved belts for rivers and streams was designed at 50 m from each bank of the rivers and the streams. These reserved belts and roads which surround forestation areas will be effective to minimize the damage from fires which could occur within and from outside of the forests. The length of the rivers of Parcel A was measured on the map and the total area was obtained by multiplying the length by the width of the belts, which amounted to 436.79 ha.

After the above areas (roads 52.45 ha and reserved belts 436.79 ha) were excluded from the re-afforestation area (2,880.24 ha), the plantable area turned out to be 2,391.00 ha, or 83% of the re-afforestation area. The same ratio was used to estimate the plantable areas in other Parcels, and the following figures were obtained (Table III-2):

Table III-2 Plantable Area by Parcels (ha)

Parcel	Re-afforestation	Road and Reserved Belts	Plantable Area
A	2,880.24	489.24	2,391
B	4,104.66	698.66	3,406
C	1,511.74	257.74	1,254
D	613.63	104.63	509
Total	9,110.27	1,550.27	7,560

2) Forestation Methods

Forestation methods for the regeneration of forests in logged-over or degraded areas are classified into two categories.

(1) Re-afforestation

The targeted areas are those whose vegetation type and land use are classified as shrub forests (F3-1~2) and grassland (G). Clear cutting system should be taken for these areas. *Acacia mangium* and *Paraserianthes falcataria* were chosen as species appropriate for this purpose. The planting methods and cutting ages for these species are as follows:

① *A. mangium* The cutting age is set at 9 years and the trees are assumed to be used in chips for pulp or MDF. Planting sites are prepared by burning, generally between June and September. A topographic survey is needed before the site preparation. After each site is divided into several zones, existing trees are slashed. Local people are free to take slashed trees except for those which SAFODA needs for itself. The slashed trees left are piled and dried at the sites and eventually burned out.
Prior to the actual planting, marking sticks are set up at each planting point at an interval of 2m × 4m (1,250 seedlings per ha). Planting is carried out normally between September and December. Strip planting is applied along contour lines. The first weeding is done three months after the planting. Strip weeding is also applied along contour lines. After the first weeding with a 1m width, 80 g of NPK fertilizer is applied to each seedling. The second weeding is carried out with a 2m width eight months after the planting. After this point, no more weeding will normally be necessary because the seedlings will have grown longer than surrounding weeds. Another weeding is only necessary when the length of the weeds exceeds that of seedlings.

② *P. falcataria* Cutting age is set at 12 years, and the utilization is principally for blockboard, furniture, cabinets, or packing materials. The planting procedures are similar to those for *A. mangium*; the sites are prepared by burning. Spacing is 4m × 3m (833 seedlings per ha) and the tending work such as weeding and fertilizing is carried out in the same way as *A. mangium*.

It should be noted that forestation methods vary depending on the slope of areas. Although afforestation is applicable for steep areas (more than 25 degrees), reforestation should be decided whether applicable or not after close examination of site condition. For example, forestation should not always be applied to steep slopes in areas designated for reforestation if trees (even pioneer species) are found on the slopes. Moreover, the useful species like fruit trees for local people should be left as much as possible.

(2) Artificial Regeneration

An appropriate work method should be chosen for artificial regeneration by observing the composition of species in the forests. Line planting - one of enrichment planting methods - should be applied to secondary forests which do not have useful species, so that the forests are turned uniform and thus economically valuable. On the other hand, gap planting is suitable for the forests in which useful species are partly left at some intervals. However, in general, line planting has been widely applied due to its easiness in tending work after planting. There are several planting methods for artificial regeneration, such as single planting or cluster (group) planting. Tending work needs careful attention. Dipterocarpaceae species need proper light control: it sprouts under the shade of trees at the young growth stage, but eventually dies if it does not acquire enough light. Fast growing species normally grow quickly under strong light after the sapling stage.

Soil moisture control is also quite important for enrichment planting since it directly affects the species' survival rate and initial growth. Climate and topographic conditions must be carefully examined. Proper lining must be planned for the planting, taking into consideration all the conditions mentioned above.

Line planting is applied in the project. Clearing belts with 150 m in length and 5 m in width are prepared at 20m interval on both sides of forest roads. Two planting lines are placed at the center of the clearing belts at an interval of 1m. Seedlings of *Dipterocarpaceae* species are planted on these planting lines, at 4m intervals. Weeding must be done twice in the first year after the planting, twice in the second year. Branches around the clearing belts must be cut in order to secure enough light to the trees. 4m intervals are applied to secure the same amount of light water to each tree.

It is necessary to develop seedlings with a higher survival rate for successful enrichment planting. The survival rate of seedlings can be raised by increasing the amount of light and decreasing water which helps the hardening of seedlings, before transplanting them from the nursery. It is also necessary to develop an efficient system to collect as many good seeds as possible every year. Species to be planted in this project are *Dryobalanops* lanceolata (Kapur paji), *Shorea parvifolia* (Seraya punai) and *Shorea leprosula* (Seraya tembaga), seeds or wildings of which can be collected in or outside the project site.

The cutting age is set at 40 years and the logs will be turned to sawntimber. The utilization of harvested logs is for houses, plywood, floor, furniture, heavy structured buildings, etc.

3) Species to be planted

It is important to select species which match the environment and the objectives of the management. The followings are the criteria to select the suitable species for this project, taking into consideration the "right tree on right site" and other conditions:

① The species grow fast. Fast growing species will facilitate fast cost recovery of the project. Their mean annual increment (MAI) must be at least 14 m^3/ha/year.

② The population of the species grows in a uniform fashion. In other words, height and diameter growth of the species is uniform between trees.

③ The species have good trunk shape and good quality of wood, and they should not have any specific problems.

④ The species fit the provided site.

Research and development for tree breeding is indispensable to obtain the species which possess all the above mentioned characteristics.

In order to determine the species to plant in this project, a site survey was conducted by using the forest land productivity map developed during the second field survey. From the vegetation conditions, the land productivity of the study area was judged to be generally poor. Fair or steep slopes predominate the study area. Considering the low land productivity, leguminous species, which has high adaptability to land, was chosen: *P. falcataria* was applied to wet riverside land and low sloped areas and *A. magium* was applied to the rest of the study area. *P. falcataria* was chosen because its wild trees are found in some part of the study area and that the market of this species already exists: logs are transported from Northern Sabah to Sandakan as a material of blockboard. On the other hand, *A. mangium* was chosen not only because it is the right tree at the right site but also a large size of *A. mangium* plantation has been already developed in northern Sabah. Joint-venture company (in which SAFODA is a partner) has recently embarked on wood chip production. Along with this plantation, the project will form a stable supply base of *A. mangium* in the future when utilization of *A. mangium* is developed and the demand is increased. *A. mangium*'s other advantages are that seeds with good quality can be easily obtained and that there are many experts or experienced people in seedling production and planting. It is indispensable to develop superior seeds and seedlings for these two species in order to improve the quality of forests.

In this plan, the above two species were chosen for reasons of soil condition and marketing (see Section 4, this chapter). However, it does not mean that the other species are not applicable. It might be able to choose other marketable species partially depending on the site conditions.

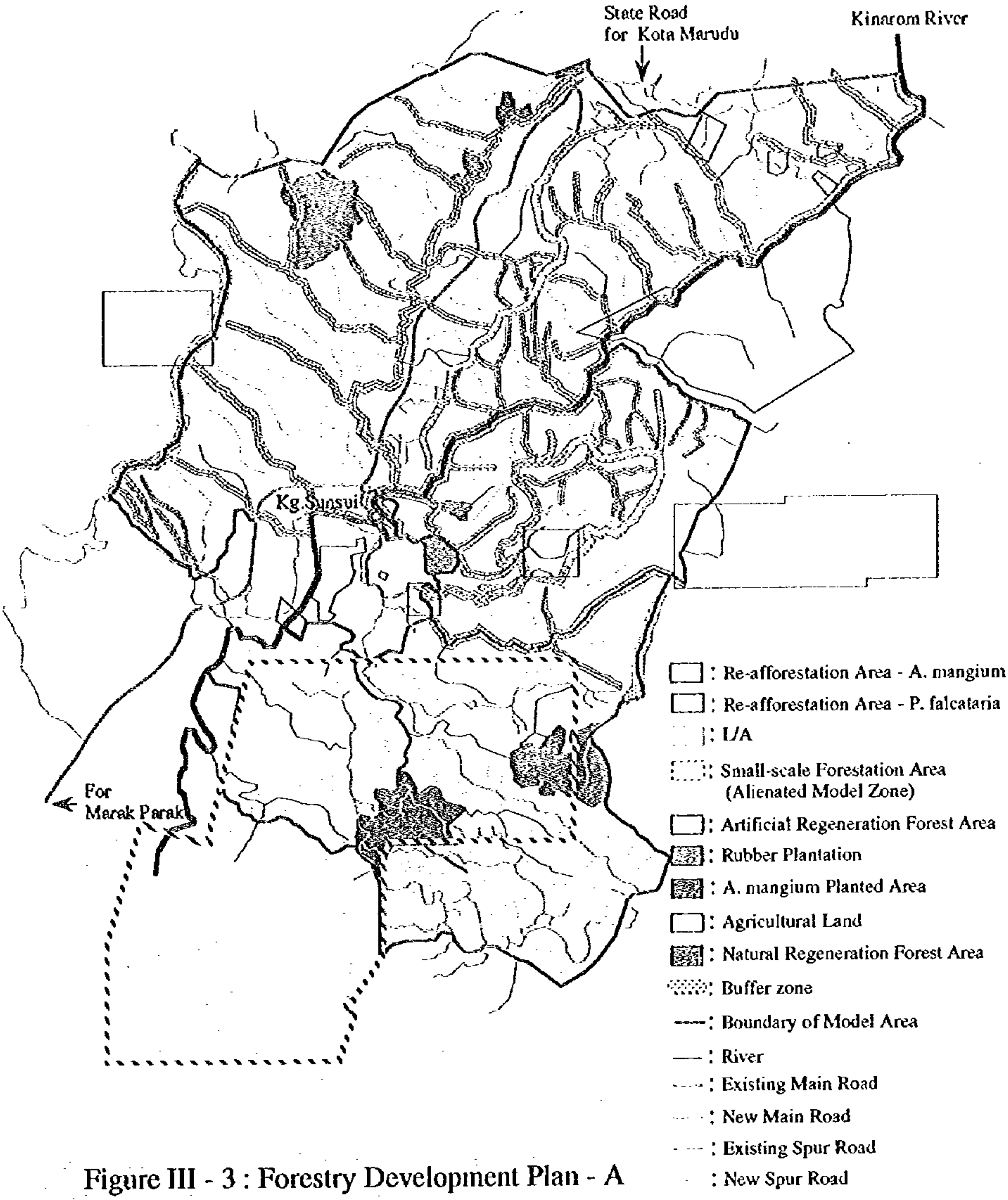


Figure III - 3 : Forestry Development Plan - A

4) Forestation Plan

(1) Forestation Plan for the State Land Model Zone

a. Re-afforestation Area by Species

Re-afforestation for Parcel A - the State land model zone - was planned in the following fashion. Through the analysis by the land productivity map prepared in the second field survey, the topographic map and the site survey, the wet riverside land and low sloped areas where wild *P. falcataria* are found were identified as areas suitable for *P. falcataria* plantation, and *A. mangium* will be planted in most of the rest of the study area. Out of the plantable area of Parcel A, 276 ha was identified to be suitable for the plantation of *P. falcataria*, which was plotted on the Land Use and Vegetation Map. As a result, the land suitable for *A. mangium* was 2,115 ha, or 88.5% of the plantable area of Parcel A, while for *P. falcataria*, it was 276 ha, or 11.5% (see Fig. III-3).

Since the same ratio was applied to the other parcels, the plantable area by species has become as Table III-3:

Table III-3 Plantable Area by Species (ha)

Parcel	*A. mangium*	*P. falcataria*	Total
A	2,115	276	2,391
B	3,015	391	3,406
C	1,110	144	1,254
D	450	59	509
Total	6,690	870	7,560

b. Re-afforestation Schedule

(a) Annual Re-afforestation Area of *A. mangium*

The following procedures were taken to establish the plantation schedule. The plantable area of Parcel A - 2,115ha - was divided by the cutting age, and each area was assumed to be replanted after harvested. *A. mangium* is to be harvested in the year when the mean annual increment peaks. Since it is learned from the land productivity study that the land productivity of a half of the area in Parcel A corresponds to the site quality grade II in the "Empirical Yield Table of *A. mangium*" by Dr. INOSE (see Chapter I, 4-3), the entire area in Parcel A was considered to fall in grade II. The study set the cutting age at the year 9 since the mean annual increment (MAI) peaks in the year 9 according to Dr. INOSE's yield table. Therefore, annual re-afforestation area in Parcel A is 235 ha (2,115 ha / 9 years).

(b) Annual Re-afforestation Area of *P. falcataria*

Since *P. falcataria* is used as a material of blockboard, the cutting age was set at the year when the logs' diameter becomes between 20 cm to 30 cm. Although there is significant deviation in MAI depending on the site quality and other site factors, 12^{th} year was applied as the most suitable year for the harvesting. As a result, annual re-afforestation area for *P. falcataria* becomes 23 ha (276 ha / 12 years) .

c. Annual Area for Artificial Regeneration (Enrichment Planting)

The areas designated for Enrichment Planting in the study was the forests classified as open low forests (F2-2) by its vegetation type. The size of the area for enrichment planting was measured based on the Forest Inventory Book and the Land Use and Vegetation Map, the results of which are shown in Table III-4.

Table III-4 Artificial Regeneration Area (ha)

Parcel	Artificial Regeneration Area
A	329
B	363
C	241
D	1,467
Total	2,400

Forest roads (rehabilitation and new construction) within the enrichment planting area of Parcel A (329 ha) was measured on the map, whose total length is 6,460 m. Enrichment planting will be conducted along these roads.
Since nursing is carried out from seeds and wildings, it is difficult to procure a large number of seedlings at one time. Therefore, the total operation was assumed to be done in 24 years and thus the annual operation area was set at 100ha. Since Parcel A has a 329 ha of enrichment planting area, it was assumed that planting would be conducted at 14 ha per year from year 1 to year 23, and 7 ha in year 24.
Annual forestation area by year (State land model zone) is shown in Table III-5.

Furthermore, careless farming on the slope (shifting cultivation) has been carried out in the study area, and it causes low fertility of soil. Promotion of tillage system considered soil/water conservation will bring good results on local people and watershed conservation. For this purpose, experimental plots of Agroforestry will be established in the plantation, closely to the villages, and several field tests like "Alley Cropping" depending on the topographical conditions will be conducted. The plots could be good models as demonstration of agroforestry for technical dissemination (see Chapter I, 2-6-6(2)).

Table III-5　Annual Forestation Plan - State Land Model Zone

Unit: ha

Year	1	2	3	4	5	6	7	8	9
A. mangium (1)	235.0	235.0	235.0	235.0	235.0	235.0	235.0	235.0	235.0
P. falcataria (1)	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Enrichment P.	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Total	272.0	272.0	272.0	272.0	272.0	272.0	272.0	272.0	272.0

Year	10	11	12	13	14	15	16	17	18
A. mangium (2)	235.0	235.0	235.0	235.0	235.0	235.0	235.0	235.0	235.0
P. falcataria (1 ,2)	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Enrichment P.	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Total	272.0	272.0	272.0	272.0	272.0	272.0	272.0	272.0	272.0

Year	19	20	21	22	23	24	Total
A. mangium (3)	235.0	235.0	235.0	235.0	235.0	235.0	5,640.0
P. falcataria (2)	23.0	23.0	23.0	23.0	23.0	23.0	552.0
Enrichment P.	14.0	14.0	14.0	14.0	14.0	7.0	329.0
Total	272.0	272.0	272.0	272.0	272.0	265.0	6,521.0

Table III-6 Annual Forestation Plan - Total Area

Unit: ha

Year	1	2	3	4	5	6	7	8	9
A. mangium (1)	743.0	743.0	743.0	743.0	743.0	743.0	743.0	743.0	746.0
P. falcataria (1)	72.0	72.0	72.0	72.0	72.0	72.0	73.0	73.0	73.0
Enrichment P.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total	915.0	915.0	915.0	915.0	915.0	915.0	916.0	916.0	919.0

Year	10	11	12	13	14	15	16	17	18
A. mangium (2)	743.0	743.0	743.0	743.0	743.0	743.0	743.0	743.0	746.0
P. falcataria (1, 2)	73.0	73.0	73.0	72.0	72.0	72.0	72.0	72.0	72.0
Enrichment P.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total	916.0	916.0	916.0	915.0	915.0	915.0	915.0	915.0	918.0

Year	19	20	21	22	23	24	Total
A. mangium (3)	743.0	743.0	743.0	743.0	743.0	743.0	5,640.0
P. falcataria (2)	73.0	73.0	73.0	73.0	73.0	73.0	552.0
Enrichment P.	100.0	100.0	100.0	100.0	100.0	100.0	329.0
Total	916.0	916.0	916.0	916.0	916.0	916.0	21,978.0

(2) Forestation Plan for the Total Area

As was discussed in the previous section, total plantable area is 6,690 ha for *A. mangium*, 870 ha for *P. falcataria* and 2,400 ha for enrichment planting. Based on the above figures and the cutting ages of each species, annual planting areas for each operation was obtained in the following fashion:

① Annual planting area of *A. mangium*
Total plantable area of *A. mangium* - 6,690 ha - divided by the cutting age - 9 years is 743.33 ha. Planting will be carried out in 743 ha of land per year from year 1 to year 8, and 746 ha in year 9. After the harvesting in year 10, the same size of area will be planted.

② Annual planting area of *P. falcataria*
Total plantable area of *P. falcataria* - 870 ha - divided by the cutting age - 12 years is 72.50 ha. Planting will be carried out in 72 ha of land per year from year 1 to year 6, and 73 ha from year 7 to year 12. After the harvesting in year 13, the same size of area will be planted.

③ Annual Operation Area for Artificial Regeneration
Annual operation area for artificial regeneration is 100ha, since total operation area (2,400 ha) divided by the total project period - 24 years - is 100 ha.

Annual plantation areas by species are shown in Table III-6.

5) Manpower Requirement

In order to estimate manpower requirement and costs for the planting, a standard forestation process table was prepared (Attachment 29)with reference to SAFODA's standard unit cost table for each operation used for subcontracting in planting. Since slopes predominate the study area, costs were increased by 5% to the standard forestation process in accordance with SAFODA's guideline (5% cost increase when the slope is 15 to 25 degrees.).
Table III-7 shows the labor requirement for land clearance, planting and tending per ha in the first year, and that for tending in the second and third year, in accordance with the standard forestation process table.

Table III-7 Annual Manpower Requirement per ha by Species (man-day)

Species	Year 1	Year 2	Year 3	Total
A. mangium	50.6	5.7	0.0	56.3
P. falcataria	40.4	5.4	0.0	45.8
Enrichment Plt.	14.2	4.0	2.0	20.2

(1) Manpower Requirement for the State Land Model Zone
The manpower requirement for Parcel A, obtained from the information in Table III-5 and Table III-7, is shown in Table III-8. From 13,000 to 14,600 man-day labor is needed annually depending on the planting area of the year, and 348,000 man-day labor in total is needed for Parcel A during the project period.

(2) Total Manpower Requirement
The total manpower requirement for the project, shown in Table III-9, was also obtained from Table III-6 and Table III-7. Total annual manpower requirement is approximately 47,100 man-day and 1,125,400 man-day is needed during the total project period.

Table III-8 Manpower Required for Forestation - State Land Model Zone

Unit: man-day

Year	1	2	3	4	5	6	7	8	9
A. mangium (1)	11,891.0	13,230.5	13,230.5	13,230.5	13,230.5	13,230.5	13,230.5	13,230.5	13,230.5
P. falcataria (1)	929.2	1,053.4	1,053.4	1,053.4	1,053.4	1,053.4	1,053.4	1,053.4	1,053.4
Enrichment P.	198.8	254.8	282.8	282.8	282.8	282.8	282.8	282.8	282.8
Total	13,019.0	14,538.7	14,566.7	14,566.7	14,566.7	14,566.7	14,566.7	14,566.7	14,566.7

Year	10	11	12	13	14	15	16	17	18
A. mangium (2)	13,230.5	13,230.5	13,230.5	13,230.5	13,230.5	13,230.5	13,230.5	13,230.5	13,230.5
P. falcataria (1, 2)	1,053.4	1,053.4	1,053.4	1,053.4	1,053.4	1,053.4	1,053.4	1,053.4	1,053.4
Enrichment P.	282.8	282.8	282.8	282.8	282.8	282.8	282.8	282.8	282.8
Total	14,566.7	14,566.7	14,566.7	14,566.7	14,566.7	14,566.7	14,566.7	14,566.7	14,566.7

Year	19	20	21	22	23	24	Total
A. mangium (3)	13,230.5	13,230.5	13,230.5	13,230.5	13,230.5	13,230.5	316,192.5
P. falcataria (2)	1,053.4	1,053.4	1,053.4	1,053.4	1,053.4	1,053.4	25,157.4
Enrichment P.	282.8	282.8	282.8	282.8	282.8	183.4	6,575.8
Total	14,566.7	14,566.7	14,566.7	14,566.7	14,566.7	14,467.3	347,925.7

Table III-9 Manpower Required for Forestation - Total Area

Unit: man-day

Year	1	2	3	4	5	6	7	8	9
A. mangium (1)	37.6	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.9
P. falcataria (1)	2.9	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Enrichment P.	1.4	1.8	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Total	41.9	46.9	47.1	47.1	47.1	47.1	47.1	47.1	47.2

Year	10	11	12	13	14	15	16	17	18
A. mangium (2)	41.9	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.9
P. falcataria (1, 2)	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Enrichment P.	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Total	47.2	47.1	47.1	47.1	47.1	47.1	47.1	47.1	47.2

Year	19	20	21	22	23	24	Total
A. mangium (3)	41.9	41.8	41.8	41.8	41.8	41.8	999.4
P. falcataria (2)	3.3	3.3	3.3	3.3	3.3	3.3	78.8
Enrichment P.	2.0	2.0	2.0	2.0	2.0	2.0	47.2
Total	47.2	47.1	47.1	47.1	47.1	47.1	1,125.4

6) Forestation Costs

The forestation costs are shown in Table III-10, which were calculated by using the unit cost per ha given by the Standard Forestation Process Table (Attachment 28) and Table III-6 - Forestation Schedule for the Entire Project. The calculation was conducted in the following fashion":

Example of *A. mangium*:

Unit Forestation Cost:	1st year	RM 976.5/ha
	2nd year	RM 85.5/ha
Planting Area:	1st year	743.0 ha
	2nd year	743.0 ha
Forestation Costs	1st year	RM 976.5/ha x 743.0 ha≒RM 725,500
	2nd year	RM (976.5+85.5)/ha x 743.0 ha≒RM 789,000

The forestation costs from the third year were obtained in the same manner.

Table III-10 Forestation Costs by Species

Unit: RM 1,000

Year	1	2	3	4	5	6	7	8	9
A. mangium	725.5	789.0	789.0	789.0	789.0	789.0	789.0	789.0	792.0
P. falcataria	54.3	60.1	60.1	60.1	60.1	61.0	60.9	61.0	61.0
Enrichment P.	23.2	29.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Total	803.0	878.3	881.3	881.3	881.3	881.3	882.1	882.2	885.2

Year	10	11	12	13	14	15	16	17	18
A. mangium	789.3	789.0	789.0	789.0	789.0	789.0	789.0	789.0	792.0
P. falcataria	61.0	61.0	61.0	60.2	60.1	60.1	60.1	60.1	60.1
Enrichment P.	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Total	882.5	882.2	882.2	881.4	881.3	881.3	881.3	881.3	884.3

Year	19	20	21	22	23	24	Total
A. mangium	789.3	789.0	789.0	789.0	789.0	789.0	18,879.1
P. falcataria	60.9	61.0	61.0	61.0	61.0	61.0	1,447.3
Enrichment P.	32.2	32.2	32.2	32.2	32.2	32.2	760.8
Total	882.4	882.2	882.2	882.2	882.2	882.2	21,087.2

2-2-2 Seedling Production

1) Concept of Seedling Production

Seedling production will be conducted through subcontract, just as SAFODA is doing now. Although no contractor in the Marak Parak Consolidation produce seedlings now, it will be relatively easy to implement seedling production by subcontract in the area. This is because some residents used to produce seedlings of *A. mangium* on a contract basis for SAFODA and residents in the Marak Parak area are interested in the seedling production as shown in the results of socio-economic survey (see Chapter I, 2-6-5 (4)).
Furthermore, SAFODA provides technical training on nursery practices at Ulu Kukut for people in adjacent villages who want to have their own nurseries. By making use of this training system, technology transfer will be ensured.
The manpower that will engage in the seedling production should be provided by local residents. This will create job opportunity for residents, especially women. Residents need training to acquire nursery techniques when engaging in nursery work. For this reason, training will be provided on a step-by-step basis for foremen in nurseries.

2) Nursery Site

SAFODA has its own nurseries in Bengkoka and Ulu Kukut. It also consigns the seedling production to contractor in both Kudat and the Langkon district near Kota Marudu and every year SAFODA buys seedlings produced there. Although it is possible to produce seedlings necessary for this forestation plan in the said nurseries and transport them to the planting sites, it is advisable to have its own nurseries within the target area for forestation in consideration of economic efficiency and prevention of seedling damage in transit.
As discussed above, it will be relatively easy to start consignment production of seedlings in the area, because residents are interested in the seedling production and it will create job opportunity for them.
Nurseries will be set up at four sites by parcel. This is designed to avoid risks associated with long-distance transport of seedlings and to create as many jobs as possible for local residents in each area.
It is preferable to set up these nurseries:
① on flat land not so far from a village so as to secure necessary labor force,
② near a truck road for easy transportation,
③ by a river whose water-source does not dry up in the dry season.

Specifically, the flat land along the Kinarom river seems appropriate in the case of Parcel A and B. In this area, passion fruit has been widely grown until recently under the guidance of KPD. However, arable land for this crop has been abandoned because its shipping price has been low owing to increase of number of farmers who have begun to grow the same crop in and around Kota Kinabalu. This area seems appropriate for setting up nurseries because the area is flat and is equipped with water-use facilities to a certain extent.
Figure III-5 shows a layout sketch of nursery.

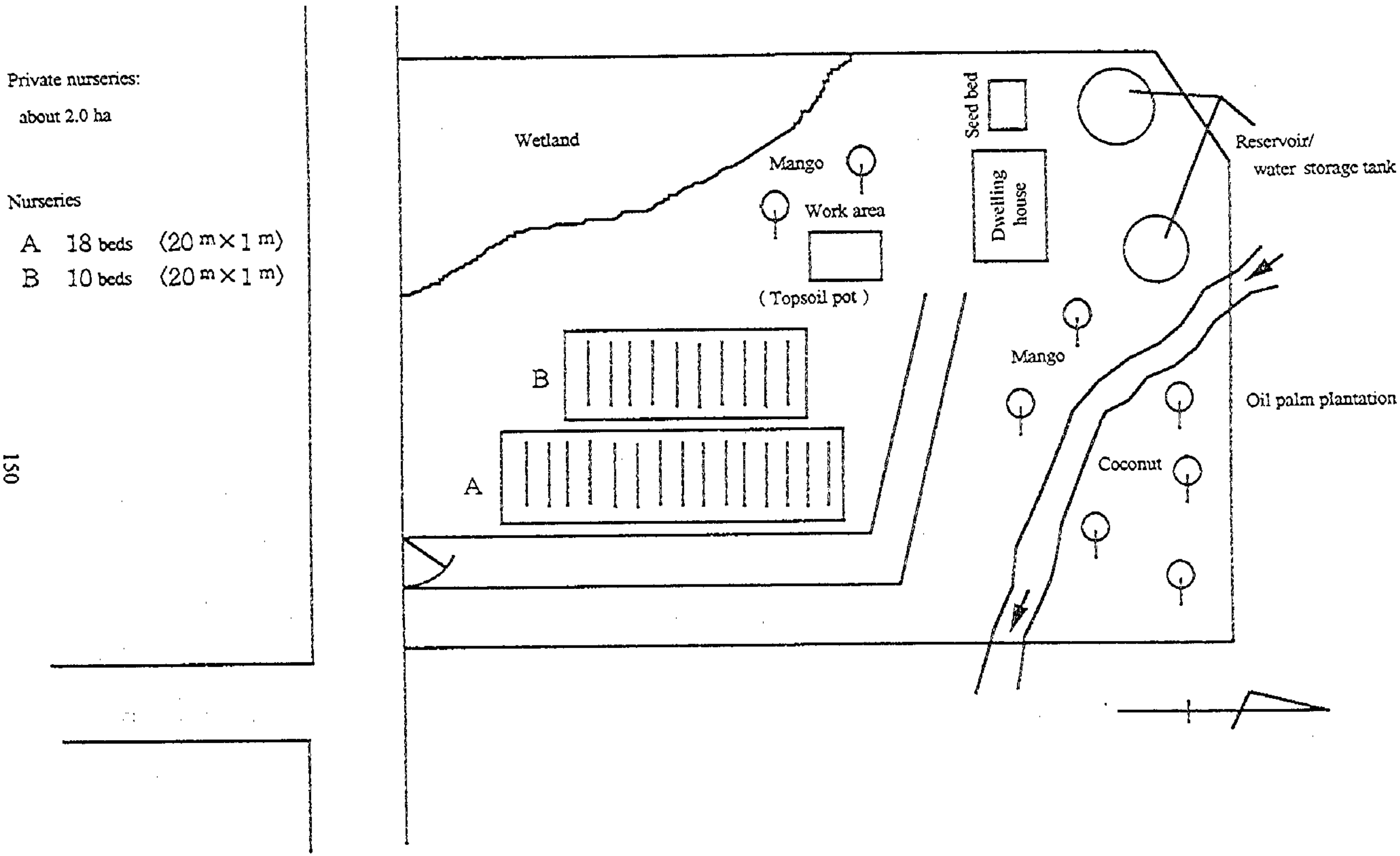


Fig. III-4 Sketch Map of Nursery

3) Seedling Production Plan

The basis for calculating the number of seedlings to be produced by species for the forestation plan follows that of the Master Plan. In case of fast-growing species such as *A. mangium* and *P. falcataria*, the Master Plan has set the plant percentage (PP) of the number of planting seedlings at 80% and the supplementary planting rate (SPR) at 10%. The Master Plan has also set planting distance at 4m x 2m for *A. mangium* and 4m x 3m for *P. falcataria*. Therefore, the production of seedlings per hectare is as follows:

4m x 2m 1,250 x 1.1 (SPR) ÷ 0.8 (PP) = 1,719/ha
4m x 3m 833 x 1.1 (SPR) ÷ 0.8 (PP) = 1,145/ha

For artificial regeneration operation, native species, especially *Dipterocarpaceae*, are used. According to the forestation plan, the line planting of 750 seedlings will be carried out for every 100m extension of the forest road. Seedlings to be planted here will be either wildings or seedlings nursed from seeds. The share of seedling production by either of two these nursing methods greatly depends on the fruiting condition in a particular year. With this in mind, the Master Plan has predicted that the plant percentage of seedlings to be used for the artificial regeneration operation will be at 70% and its supplementary planting rate at 10%. Therefore, the seedling production necessary for every 100m extension of the forest road will be as follows:

750 x 1.1 (SPR) ÷ 0.7 (PP) = 1,176/100m

The plant percentage for each species would be somewhat different from the above plant percentage depending on the states of seed storage and operation control. For the nursery management, it is important to secure stable production of seedlings while trying to maintain a high plant percentage and to raise healthy seedlings. The first step to this end is to secure good-quality seeds.
A good-quality seed refers to one that meets the following criteria: ① its growth is good, ② produces a straight trunk, ③ resilient to pests and diseases, and ④ good wood quality. At present, SSSB Company is an option from which good-quality seeds of *A.mangium* and *P.falcataria* will be purchased. When it comes to *A.mangium* alone, it is quite feasible to use seeds provided from SAFODA's plantation in the Bengkoka district. Yet, in a case of a long-term forestation plan on a relatively large scale like this project, it would be necessary to establish one's own seed orchard and scion garden, as recommended by the Master Plan.

• Seedling Production Plan for the State Land Model Zone

Seedling production in the model zone is calculated based on the aforementioned equations. Because the annual forestation plan for *A.mangium* is 235ha in the model zone, the annual seedling production necessary for this is:

235ha x 1,719/ha = 403,965

In the case of *P.falcataria*, the annual forestation area in the model zone is 23ha, and therefore, the annual seedling production is:

23ha x 1,145/ha = 26,335

Seedling production for artificial regeneration mainly consists of native species including *Dipterocarpaceae*. The proposed operation area in the model zone is 329ha. The extension of forest road within the area is 6,460m long. Therefore, seedlings required per hectare is:

1,176/100m x 64 ÷ 329ha = 229

According to the forestation plan, the annual operation area in the model zone is 14ha from the first year to the 23rd year, and 7ha for the 24th year. The annual seedling production is:

(1st to 23rd year)	17ha x 229 = 3,893
(24th year)	7ha x 229 = 1,603

The seedling production plans for *A. mangium* and *P. falcataria*, and for native species for artificial regeneration are shown in Table III-11.

- Seedling Production Plan for the Total Area

The general plan for the entire study area will be worked out based on the concept of seedling production in the model zone discussed above. As discussed in the paragraph concerning the forestation plan, the re-afforestation area is 7,560 ha in total, of which the planned area for *A. mangium* is 6,690 ha and that for *P.falcataria* is 870 ha. For artificial regeneration, 2,400 ha is planned (see Table III-3, 4).

According to the general forestation plan, 6,690 ha will be covered with *A. mangium* in nine years, and 870 ha will be covered with *P. falcataria* in 12 years. In addition, artificial regeneration will cover 100ha every year. Therefore, the annual seedling production necessary for this forestation plan is:

• *A mangium*	(1st to 8th year)	743ha x 1,719 seedlings/ha = 1,277,217 seedlings/yr.
	(9th year)	746ha x 1,719 seedlings/ha = 1,282,374 seedlings/yr.
• *P.falcataria*	(1st to 6th year)	72ha x 1,145/ha = 82,440/yr.
	(7th to 12th year)	73ha x 1,145/ha = 83,585/yr.
• Artificial regeneration	(for 24 years)	100ha x 229 seedlings/ha = 22,900 seedlings/yr.

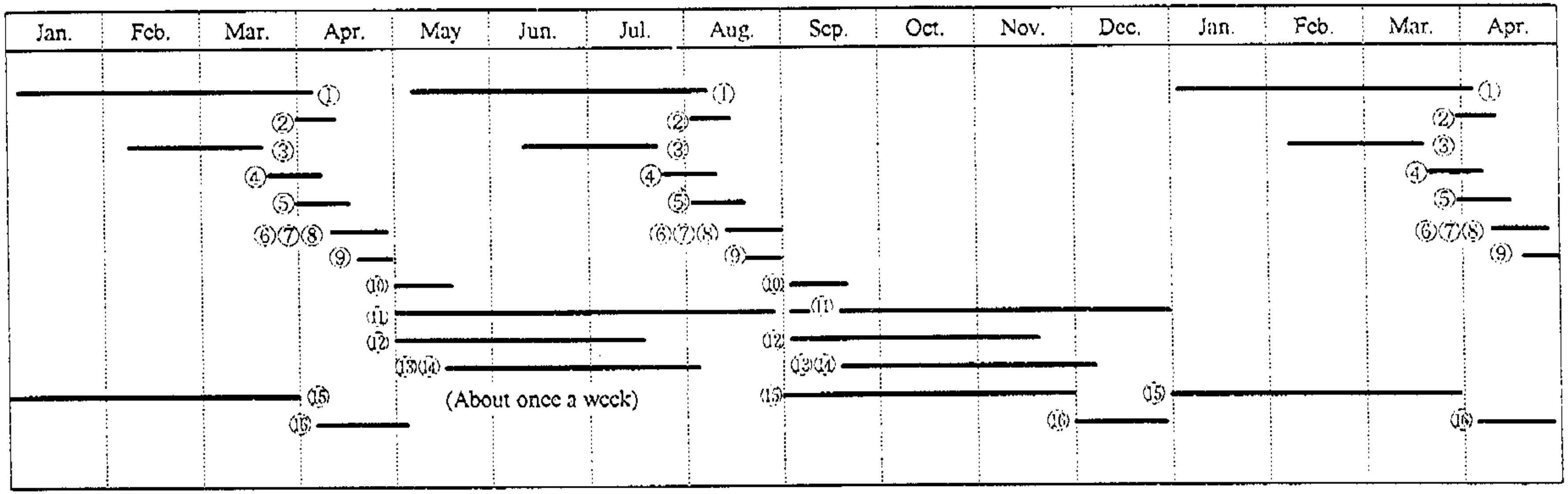
Table III-12 show the corresponding seedling production plans by year for *A. mangium* and *P. falcataria*, and for artificial regeneration.

4) Working Process and Schedule for Nursery Practices

All the nursery work is carried out through contractors. The general work schedule for *A.mangium* and *P.falcataria* is shown in Figure III-5-1. This work will continue almost throughout the year; it will begin with compost production in early January and finish with the preparation of seedlings for supplementary planting in December. The production has two cycles: one begins in January and the other begins in May. The processes of ② and ⑩, which require the greatest amount of manpower, will be carried out in the dry season between April and August for both cycles. This period of the year does not fall during the busy farming season of the local residents, making it rather easy to secure the necessary manpower discussed in 5) below.
The nursery practice schedule for artificial regeneration is shown in Fig. III-5-2.

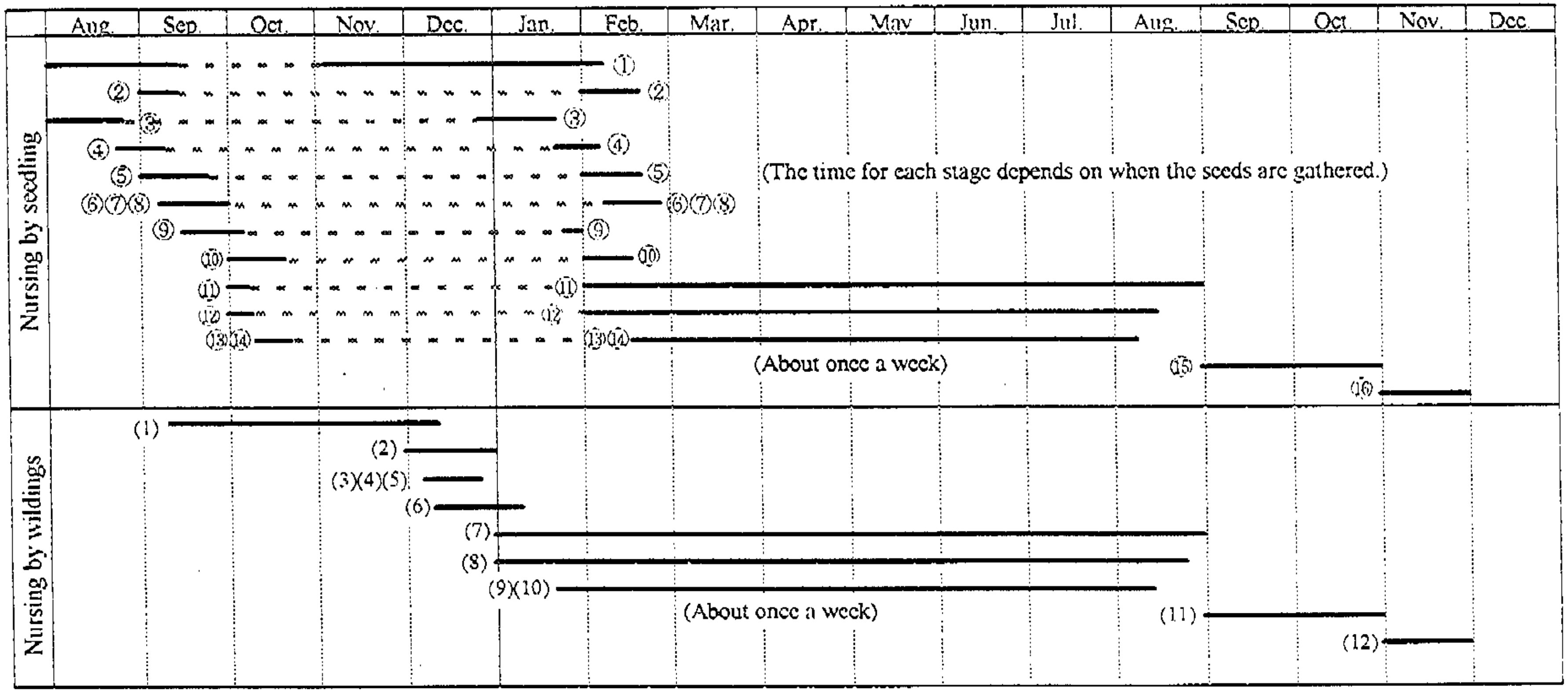
Like *A. mangium* and *P. falcataria*, there are two methods of nursing of native species: a) transplanting seedlings germinated in seedbeds to pots, and b) sowing seeds directly in pots. Method b) is less costly but method a) should be a wiser way in light of the risks associated with germination. Yet, in the case of *Dipterocarpaceae*, there are some problems: the timing of fruiting is not uniform and storage of seeds is technically difficult. Thus, it is necessary to sow seeds as soon as gathered from forests and to control the seedling height by trimming them until the planting season.

Both seedlings and wildings are used to secure stable seedling production. The tendering period for seedlings is about 6 months, whereas that for wildings is 8-9 months so as to recover from the damage of fine roots caused at the time of collecting.



① Compost production
② Preparation of seedbed
③ Seed procurement
④ Pre-treatment for sowing
⑤ Seeding
⑥ Soil gathering
⑦ Preparation of pot soil
⑧ Potting of soil
⑨ Arrangement of pots
⑩ Transplanting of seedlings
⑪ Watering
⑫ Shading
⑬ Insecticide spraying
⑭ Weeding and removal of seedlings damaged by disease or insects
⑮ Selection and shipment of seedlings
⑯ Preparation of seedlings for supplementary planting

Fig. III-5 Nursery Operations Schedule
1. *A. mangium*, *P. falcataria*



- Nursing by seedlings
  - ① Compost production
  - ② Preparation of seedbed adjustment
  - ③ Seed procurement
  - ④ Pre-treatment for sowing
  - ⑤ Seeding
  - ⑥ Soil gathering
  - ⑦ Preparation of pot soil
  - ⑧ Potting of soil
  - ⑨ Arrangement of pots
  - ⑩ Transplanting of seedlings
  - ⑪ Watering
  - ⑫ Shading
  - ⑬ Insecticide spraying
  - ⑭ Weeding and removal of seedlings damaged by disease or insects
  - ⑮ Selection and shipment of seedlings
  - ⑯ Preparation of seedlings for supplementary planting
- Nursing by wildings
  - (1) Compost production
  - (2) Soil gathering
  - (3) Preparation of pot soil
  - (4) Potting of soil
  - (5) Arrangement of pots
  - (6) Collecting and transplanting of wildings
  - (7) Watering
  - (8) Shading
  - (9) Insecticticide spraying
  - (10) Weeding and removal of seedlings damaged by disease or insects
  - (11) Selection and shipment of seedlings
  - (12) Preparation of seedlings for supplementary planting

Fig. III-5 Nursery Operations Schedule

2. Native species for artificial regeneration

Table III-11 Annual Seedling Production Plan - State Land Model Zone

1. *A.mangium*

Proposed Area	2,115 ha (in 9 years)
Annual Area	235 ha/yr
No. of Seedlings per ha	1,719

	1	2	3	4	5	6	7	8	(Year)
Annual Area	235	235	235	235	235	235	235	235	(ha)
No. of necessary seedlings	403,965	403,965	403,965	403,965	403,965	403,965	403,965	403,965	(No.)
	9	10	11	12	13	14	15	16	
Annual Area	235	235	235	235	235	235	235	235	
No. of necessary seedlings	403,965	403,965	403,965	403,965	403,965	403,965	403,965	403,965	
	17	18	19	20	21	22	23	24	Total
Annual Area	235	235	235	235	235	235	235	235	5,640
No. of necessary seedlings	403,965	403,965	403,965	403,965	403,965	403,965	403,965	403,965	9,695,160

2. *P. falcataria*

Proposed Area	276 ha (in 12 years)
Annual Area	23 ha/yr
No. of Seedlings per ha	1,145

	1	2	3	4	5	6	7	8	(Year)
Annual Area	23	23	23	23	23	23	23	23	(ha)
No. of necessary seedlings	26,335	26,335	26,335	26,335	26,335	26,335	26,335	26,335	(No.)
	9	10	11	12	13	14	15	16	
Annual Area	23	23	23	23	23	23	23	23	
No. of necessary seedlings	26,335	26,335	26,335	26,335	26,335	26,335	26,335	26,335	
	17	18	19	20	21	22	23	24	Total
Annual Area	23	23	23	23	23	23	23	23	552
No. of necessary seedlings	26,335	26,335	26,335	26,335	26,335	26,335	26,335	26,335	632,040

3. Artificial Regeneration

Proposed Area	235 ha (in 24 years)
Annual Area	17 ha/yr (1-23rd year), 7 ha (24th year)
No. of Seedlings per ha	229

	1	2	3	4	5	6	7	8	(Year)
Annual Area	17	17	17	17	17	17	17	17	(ha)
No. of necessary seedlings	3,893	3,893	3,893	3,893	3,893	3,893	3,893	3,893	(No.)
	9	10	11	12	13	14	15	16	
Annual Area	17	17	17	17	17	17	17	17	
No. of necessary seedlings	3,893	3,893	3,893	3,893	3,893	3,893	3,893	3,893	
	17	18	19	20	21	22	23	24	Total
Annual Area	17	17	17	17	17	17	17	7	398
No. of necessary seedlings	3,893	3,893	3,893	3,893	3,893	3,893	3,893	1,603	89,539

Table III-12 Annual Seedling Production Plan - Total Area

1. *A. mangium*
   Proposed Area 6,690 ha
   Annual Area 743 ha/yr (746 ha in 9th year)
   No. of Seedlings per ha 1,719

	1	2	3	4	5	6	7	8	(Year)
Annual Area	743	743	743	743	743	743	743	743	(ha)
No. of necessary seedlings	1,277.2	1,277.2	1,277.2	1,277.2	1,277.2	1,277.2	1,277.2	1,277.2	('000)
	9	10	11	12	13	14	15	16	
Annual Area	746	743	743	743	743	743	743	743	
No. of necessary seedlings	1,282.4	1,277.2	1,277.2	1,277.2	1,277.2	1,277.2	1,277.2	1,277.2	
	17	18	19	20	21	22	23	24	Total
Annual Area	743	746	743	743	743	743	743	743	17,838
No. of necessary seedlings	1,277.2	1,282.4	1,277.2	1,277.2	1,277.2	1,277.2	1,277.2	1,277.2	30,663.2

2. *P. falcataria*
   Proposed Area 870 ha
   Annual Area 72 ha up to 6th year; 73 ha from 7th to 12th year)
   No. of Seedlings per ha 1,145

	1	2	3	4	5	6	7	8	(Year)
Annual Area	72	72	72	72	72	72	73	73	(ha)
No. of necessary seedlings	82.4	82.4	82.4	82.4	82.4	82.4	83.6	83.6	('000)
	9	10	11	12	13	14	15	16	
Annual Area	73	73	73	73	72	72	72	72	
No. of necessary seedlings	83.6	83.6	83.6	83.6	82.4	82.4	82.4	82.4	
	17	18	19	20	21	22	23	24	Total
Annual Area	72	72	73	73	73	73	73	73	1,740
No. of necessary seedlings	82.4	82.4	83.6	83.6	83.6	83.6	83.6	83.6	1,992.3

3. Artificial Regeneration

Proposed Area	2,400 ha
Annual Area	100 ha
No. of Seedlings per ha	229

	1	2	3	4	5	6	7	8	(Year)
Annual Area	100	100	100	100	100	100	100	100	(ha)
No. of necessary seedlings	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	('000)
	9	10	11	12	13	14	15	16	
Annual Area	100	100	100	100	100	100	100	100	
No. of necessary seedlings	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	
	17	18	19	20	21	22	23	24	Total
Annual Area	100	100	100	100	100	100	100	100	2,400
No. of necessary seedlings	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	549.6

5) Manpower Requirement

The manpower for seedling production, which will be basically on a contract basis, will be supplied by local residents. Because nursery operations are generally performed by women, this will create jobs for women in the local community, who have so far had few jobs available but farming. For calculating the required manpower and costs, the standard process table of nursery practice have been prepared (Attachment 30). Based on this, the manpower necessary for seedling production was calculated as follows:

- Required manpower for the State Land Model Zone

To produce 1,000 seedlings of *A. mangium* or *P. falcataria*, 7.02 man-days are necessary. Because the number of seedlings to be produced annually in the model zone is 430,300 in total (403,965 for *A. mangium* and 26,335 for *P. falcataria*), the required man-days will be:

403,300 ÷ 1,000 x 7.02 = 3,020.7 man-days.

To produce 1,000 seedlings for artificial regeneration, 15.63 man-days are necessary. In the Model Zone, the number of seedlings to be produced annually will be 3,893 from the first to 23rd year and 1,603 for the 24th year. The required man-days per year will be:

3,893 ÷ 1,000 x 15.63 = 60.8 man-days (1st to 23rd year)
and
1,603 ÷ 1,000 x 15.63 = 25.1man-days (24th year)

Therefore, the model zone will require 3,082 man-days from the first to 23rd year and 3,046 man-days for the 24th year. This manpower will be provided by local residents (Table III-13 (1)).

- Required manpower for the Total Area

Based on the seedling production plan for the total area, the manpower required to produce seedlings for the study area was calculated as shown in Table III-13 (2).

Table III-13 Manpower Required at Nurseries
(1) State Land Model Zone

Year	1～23	24
Seedling production (No.)		
A. mangium	Annually 403,965	403,965
P. falcataria	26,375	26,375
① Total	430,300	430,300
② Artificial regeneration	3,893	1,603
Man-days for ① (man-days)	Annually 3,021	3,021
Man-days for ② (man-days)	61	25
Total (man-days)	3,082	3,046

(2) Total Area

Unit: 1,000 man-days

Year	1～6	7～8	9	10～12	13～17	18	19～24
Seedling production (No.)							
A. mangium	1,277,217	1,277,217	1,282,374	1,277,217	1,277,217	1,282,374	1,277,217
P. falcataria	82,440	83,575	83,575	83,575	82,440	82,440	83,575
① Total	1,359,657	1,365,949	1,360,792	1,359,657	1,364,657	1,364,814	1,360,792
② Artificial regeneration	22,900	22,900	22,900	22,900	22,900	22,900	22,900
Man-days for ①(man-days)	9.5	9.6	9.6	9.6	9.5	9.6	9.6
Man-days for ②(man-days)	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Total (man-days)	9.9	10.0	10.0	10.0	9.9	10.0	10 0

In this way, nursery operations in the entire study area are expected to create jobs for about 10,000 man-days.

6) Seedling Production Cost

All the seedlings necessary for the forestation plan will be provided through subcontract. Thus, the cost of seedling production will be the purchase price of seedlings produced that way. The standard price will be RM0.28 per seedling, the price at which SAFODA has so far purchased seedlings. This includes RM0.04 for transporting seedlings from the nurseries to the planting sites. Adding the cost of setting up new nurseries by tractors to the standard price, the purchase price per seedling will be RM0.30 in this plan. Although SAFODA has never purchased seedlings of *P. falcataria*, the purchase price of seedlings of this species is assumed to be that of *A. mangium*. This is because *A. mangium* and *P. falcataria* are similar in many respects: the number of seeds per kilogram (40,000～70,000 for *A. mangium* and 40,900～50,000 for *P. falcataria*), the purchase price, and the nursing period until the planting season. The purchase price of a seedling for artificial regeneration will be RM1.05 based on the experimental data of JICA Project[1], The Multi-Storied Forest Management Project in Malaysia.

[1] 5-Year Report (1991-1996) on The Multi-Storied Forest Management Project in Malaysia (1996), Page 82.

The number of required seedlings per hectare of planting area will be as follows after taking into account the supplementary planting rate of 10%

A. mangium:	Planting No.	1,250/ha
	Required No.	1,250 x 1.1 = 1,375/ha
P. falcataria:	Planting No.	833/ha
	Required No.	833 x 1.1 = 916/ha
Artificial regeneration:	Planting No.	146/ha
	Required No.	146 x 1.1 = 161/ha

As shown in Table III-14, the cost of seedling production is obtained by using the seedling price, the required number of seedlings per hectare and the yearly planting area (Table III-5, 6).

Table III-14 Seedling Production Cost
1) State Land Model Zone

1. *A. mangium*
Proposed Area 2,115 ha
Annual Area 235 ha
No. of Seedlings per ha 1,375

Year	1	2	3	4	5	6	7	8	
Annual Area (ha)	235	235	235	235	235	235	235	235	
No. of necessary seedlings ('000)	323.1	323.1	323.1	323.1	323.1	323.1	323.1	323.1	
Production Cost (RM 1,000)	96.9	96.9	96.9	96.9	96.9	96.9	96.9	96.9	
Year	9	10	11	12	13	14	15	16	
Annual Area (ha)	235	235	235	235	235	235	235	235	
No. of necessary seedlings ('000)	323.1	323.1	323.1	323.1	323.1	323.1	323.1	323.1	
Production Cost (RM 1,000)	96.9	96.9	96.9	96.9	96.9	96.9	96.9	96.9	
Year	17	18	19	20	21	22	23	24	Total
Annual Area (ha)	235	235	235	235	235	235	235	235	5,640
No. of necessary seedlings ('000)	323.1	323.1	323.1	323.1	323.1	323.1	323.1	323.1	7,754.4
Production Cost (RM 1,000)	96.9	96.9	96.9	96.9	96.9	96.9	96.9	96.9	2,325.6

2. *P. falcataria*
Proposed Area 276 ha
Annual Area 23 ha
No. of Seedlings per ha 916

Year	1	2	3	4	5	6	7	8	
Annual Area (ha)	23	23	23	23	23	23	23	23	
No. of necessary seedlings ('000)	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	
Production Cost (RM 1,000)	6.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	
Year	9	10	11	12	13	14	15	16	
Annual Area (ha)	23	23	23	23	23	23	23	23	
No. of necessary seedlings ('000)	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	
Production Cost (RM 1,000)	6.3	6.3	6.3	6.3	6.3	6.3	6 3	6.3	
Year	17	18	19	20	21	22	23	24	Total
Annual Area (ha)	23	23	23	23	23	23	23	23	552
No. of necessary seedlings ('000)	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	506.4
Production Cost (RM 1,000)	6.3	6.3	6.3	6 3	6.3	6.3	6.3	6.3	151.2

3. Total (*A. mangium* + *P. falcataria*)
Proposed Area 2,391 ha

Year	1	2	3	4	5	6	7	8	
Annual Area (ha)	258	258	258	258	258	258	258	258	
No. of necessary seedlings ('000)	344.2	344 2	344 2	344 2	344.2	344.2	344.2	344 2	
Production Cost (RM 1,000)	103.3	103.3	103 3	103.3	103.3	103.3	103.3	103.3	
Year	9	10	11	12	13	14	15	16	
Annual Area (ha)	258	258	258	258	258	258	258	258	
No. of necessary seedlings ('000)	344.2	344.2	344.2	344.2	344.2	344.2	344.2	344.2	
Production Cost (RM 1,000)	103.3	103.3	103.3	103.3	103 3	103.3	103.3	103.3	
Year	17	18	19	20	21	22	23	24	Total
Annual Area (ha)	258	258	258	258	258	258	258	258	6,192.0
No. of necessary seedlings ('000)	344.2	344 2	344.2	344.2	344.2	344.2	344.2	344.2	8,260.6
Production Cost (RM 1,000)	103.3	103.3	103.3	103.3	103.3	103.3	103.3	103.3	2,478.2

4. Artificial Regeneration

Proposed Area 329 ha

Annual Area 14 ha/yr (7 ha in 24th year))

No. of Seedlings per ha 161

Year	1	2	3	4	5	6	7	8	
Annual Area (ha)	14	14	14	14	14	14	14	14	
No. of necessary seedlings('000)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	
Production Cost (RM 1,000)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Year	9	10	11	12	13	14	15	16	
Annual Area (ha)	14	14	14	14	14	14	14	14	
No. of necessary seedlings ('000)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	
Production Cost (RM 1,000)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	
Year	17	18	19	20	21	22	23	24	Total
Annual Area (ha)	14	14	14	14	14	14	14	7	329
No. of necessary seedlings ('000)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	1.1	54.0
Production Cost (RM 1,000)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	1.2	56.4

Table III-14 Seedling Production Cost
2) Total Area

1. *A. mangium*

Proposed Area 6,690 ha (746 ha in 9th year)
Annual Area 743 ha
No. of Seedlings per ha 1,375

Year	1	2	3	4	5	6	7	8	
Annual Area (ha)	743	743	743	743	743	743	743	743	
No. of necessary seedlings ('000)	1,021.6	1,021.6	1,021.6	1,021.6	1,021.6	1,021.6	1,021.6	1,021.6	
Production Cost (RM 1,000)	306.5	306.5	306.5	306.5	306.5	306.5	306.5	306.5	
Year	9	10	11	12	13	14	15	16	
Annual Area (ha)	746	743	743	743	743	743	743	743	
No. of necessary seedlings ('000)	1,025.8	1,021.6	1,021.6	1,021.6	1,021.6	1,021.6	1,021.6	1,021.6	
Production Cost (RM 1,000)	307.7	306 5	306.5	306.5	306.5	306.5	306.5	306.5	
Year	17	18	19	20	21	22	23	24	Total
Annual Area (ha)	743	746	743	743	743	743	743	743	17,838
No. of necessary seedlings ('000)	1,021.6	1,025.8	1,021.6	1,021.6	1,021.6	1,021.6	1,021.6	1,021.6	24,527.3
Production Cost (RM 1,000)	306.5	307.7	306.5	306.5	306.5	306.5	306 5	306.5	7,358.2

2 *P. falcataria*

Proposed Area 870 ha
Annual Area 72 ha up to 6th year; 73 ha 7th to 12th year
No. of Seedlings per ha 916

Year	1	2	3	4	5	6	7	8	
Annual Area (ha)	72	72	72	72	72	72	73	73	
No. of necessary seedlings ('000)	66.0	66.0	66.0	66.0	66.0	66.0	66.9	66.9	
Production Cost (RM 1,000)	19.8	19.8	19.8	19.8	19.8	19.8	20.1	20.0	
Year	9	10	11	12	13	14	15	16	
Annual Area (ha)	73	73	73	73	72	72	72	72	
No. of necessary seedlings ('000)	66.9	66.9	66.9	66.9	66.0	66.0	66.0	66.0	
Production Cost (RM 1,000)	20.1	20.1	20.1	20.1	19.8	19.8	19.8	19.8	
Year	17	18	19	20	21	22	23	24	Total
Annual Area (ha)	72	72	73	73	73	73	73	73	1,740
No. of necessary seedlings ('000)	66.0	66.0	66.9	66.9	66.9	66.9	66.9	66.9	1,593.8
Production Cost (RM 1,000)	19.8	19.8	20.1	20.1	20.1	20.1	20.1	20.1	478.2

3. Total (*A. mangium* + *P. falcataria*)
Proposed Area 7,560 ha

Year	1	2	3	4	5	6	7	8	
Annual Area (ha)	815	815	815	815	815	815	816	816	
No. of necessary seedlings ('000)	1,087.6	1,087.6	1,087.6	1,087.6	1,087.6	1,087.6	1,088.5	1,088.5	
Production Cost (RM 1,000)	326.3	326.3	326.3	326.3	326.3	326.3	326.5	326.5	
Year	9	10	11	12	13	14	15	16	
Annual Area (ha)	819	816	816	816	815	815	815	815	
No. of necessary seedlings ('000)	1,092.6	1,088.5	1,088.5	1,088.5	1,087.6	1,087.6	1,087.6	1,087.6	
Production Cost (RM 1,000)	327.8	326.5	326.5	326.5	326.3	326.3	326.3	326.3	
Year	17	18	19	20	21	22	23	24	Total
Annual Area (ha)	815	818	816	816	816	816	816	816	19,578.0
No. of necessary seedlings ('000)	1,087.6	1,091.7	1,088.5	1,088.5	1,088.5	1,088.5	1,088.5	1,088.5	26,121.1
Production Cost (RM 1,000)	326.3	327.5	326.5	326.5	326.5	326.5	326.5	326.5	7,836.3

4. Artificial Regeneration
Proposed Area 2,400 ha
Annual Area 100 ha/yr (7ha in 24th year)
No. of Seedlings per ha 161

Year	1	2	3	4	5	6	7	8	
Annual Area (ha)	100	100	100	100	100	100	100	100	
No. of necessary seedlings ('000)	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	
Production Cost (RM 1,000)	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	
Year	9	10	11	12	13	14	15	16	
Annual Area (ha)	100	100	100	100	100	100	100	100	
No. of necessary seedlings ('000)	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	
Production Cost (RM 1,000)	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	
Year	17	18	19	20	21	22	23	24	Total
Annual Area (ha)	100	100	100	100	100	100	100	100	2,400
No. of necessary seedlings ('000)	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	386.4
Production Cost (RM 1,000)	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	405.6

2-2-3 Forestry Infrastructure

1) Forest Roads

(1) Basic Ideas of the Forest Road Plan

Forest roads play a central role in forest management and are an important part of forest infrastructure. A forest road plan should be formulated from the view point of forest management and according to the situation in the field. A forest road network and structural standards of a forest road depend on the scale of the logging and the acreage of the target forests.
If a survey covers a forestation plan, as this study does, the efficiency of forestation activities should be considered. It should be noted that timber produced from artificial forests tends to be small in diameter and the selling price tends to be low. Thus, it is difficult to procure a large amount of money. The greater the forest road density, the more efficient are forestation and logging operation. However, high road density will raise the possibility of sediment discharge and mountain landslides associated with forest road construction. It will also require more investment.
In the study area, there are many roads used for past logging operations. The forest road plan should primarily try to make the best use of these existing roads. The construction of new roads should be minimized in terms of watershed conservation.
In arrangement of forest roads, it should be considered to make access possible throughout the proposed areas for forestation and at the same time to provide access in the alienated lands to contribute to improvement of local communities.

(2) Construction Standards for Forest Roads

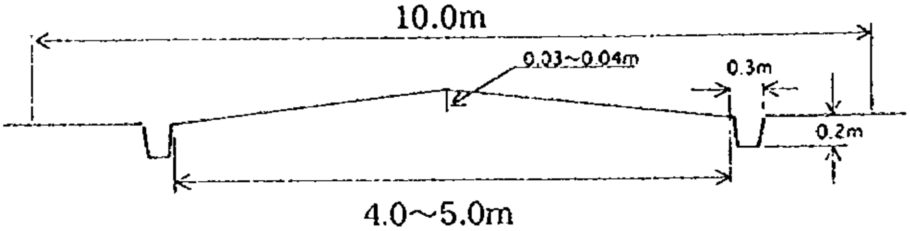
In this region, there are no construction standards for forest roads (Forest Management Department, SAFODA). At present, forest roads are constructed according to the conditions of the specific area. As a guideline for the construction and improvement of forest roads, standards have been established based on the condition of the area as follows. Because these standards cannot always be applied to the existing roads, it is necessary to be flexible in applying the standards depending on the situation in the field.

- Forest Road Standards

	Curve radius	Gradient	Effective width	Cleared width
Main	15.0 m	10～12%	4.0～5.0 m	10 m
Branch	10.0	13～15	3.6～4.0	4

- Roadway diagraph
Cutting slope: should be suitable for the soil in the field (prevention of landslides)

Banking slope: do. (prevention of washouts)



	cross-fall
New construction/improvement (main)	1.5~1.6%
New construction/improvement (branch)	1.5~1.6%

(3) Forest Road Plan

The plan for the forest road network in the Model Area has been worked out based on the results of a field survey on the proposed forestation area and on the location of existing roads within the Model Area. In formulating the forest road network plan, attention has been paid to: use of existing roads; even distribution of roads; and construction of roads in the upper part of the slopes for easier (downhill) transportation of seedlings. Table III-15 shows the forest road plan in the Model Area.

Table III-15 Forest Road Plan in Model Area

Unit: km

Zone	Existing roads	New construction			Total
		Main	Branch	Subtotal	
Re-afforestation area	28.2	6.2	38.2	44.4	72.6
Enrichment Planting	8.2				8.2
Alienated land	7.6				7.6
Total	44.0	6.2	38.2	44.4	88.4

The acreage of the Model Area is 3,209 ha in total: 2,880 ha of re-afforestation area and 329 ha of enrichment planning. Based on this, the forest road extension (density) per hectare is as follows:

Re-afforestation area:	new construction (main)	2.2 m	
	(branch)	13.3 m	
	existing roads	9.8 m	Sub-total 25.3 m
Enrichment planting:	existing roads	24.9 m	

Although it will be drawn up based on the annual forestation plan, the forest road plan will be implemented one year ahead of the forestation operation. The annual plan for new construction and improvement of forest roads has been worked out according to the annual forestation area based on the forest road density mentioned above. Note that the improvement of the existing roads will be carried out by 60% of the road density. The forest road plan for total area is shown in Table III-16 (2). Existing roads will be improved. Construction of new forest roads and the improvement of existing roads in the re-afforestation area will be completed in nine years to coincide with the forestation operation. Also in the artificial regeneration area, improvement work will be conducted every year in accordance with the operation plan. Maintenance of forest roads will be carried out for three years to care the reforested areas after the new construction and improvement work have been completed.

The new construction and improvement of forest roads will also require the construction of bridges/overflow bridges. Based on the results of a field survey in the Model Area, these bridges will be constructed according to the following standard:

Bridge:	one for every 14 km
Overflow bridge:	one for every 45.5 km

Because about 28 km of new forest roads will be constructed (or existing roads improved) annually, two bridges will be built every year, with one overflow bridge constructed every two years (Table III-16 (2)). The span of a bridge will be 10-15 m depending on the actual condition. A bridge will be made of wood and will be replaced every ten years. An overflow bridge will be about 100 m long in the Model Area and 15 m long in other areas. Because an overflow bridge will be made of concrete, its replacement has not been planned.

Table III-16 Annual Forest Road Plan — (I)

— State Land Model Zone —

Year			0	1	2	3	4	5	6
Forestation Area									
(A) Re-afforestation		(ha)		320	320	320	320	320	320
(B) Enrichment planting		(ha)		14	14	14	14	14	14
Forest Road									
New construction	Main-(A)	(km)	0.7	0.7	0.7	0.7	0.7	0.7	0.7
	Branch-(B)	(km)	4.3	4.3	4.3	4.3	4.3	4 3	4.3
Improvement	(A)	(km)	3.1	3.1	3.1	3.1	3.1	3.1	3.1
	(B)	(km)	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Total		(km)	8.5	8.5	8.5	8 5	8.5	8.5	8.5
Repair		(km)		8.5	17.0	25.5	25.5	25.5	25.5
Bridge		(No.)			1				
Overflow bridge		(No.)			1				

Year			7	8	9	10	11～24	Total
Forestation Area								
(A) Re-afforestation		(ha)	320	320	320	320	Same as the left.	7.680
(B) Enrichment planting		(ha)	14	14	14	14	Same as the left.	329
Forest Road								
New construction	Main-(A)	(km)	0.7	0.6	0	0	Same as the left.	6.2
	Branch-(B)	(km)	4.3	3.8	0	0	Same as the left.	38.2
Improvement	(A)	(km)	3.1	3.4	0	0	Same as the left.	28 2
	(B)	(km)	0.4	0.4	0.4	0.4	0.3 (11th～22nd yr), 0 2 (23rd yr)	8.2
Total		(km)	8.5	8.2	0.4	0.4	0.3 (11th～22nd yr), 0.2 (23rd yr)	80.8
Repair		(km)	25.5	25.2	25.2	25.2	25.5 (25.2 for 17th～19th yr)	-
Bridge		(No.)		1			3	5
Overflow bridge		(No.)					0	1

Table III-16 Annual Forest Road Plan — (2)
— Total Area —

Year			0	1	2	3	4	5	6
Forestation Area									
(A) Re-afforestation		(ha)		1,012	1,012	1,012	1,012	1,012	1,012
(B) Enrichment planting		(ha)		100	100	100	100	100	100
Forest Road									
New construction	Main-(A)	(km)	2.2	2.2	2.2	2.2	2.2	2.2	2.2
	Branch-(B)	(km)	13.5	13.5	13.5	13.5	13.5	13.5	13.5
Improvement	(A)	(km)	9.9	9.9	9.9	9.9	9.9	9.9	9.9
	(B)	(km)	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total		(km)	28.1	28.1	28.1	28.1	28.1	28.1	28.1
Repair		(km)		28.1	56.2	84.3	84.3	84.3	84.3
Bridge		(No.)	2	2	2	2	2	2	2
Overflow bridge		(No.)			1		1		1

Year			7	8	9	10	11~24	Total
Forestation Area								
(A) Re-afforestation		(ha)	1,102	1,012	1,012	1,012	Same as the left.	25,300
(B) Enrichment planting		(ha)	100	100	100	100	Same as the left.	2,400
Forest Road								
New construction	Main-(A)	(km)	2.2	2	0	0	0	19.8
	Branch-(B)	(km)	13.5	13	0	0	0	121.5
Improvement	(A)	(km)	9.9	9	0	0	0	89.1
	(B)	(km)	2.5	2	2.5	2.5	Same as the left.	62.5
Total		(km)	28.1	28	2.5	2.5	Same as the left	292.9
Repair		(km)	84.3	84	84.3	84.3	Same as the left	-
Bridge		(No.)	2	2	2	2	Same as the left	50
Overflow bridge		(No.)		1		1	0	5

(4) Manpower Requirement

Because the new construction and improvement of forest roads will be subcontracted, in principle, the project body will not directly create jobs for local residents. However, it is possible to create jobs for unskilled workers indirectly if the subcontractors will hire them.

The project body will hire workers for surveying (several polemen and brush cutting workers) and repair work. The repair of forest roads is expected to create jobs almost throughout the year from the start of the work.

Manpower necessary for the project body is shown in Table III-17.

Table III-17 Manpower Required for Forest Road Operations

Unit: 1,000 man-days

Year	0	1	2	3	4~5
Surveying	(0.3) 1	(0.3) 1	(0.3) 1	(0.3) 1	Same as the left
Repair of forest roads		(0.2) 1	(0.5) 1.8	(0.7) 2.7	Same as the left
Total	(0.3) 1	(0.5) 2	(0.8) 2.8	(1.0) 3.7	Same as the left

Note: "Repair of forest roads" is calculated based on the premise that one worker is required for every 5 km and that the annual operation days will be 160. Figures in parentheses indicate man-days for the Model Area.

2) Other Related Facilities

(1) Buildings and other facilities

The following facilities will be necessary for the implementation of the large-scale forestation plan:

Office building:	1		
Warehouse:	1		
Garage:	1		
Housing for staff:	9	(breakdown) Manager:	(1)
		Assistant Manager:	(2)
		Field Assistant:	(6)
Lookout Tower:	4	(made of basic concrete and steel frame)	

(2) Building construction plan

Buildings will be constructed during the first year of operations. One lookout tower will be constructed on each parcel (four towers in total); one on Parcel A (within the Model Area) in the third year of the forestation operation, and one in another area every two years after that (Table III-21).
Vehicles are also essential at each section for smooth implementation of this project. The numbers and types of vehicles to be distributed among sections will be as follows:

Project Manager
4WD (land cruiser type): 1

Planting Division
Small trucks (pickup type) will be used for various purposes.
1 Assistant Manager (2 from 6th year): 1 truck (2 from 6th year)
3 Field Assistants (6 from 6th year): 3 trucks (6 from 6th year)
Agricultural tractors will be used for transporting workers and seedlings to the field.
4 Tractor Drivers: 4 tractors

Roads Division
A small truck (pickup type) will be used for maintenance of forest roads.
1 Field Assistant (2 from 6th year): 1 truck (2 from 6th year)

Forest Control Division
A truck (pickup type) will be used for patrolling for fire control and when a fire breaks out.
1 Field Assistant: 1 truck

Harvesting Division
Although contractors will be in charge of the actual operations, a small truck (pickup type) will be needed for supervision.
1 Assistant Manager (from 10th year of harvest): 1 truck
1 Field Assistant (from 10th year of harvest; 2 from 15th year):
1 truck (2 from 15th year)

Community Liaison and P.T.F. Division

A small truck (pickup type) will be used for the promotion of private tree farming among the local residents and for other purposes.

1 Assistant Manager:	1 truck

Transportation Division

A 3-ton capacity truck will be used for consolidated transportation.

2 Drivers:	2 trucks

The total number of each type of vehicle is:

4WD:	1
Small truck (pickup):	7 (1st year [of the project])
	12 (from 6th year)
	14 (from 10th year)
	15 (from 15th year)
Agricultural tractor:	4
Truck:	2

All these vehicles will be used for eight years based on previous experience; new vehicles will be purchased in the 9th year. The vehicle purchase plan is shown in Table III-18.

Table III-18 Vehicle Purchase Plan

Organization		Vehicle			Year																							
Section	Title	Number	Type	Remarks	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Project	Project Manager (Plantation Manager)	1	Land Cruiser		1								1								1							
Plantation	Plantation Assistant Manager	1/2	Toyota Pickup	after 6 year 2 units	1					1			1					1			1					1		
	Plantation Field Assistant	3/6	Toyota Pickup	after 6 year 6 units	3					3			3					3			3					3		
Road	KUBOTA Driver	4	KUBOTA Tractor		4								4								4							
	Road Field Assistant	1/2	Toyota Pickup	after 6 year 2 units	1					1			1					1			1					1		
Fire Control	Fire Control Field Assistant	1	Toyota Pickup		1								1								1							
Harvesting	Harvesting Assistant Manager	1	Toyota Pickup	after 10 year										1								1						
	Harvesting Field Assistant	1/2	Toyota Pickup	after 15 year 2 units										1					1			1					1	
Community Development and Private Tree Farm	Community Dev. Assistant Manager	1	Toyota Pickup		1								1								1							
Transportation	Driver	2	LORRY	for plantation	2								2								2							
Total		16/22			14					5			14	2				5	1		14	2				5	1	

3) Cost of Forestry Infrastructure

(1) Forest Roads

Although new construction and improvement of forest roads will be subcontracted, other works will be carried out directly by the project body. The unit price of the subcontracted construction has been calculated based on a daily construction cost by machine of MR 547.3/day (see Attachment 32). Table III-19 shows the unit price by type of construction.

Table III-19 Unit Cost by Type of Work

Type	Effective width (m)	Cleared width (m)	Manpower (man-day)	Construction cost per meter (RM)
New construction (main)	4.0~5.0	10	30	18.2
(branch)	3.6~4.0	4	50	10.9
Improvement of existing roads	3.6~5.0	4~10	70	7.8
Repair work	10% of the average cost of new construction			1.5

Note: New construction and improvement include simple land works such as culverts and drainage ditches; a passing place will be constructed every 300 m

Based on the unit price by type of construction, the cost of the forest roads has been calculated as shown in Table III-20. Note that the costs of bridges and overflow bridges have been calculated based on the following unit prices:

Bridge:	span	10 m	RM	10,000
		15 m	RM	15,500
		Average	RM	12,750
Overflow bridge:	within Model Area (one point)		RM	172,800
	Other areas		RM	21,600

(2) Other Related Facilities

The costs of other related facilities such as lookout towers and buildings have been calculated based on the costs that reflect the actual costs in the field; these costs have been decided in the consultation with the counterpart (Table III-21). Regarding the purchase and maintenance costs of vehicles, the unit costs for purchase and maintenance in the vehicle purchase plan (Table III-18) are calculated based on the figures below. Note that the prices are as of February 1997:

4WD:	RM 138,000
Pickup:	RM 73,000
Truck:	RM 59,000
Agricultural Tractor:	RM 82,000

All the vehicles use diesel. The price of diesel is RM 0.8/Liter.

Annual fuel consumption for each type of vehicle is:

4WD:	7,200 liters
Pickup:	9,600 liters
Truck:	14,400 liters
Agricultural Tractor:	9,600 liters

Annual maintenance cost for each type of vehicle is:

4WD:	RM 14,000
Pickup:	RM 7,000
Truck:	RM 6,000
Agricultural Tractor:	RM 20,000

The vehicle costs including their maintenance have been calculated as shown in Table III-22.

Table III-20 Cost of Forest Roads by Year
(1) State Land Model Zone

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
Forest road (km)													
New construction:													
main—re-afforestation	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6				
branch—re-afforestation	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	3.8				
Improvement:													
re-afforestation	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.4				
enrichment	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3
Subtotal	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.2	0.4	0.4	0.3	0.3
Repair		8.5	17.0	25.5	25.5	25.5	25.5	25.5	25.2	25.2	25.2	25.5	25.5
Bridge (No.)			1						1				
Overflow bridge (No.)			1										
Forest road cost (RM 1,000)													
New construction:													
main—re-afforestation	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	10.9				
branch—re-afforestation	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.9	41.4	41.4			
Improvement:													
re-afforestation	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	26.5	26.5			
enrichment	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	2.3	2.3
Repair		12.8	25.5	38.3	38.3	38.3	38.3	38.3	37.8	37.8	37.8	38.3	38.3
Bridge	0.0	0.0	25.5	0.0	0.0	0.0	0.0	0.0	25.5	0.0	0.0	0.0	25.5
Overflow bridge			172.8		21.6		21.6		21.6		21.6		
Total(RM1,000)	86.9	99.7	310.7	125.2	146.8	125.2	146.8	125.2	166.9	40.9	62.5	40.6	66.1

Year	13	14	15	16	17	18	19	20	21	22	23	24	Total
Forest road (km)													
New construction:													
main—re-afforestation													6.2
branch—re-afforestation													38.2
Improvement:													
re-afforestation													28.2
enrichment	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.0	8.2
Subtotal	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.0	80.8
Repair	25.5	25.5	25.5	25.5	25.2	25.2	25.2	25.5	25.5	25.5	25.5	25.5	584.7
Bridge (No.)													2
Overflow bridge (No.)													1
Forest road cost (RM 1,000)													
New construction:													
main—re-afforestation													112.8
branch—re-afforestation													416.4
Improvement:													
re-afforestation													220.0
enrichment	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	1.6	0.0	64.0
Repair	38.3	38.3	38.3	38.3	37.8	37.8	37.8	38.3	38.3	38.3	38.3	38.3	877.1
Bridge	0.0	0.0	0.0	0.0	0.0	25.5	0.0	0.0	0.0	25.5	0.0	0.0	127.5
Overflow bridge													259.2
Total (RM1,000)	40.6	40.6	40.6	40.6	40.1	65.6	40.1	40.6	40.6	66.1	39.8	38.3	2,076.9

Table III-20 Cost of Forest Roads by Year
(2) Total Area

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
Forest road (km)													
New construction:													
main—re-afforestation	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2				
branch—re-afforestation	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5				
Improvement.													
re-afforestation	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9				
enrichment	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Subtotal	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	2.5	2.5	2.5	2.5
Repair		28.1	56.2	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3
Bridge (No.)	2	2	2	2	2	2	2	2	2	2	2	2	2
Overflow bridge (No.)			1		1		1		1		1		
Forest road cost (RM 1,000)													
New construction:													
main—re-afforestation	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0				
branch—re-afforestation	147.2	147.2	147.2	147.2	147.2	147.2	147.2	147.2	147.2				
Improvement:													
re-afforestation	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2				
enrichment	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5
Repair		42.2	84.3	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5
Bridge	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
Overflow bridge			172.8		21.6		21.6		21.6		21.6		
Total(RM1,000)	334.9	377.1	592.0	461.4	483.0	461.4	483.0	461.4	483.0	197.0	218.6	197.0	197.0

Year	13	14	15	16	17	18	19	20	21	22	23	24	Total
Forest road (km)													19.8
New construction:													
main—re-afforestation													
branch—re-afforestation													121.5
Improvement:													89.1
re-afforestation													
enrichment	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	62.5
Subtotal	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	292.9
Repair	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	84.3	1,938.9
Bridge (No.)	2	2	2	2	2	2	2	2	2	2	2	2	50
Overflow bridge (No.)													5
Forest road cost (RM 1,000)													360.4
New construction:													
main—re-afforestation													
branch—re-afforestation													1,324.4
Improvement:													695.0
afforestation													
enrichment	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	487.5
Repair	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	126.5	2,908.4
Bridge	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	1,275.0
Overflow bridge													259.2
Total(RM1,000)	197.0	197.0	197.0	197.0	197.0	197.0	197.0	197.0	197.0	197.0	197.0	197.0	7,309.7

Table III-21 Buildings and Other Facilities

Unit: RM 1,000

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
Lookout towers				16.1		16.1		16.1		16.1			
Housing buildings (9)	450.0												
Office building: (1)	60.0												
Warehouse: (1)	30.0												
Garage: (1)	20.0												
Other*	3.0	3.0	3.0	40.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Total	563.0	3.0	3.0	56.1	3.0	19.1	3.0	19.1	3.0	19.1	3.0	3.0	3.0

Year	13	14	15	16	17	18	19	20	21	22	23	24	Total
Lookout towers													64.4
Housing buildings (9)													450.0
Office building: (1)													60.0
Warehouse: (1)													30.0
Garage: (1)													20.0
Other*	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	112.0
Total	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	736.4

* "Other" includes equipment for the prevention of forest fires, surveying instruments, etc. The third year includes radio apparatus.

Table III-22 Vehicle Cost/Maintenance Cost

1) Basis for Calculation

Section	4WD	Pickup			Lorry	Tractor
			from 6yrs			
			Total No.	New Buy		
Project Manager	1					
Plantation		4	8	4	2	4
Road		1	2	1		
Fire Control		1	1			
Harvesting		2	0	3 (after 15yrs)		
Community		1	1			
Total	1	9	12	8	2	4

Unit Price RM1000	138.0	73.0	73.0	73.0	59.0	82.0
Total Vehicle Cost RM1000	138.0	511.0	876.0	365.0	118.0	328.0
Fuel Month liter	600.0	800.0	800.0		1200.0	800.0
Fuel (L)/year	7200.0	9600.0	9600.0		14400.0	9600.0
Fuel Cost/year RM1000 (RM0.8/L)	5.8	53.8	92.2		23.0	30.7
Maintenance/year RM1000	14.0	7.0	7.0		6.0	6.0
Total Maintenance RM1000	14.0	49.0	84.0		12.0	80.0
TOTAL COST	157.8	613.8	1052.0		153.0	438.7

2) Costs by Year

Unit: RM 1,000

Type	Year	1	2	3	4	5	6	7	8	9	10	11	12
4WD	PRICE	138.0								138.0			
	FUEL	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
	MAINTENANCE	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Pickup	PRICE	511.0					365.0			511.0	146.0		
	FUEL	53.8	53.8	53.8	53.8	53.8	92.2	92.2	92.2	92.2	107.5	107.5	107.5
	MAINTENANCE	49.0	49.0	49.0	49.0	49.0	84.0	84.0	84.0	84.0	98.0	98.0	98.0
Lorry	PRICE	118.0								118.0			
	FUEL	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
	MAINTENANCE	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Tractor	PRICE	328.0								328.0			
	FUEL	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7
	MAINTENANCE	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
TOTAL		1,363.3	268.3	268.3	268.3	268.3	706.7	341.7	341.7	1,436.7	517.0	371.0	371.0
Total Cost	PRICE	1,095.0	0.0	0.0	0.0	0.0	365.0	0.0	0.0	1,095.0	146.0	0.0	0.0
	FUEL	113.3	113.3	113.3	113.3	113.3	151.7	151.7	151.7	151.7	167.0	167.0	167.0
	MAINTENANCE	155.0	155.0	155.0	155.0	155.0	190.0	190.0	190.0	190.0	204.0	204.0	204.0
TOTAL		1,363.3	268.3	268.3	268.3	268.3	706.7	341.7	341.7	1,436.7	517.0	371.0	371.0

Type	Year	13	14	15	16	17	18	19	20	21	22	23	24
4WD	PRICE					138.0							
	FUEL	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
	MAINTENANCE	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
Pickup	PRICE		365.0	73.0		511.0	146.0						
	FUEL	107.5	107.5	115.2	115.2	115.2	115.2	115.2	115.2	115.2	115.2	115.2	115.2
	MAINTENANCE	98.0	98.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0	105.0
Lorry	PRICE					118.0							
	FUEL	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
	MAINTENANCE	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Tractor	PRICE					328.0							
	FUEL	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7
	MAINTENANCE	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
TOTAL		371.0	736.0	458.7	385.7	1,480.7	531.7	385.7	385.7	385.7	750.7	458.7	385.7
Total Cost	PRICE	0.0	365.0	73.0	0.0	1,095.0	146.0	0.0	0.0	0.0	365.0	73.0	0.0
	FUEL	167.0	167.0	174.7	174.7	174.7	174.7	174.7	174.7	174.7	174.7	174.7	174.7
	MAINTENANCE	204.0	204.0	211.0	211.0	211.0	211.0	211.0	211.0	211.0	211.0	211.0	211.0
TOTAL		371.0	736.0	458.7	385.7	1,480.7	531.7	385.7	385.7	385.7	750.7	458.7	385.7

2-2-4 Forest Fire Prevention

1) Concept of Forest Fire Prevention

The principles of forest fire prevention are not so much based on physical aspects. Of course, once a fire unfortunately breaks out, measures must be taken to minimize the damage. It is more about the mental aspects, i.e., to understand the importance of forests and the use and danger of fire so as not to cause a forest fire in the first place. Forest fire prevention involves two aspects: fire fighting and education.
To prevent fire disasters it is important to handle fire respectfully in everyday life. Local residents know the danger of fires based on their experiences, as the results of socioeconomic surveys show. Yet the fact remains that there is still careless handling of fire which results in fires. Therefore, enlightenment and education of the community must be the major aspects of forest fire prevention (see Chapter 1, 2-6-5 (3)).
The other aspects is effective fire fighting. It is necessary to create a system designed to find a fire and extinguish it as soon as possible and to take effective measures to prevent the spread of a fire.
The plan for forest fire prevention will be worked out based on these two aspects.

2) Plan for Forest Fire Prevention

Based on the results of a field survey in the Model Area, the following has been planned as part of the plan for forest fire prevention:

① The brush cutting on either side of a forest road will be 4～10 m, functioning as a firebreak.
② A protection belt will be established along stream lines, functioning as a firebreak as well as protecting streams and rivers.
③ Lookout towers will be constructed at locations that command a wide view of an area. Two watchmen will be stationed in each tower during the "fire" season when forest fires are more likely to break out. The watchmen will receive training.
④ Patrols will be conducted to raise the awareness of local residents about fire during the "fire" season.
⑤ Forest education will be provided in local schools to teach and enlighten local residents about forest fire prevention.
⑥ Fire brigades will be organized for emergencies in cooperation with the villages.
⑦ Basic fire fighting equipment such as jet shooters will be made available.

Based on this plan, each parcel will implement its plan for forest fire prevention, covering the entire study area.

3) Required Manpower

During the fire season (from February to June), a total of nine workers employed from the local villages will be assigned at basically two workers per parcel (three workers at Parcel B and C combined). The annual employment is as the follow:

Model area:	two workers, 250 man-days
Other areas:	seven workers, 875 man-days
Total:	nine workers, 1,125 man-days

4) Cost for Forest Fire Prevention

The cost for forest fire prevention is included in the column of "other" of Table III-25.

2-2-5 Harvesting

1) Concept of Harvesting

Harvesting of plantation area basically uses the clear cutting method.
It is important that a harvesting plan consider not only the efficiency of cutting operation but the conservation of the natural environment such as watershed conservation and erosion control. For example, it is important to restrict hauling routes to existing roads and to try to avoid constructing spur roads. If a spur road must be constructed, soil erosion should be prevented. Consideration should be also given to the yarding method.
The trees harvested in the plantation have a small diameter, unlike natural forests. Therefore, when the efficiency of harvesting and the soil conservation are taken into account, it is not advisable to introduce large machinery nor to use skidders for hauling trees to spur roads: such large machinery will damage the forest floor. Rather, it is preferable to use the skyline yarder system with the high-lead method that is easy to transfer. Regarding the yarder, lead wires should be installed for efficient transportation in light of the topography of the forestation area and the forest road network. A lead wire should be 200-300 m.
The species to be planted in this forestation plan are *A. mangium* and *P. falcataria*. Their appropriate cutting ages are different due to the difference in growth and use. The cutting age of *A. mangium*, which is mainly used for chips, is nine years, while that of *P. falcataria*, which is used for sawen timber, is twelve years. Therefore, the first years for cutting *A. mangium* and *P. falcataria* trees are the tenth year and thirteenth year, respectively. Gathered trees are bucked according to their use. *A. mangium* logs will be made so that their length fits machines at chip mills. The usual length of *P. falcataria* logs in Sabah is 4.2 m.
The planting areas of the two species are also different. The annual planting area of *A. mangium* is basically 743 ha, but every ninth year, it is 746 ha. The planting area of *P. falcataria* changes from 72 ha to 73 ha or vice versa every six years.
MAI at the cutting season by species, which constitutes the basis for calculating the planned harvest volume, is:

A. mangium 20 m^3/ha/yr.
P. falcataria 22 m^3/ha/yr.

The utilization percentages of *A. mangium* and *P. falcataria* are estimated at 80% and 70%, respectively.
Because the harvesting operation is carried out depending on the trends in supply and demand, the harvesting plan must be formulated accordingly. However, harvesting in this project will be conducted concentrating on the dry season in the view point of conservation of the forest roads and prevention of soil erosion.

Because harvesting requires large funds for machinery and other necessities, contractors will be introduced. The appropriate area for one contractor harvests should be about 50 ha in the harvesting plan. Regarding transportation, trucks with a capacity of 3-5 tons are appropriate. Because spur roads are narrow, large trucks would damage the roads, resulting in high costs for repair work; they would also cause soil erosion.

Logs will be free at the port of shipment or at chip mills depending on the contract with the buyer. The cost of logging is based on the following standard. This standard was decided with reference to a preliminary survey (in Tawau district, 1997). Note that the standard transportation distance per truck is 40 km.

A. mangium: RM25/m^3
P. falcataria: RM23/m^3

2) Harvest Plan

(1) State Land Model Zone

The harvest plan will be formulated based on the annual reforestation plan.
In the model zone, the planting plans for *A. mangium* and *P. falcataria* are 2,115 ha and 276 ha, respectively, with annual planting areas of 235 ha and 23 ha, respectively. Based on these figures and 1) above, the annual harvesting area, log production and the logging cost have been calculated as shown in Table III-23.

Table III-23 Harvesting Plan:
harvesting area, log production, logging cost (State Land Model Zone)

Year	Harvesting area (ha)		Log Production ('000 m^3)		Logging cost (RM1,000)		
	Acacia mangium	*Paraserienthes falcataria*	*Acacia mangium*	*Paraserienthes falcataria*	A.m RM25/m^3	P.f RM23/m^3	Total
9	0	0	0	0	0	0	0
10	235	0	33.8	0	846.0	0.0	846.0
11	235	0	33.8	0	846.0	0.0	846.0
12	235	0	33.8	0	846.0	0.0	846.0
13	235	23	33.8	4.9	846.0	111.7	957.7
14	235	23	33.8	4.9	846.0	111.7	957.7
15	235	23	33.8	4.9	846.0	111.7	957.7
16	235	23	33.8	4.9	846.0	111.7	957.7
17	235	23	33.8	4.9	846.0	111.7	957.7
18	235	23	33.8	4.9	846.0	111.7	957.7
19	235	23	33.8	4.9	846.0	111.7	957.7
20	235	23	33.8	4.9	846.0	111.7	957.7
21	235	23	33.8	4.9	846.0	111.7	957.7
22	235	23	33.8	4.9	846.0	111.7	957.7
23	235	23	33.8	4.9	846.0	111.7	957.7
24	235	23	33.8	4.9	846.0	111.7	957.7

(2) Total Area

In the general forestation plan, the planting areas of *A. mangium* and *P. falcataria* will be 6,690 ha and 870 ha, respectively. The annual planting area of *A. mangium* will be 743 ha, but in every nine year, it will be 746 ha. The annual planting area of *P. falcataria* is 72 ha or 73 ha alternately every six years. In line with this, the harvesting plan will be formulated.
The harvesting area, log production and logging cost have been calculated as shown in Table III-24.

Table III-24 Harvesting Plan:
harvesting area, log production, logging cost (Total Area)

Year	Harvesting area (ha)		Log Production ('000 m^3)		Logging cost (RM1,000)		
	Acacia mangium	*Paraserienthes falcataria*	*Acacia mangium*	*Paraserienthes falcataria*	A.m RM25/m^3	P.f RM23/m^3	Total
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	743.0	0	107.0	0	2,674.8	0.0	2,674.8
11	743.0	0	107.0	0	2,674.8	0.0	2,674.8
12	743.0	0	107.0	0	2,674.8	0.0	2,674.8
13	743.0	72	107.0	12.1	2,674.8	278.2	2,953.0
14	743.0	72	107.0	12.1	2,674.8	278.2	2,953.0
15	743.0	72	107.0	12.1	2,674.8	278.2	2,953.0
16	743.0	72	107.0	12.1	2,674.8	278.2	2,953.0
17	743.0	72	107.0	12.1	2,674.8	278.2	2,953.0
18	743.0	72	107.4	12.1	2,685.6	278.2	2,963.8
19	743.0	72	107.0	12.3	2,674.8	282.1	2,956.9
20	743.0	72	107.0	12.3	2,674.8	282.1	2,956.9
21	743.0	72	107.0	12.3	2,674.8	282.1	2,956.9
22	743.0	72	107.0	12.3	2,674.8	282.1	2,956.9
23	743.0	72	107.0	12.3	2,674.8	282.1	2,956.9
24	743.0	72	107.0	12.3	2,674.8	282.1	2,956.9

Note: The output has been calculated based on estimated utilization percentages of *A. mangium* and *P. falcataria* of 80% and 70%, respectively.

2-2-6 Watershed Conservation

Regarding watershed conservation in the study area, no special structures have been considered. Instead, operations sensitive to watershed conservation have been applied in formulating the forestry development plan. To this end, the following specific operations have been considered:

① Imposing a felling ban in steep-slope areas
② Conserving natural trees along rivers to protect rivers (protection belt)
③ Conserving natural trees along major ridges
④ Implementation of contour weeding in strips
⑤ Application of selective cutting in high altitude regions
⑥ Reducing new forest roads by using old transportation routes
⑦ Construction of forest roads along ridges to reduce cutting volume

2-2-7 Training

1) Concept of Training

Local residents will play a central role in forestation operation. Because forestation activities will be carried out in concert over a wide area, it is necessary to organize working groups as units for these activities by region (parcel). Working groups will carry out activities in a coordinated way under the supervision of group leaders. At present, forestation activities are not common in the study area, with only SAFODA carrying out PTF on a small scale. There seems to be very few people well-trained in forestation activities. Therefore, it is necessary to develop foremen who are experienced in actual forestation work. To this end, training will be provided to teach practical skills in a systematic way.

2) Content of the Training

In line with the content of the project, the following four training courses will be provided.

Forestation operations:	Operations such as: site preparation, planting, temporary storage of seedlings (roadside), transportation of seedlings, weeding, pruning, keeping a work log (14 days).
Nursery operations:	Operations such as: handling seeds, pretreatment to promote germination, seeding, weeding, watering, fertilizer application, hardening, planting, keeping a work log (14 days).
Forest fire prevention:	Patrolling, prevention measures, organizing a fire brigade, fire extinguishing methods, keeping a work log, etc. (10 days)
Maintenance of forest roads:	Familiarization with the road network, formulation of a repair plan, repair methods, maintenance and management of points vulnerable to slides, etc., keeping a work log (10 days)

3) Training Plan

Trainees will be selected from local residents who seem to have what it takes to be leaders. The number of trainees to be selected will be determined in response to the requirements and operation scale of the working group of each area (parcel). Table III-25 shows the breakdown of trainees.

Table III-25 No. of Trainees

Training course	Parcel				Total
	A	B/C	D	E	
Reforestation operations	3	3	2	2	10
Nursery operations	2	3	2	2	9
Forest fire prevention	2	3	2	2	9
Repair of forest roads	2	3	2	2	9
Total	9	12	8	8	37

Each course will be provided in three rounds: the first round is conducted in the first year of the project as an initial education, the second in the second year as reeducation; and the third in the fifth year to further improve skills.

4) Training Costs

Lodging, training material, training equipment, and administration costs will be calculated based on the following standards.

- Calculating unit

Lodging cost:	RM 30/person/day
Training material cost:	RM 30/person/course
Training equipment cost:	RM 50/person/course
Administrative cost:	RM 30/person/course

- Based on Table III-25, the annual costs are calculated as follows:

Lodging:	RM 30/person/day x 446 persons/day = RM 13,380
Training material cost:	RM 30/person/course x 37 persons/course = RM 1,100
Training equipment cost:	RM 50/person/course x 37 persons/course = RM 1,850
Administrative cost:	RM 30/person/course x 37 persons/course = RM 1,100
Total	RM 17,430 ≒ RM 17,500

Note: See Attachment 33 for details.

Based on the calculations above, the training cost is calculated as the following.

Unit: RM

	1st year	2nd year	5th year	Total
Cost	17,500	17,500	17,500	52,000

2-2-8 Employment of Local Residents

The large-scale forestation plan has been formulated on the premise that SAFODA or a joint venture between SAFODA and (a) private company(-ies) will carry out the plan. Expected effects are the expansion of job opportunities for local residents and the development of infrastructure.

Forestation operations are usually subcontracted. Subcontractors usually organize a group of 15-30 people led by an influential man in the local community. In this plan, either direct employment by the project or subcontracting will be feasible. In the case of the latter, it is desirable that the village will be the subcontracting unit with the goal to guarantee employment of local residents. However, they show presently a negative attitude towards this idea. Another problem is the lack of technicians well-experienced in forestation operations. Therefore, in the case of subcontracting, there is no choice but to turn to appropriate subcontractors who have technical experience in this field. In any case, hiring local residents is a prerequisite.

Seedlings will be produced on a consignment basis. Nurseries will be established near villages and local residents will be hired for nursery operations. It is assumed that the project villages and local residents will be hired for nursery operations. It is assumed that the project body will directly hire workers for repair work of forest roads and for forest fire prevention.

For effective implementation of the operations above, it is necessary to train responsible foremen who can supervise well.

Based on all the conditions above, the manpower necessary for the execution of the large-scale forestation plan is shown in Table III-26.

The number of people to be hired depends on the estimated working days in a year, the adjustment of the period when each operation will be carried out, and the combination of such operations. If the number of annual working days is 120, 520 workers (160 for the Model Area) will be needed. In the case of 180 working days in a year, the number of required workers will be 340 (110 for the Model Area). It should be noted that the number of necessary workers will also depend on whether specific workers will be employed for a long period or if many workers will be hired on a rotation basis.

The number of residents in the study area who are 20-49 years old is 2,074 (Table III-27). One of every 4-5 residents can be hired by this project. Although the timing of the execution of this plan has to be adjusted in relation to the workload of agricultural operations, the manpower above is thought to be acceptable to local residents. However, recruitment of workers should be done through the communities to get understanding each other (see Chapter I, 2-6-5).

Table III-26 Total Required Manpower

(1) State Land Model Zone

Unit: 1,000 man-days

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
Forestation		13.0	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
Seedling. Production		3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Forest Roads	0.3	0.5	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Fire Control		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total	0.3	16.9	18.7	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9

Year	13	14	15	16	17	18	19	20	21	22	23	24	Total
Forestation	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.4	346.4
Seedling. Production	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.0	74.3
Forest Roads	1.0	1.0	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	23.6
Fire Control	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	7.2
Total	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.7	451.5

(2) Total Area

Unit: 1,000 man-days

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
Forestation		41.9	46.9	47.1	47.1	47.1	47.1	47.1	47.1	47.2	47.2	47.1	47.1
Seedling. Production		9.9	9.9	9.9	9.9	9.9	9.9	10.0	10.0	10.0	10.0	10.0	10.0
Forest Roads	1	2.0	2.8	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Fire Control		1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Total	1	54.9	60.7	61.8	61.8	61.8	61.8	61.9	61.9	62.0	62.0	61.9	61.9

Year	13	14	15	16	17	18	19	20	21	22	23	24	Total
Forestation	47.1	47.1	47.1	47.1	47.1	47.2	47.2	47.1	47.1	47.1	47.1	47.1	1,125.4
Seedling. Production	9.9	9.9	9.9	9.9	9.9	10.0	10.0	10.0	10.0	10.0	10.0	10.0	238.9
Forest Roads	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	87.2
Fire Control	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	26.4
Total	61.8	61.8	61.8	61.8	61.8	62.0	62.0	61.9	61.9	61.9	61.9	61.9	1,477.9

Table III-27 Age Bracket by Village

Unit: 1 person

Village	20 - 29		30 - 39		40 - 49		Total		
	Male	Female	Male	Female	Male	Female	Male	Female	Total
Talas	10	7	20	17	10	5	40	29	69
Marak Parak	47	45	93	95	39	34	179	174	353
Melangkap Darat	80	70	80	70	50	50	210	190	400
Melangkapt tengah	25	30	32	30	40	35	97	95	192
Natu	12	13	7	13	12	13	31	39	70
Paka	13	8	20	19	25	25	58	52	110
Paliu Sumbuh	8	6	12	10	20	18	40	34	74
Pengapuyan Baru	25	35	25	5	6	4	56	44	100
Polipikan	35	25	20	18	6	5	61	48	109
Pompadon	5	19	5	5	10	10	20	34	54
Sorinsim	5	5	9	3	14	20	28	28	56
Sunsui	18	12	24	28	14	16	56	56	112
Talamason	17	18	26	14	24	26	67	58	125
Tandahawon	30	30	27	23	20	15	77	68	145
Tangkol	17	23	20	30	8	7	45	60	105
Total	347	346	420	380	298	283	1,065	1,009	2,074

2-2-9 Execution Body

1) Organizational Structure

Large-scale forestation requires huge operations and administration budgets. It could be that the success of the plan for forestation with fast-growing species depends on how to minimize costs. This plan also aims at environmental conservation and contribution to community development, such as a better living environment and higher farm income. This is why the plan assumes that the forestation operations will be carried out by SAFODA, not a private business entity which tends to pursue only profit.

The target area is in North Sabah and comes under the jurisdiction of the Northern Regional Office of SAFODA in Ulu Kukut. The plan assumes that this project is positioned as a project of the Northern Regional Office so as to make the best use of the Office's expertise and organization/facilities for smooth execution of the project. Thus the plan assumes that the project division will be established within the office. The Director of the Northern Regional office will supervise the operations and the headquarters of SAFODA will administer the project as a whole (Fig. III-6).

2) Administraion and Management

The Northern Regional Office in Ulu Kukut, which is carrying out re-afforestation operations at present, has the expertise and the organization/facilities for that purpose. It is reasonable to make the best use of these assets so as to realize effective administration and to cut costs.

Because the forestation area is very large, it is necessary to establish a system designed for smooth operation. The project division will have the sections of Administration, Plantation, Nursery, Roads, Fire Control, Mechanical/Building Management, Harvesting, Community Liaison & PTF, Transportation, etc. The Plantation Section will increase its staff when the planted area exceeds 5,000 ha. The delimitation of the forestation area, the survey of that area, and research activities are carried out by the divisions in charge of the headquarters. The project body will not be in charge of these divisions.

Each section will make every effort to hire local residents, creating jobs for them and establishing a cooperative relationship with them.

Work responsibilities within the project division are as described below:

① Director of the Project Division:
Supervision and administration of the project. Director of the Northern Regional office will assume this post.

② Project Manager
The project manager is responsible for the general administration of the project under the supervision of the director of the project division. This means that the project manager will execute all the operations under the director of the project division. The project manager will also act as the chief superintendent, who is responsible for the administration of the Plantation Section, the core section of the project.

③ Administration
General clerical work will be conducted by the staff of the Administration Division of the Northern Regional Office.

○ Accounts Clerk
Assistance with accounting. The accounting section of the Northern Regional Office will take care of the accounting in the project division.

○ Typist
Documentation for the project division

○ Store keeper
Management of the warehouse/storeroom of the project division.

④ Plantation

○ Plantation Manager
The project manager will double this post. The plantation manager will administer the forestation operations and be responsible for manpower development. Regarding manpower development, the plantation manager will draw up the training program for each field of operation. The execution of these programs will be carried out by the training division of the headquarters.

○ Plantation Assistant Manager
Administration of field works of forestation under the supervision of the plantation manager. After the planted area exceeds 5,000 ha, two staff members will be added to the plantation section, and the plantation assistant manager will supervise them.

○ Plantation Field Assistant
Supervision of forestation operations in the field under the supervision of the plantation assistant manager. Three assistant will be assigned under one plantation assistant manager.

○ Junior Plantation Field Assistant
Supervision of field workers. Three junior plantation field assistants will be

supervised by one plantation field assistant.

○ Tractor Operator

Transportation of seedlings and workers to the field, etc. under the supervision of the plantation assistant manager. Tractors to be used are those designed for farming. Four tractors will be made available at all times. Thus, four tractor operators will be required.

⑤ Nursery

○ Nursery Field Assistant

Production of seedlings necessary for the forestation plan including PTF under the supervision of the general manager of the nursery division of the Northern Regional Office. The nursery field assistant will provide advice concerning production and transportation of seedlings. Seedlings will be produced on a consignment basis, in principle.

⑥ Planning & Mapping

This section will survey the forestation target area in collaboration with the sections of planting, roads and fire control, and will prepare basic materials for the project implementation plan. It will also prepare maps for the execution of planting and constructing/improving forest roads. This undertaking will be carried out by the planning & mapping division of the headquarters, which will take charges of the entire project. The project body will not be in charge of this section.

⑦ Research

This section will take charge of research/development on breeding and planting/nursing technology. Like the planning & mapping section, this undertaking will be carried out by the division of the headquarters. The project body will not be in charge of this section.

⑧ Roads

This section will maintain and repair forest roads.

○ Road Field Assistant

Maintenance and repair of forest roads under the supervision of the project manager. Two staff members will be assigned to this position once the planted area exceeds 5,000 ha.

○ Junior Road Assistant

Regular maintenance and repair of forest roads in the field under the supervision of the road field assistant. One junior road assistant will be supervised by one road field assistant. Thus, the number of junior road assistants will be two once the planted area exceeds 5,000 ha.

⑨ Fire Control

○ Fire Control Field Assistant

Regular patrolling of the field for forest fire prevention and management of lookout towers under the supervision of the project manager. One person.

○ Junior Fire Control Field Assistant

These assistants will usually watch for possible fires from the lookout towers. A lookout tower will be constructed on one parcel every two years starting the third year of the project. Two junior field assistants will be stationed at each lookout tower. Thus, nine junior field assistants will be stationed from the ninth year.

⑩ Harvesting

- ○ Assistant Harvesting Manager

  Supervision of contractors. Harvesting will not be carried out by SAFODA but by contractors. Because harvesting will start at the tenth year, one person will be assigned to this position then.

- ○ Harvesting Field Assistant

  Supervision of operations based on the harvesting plan in the field. One person will be assigned to this position at the tenth year.

⑪ Mechanical & Building

- ○ Mechanic

  Repair and maintenance of machines and vehicles used in this project. One person.

- ○ Carpenter

  Carpenters will participate in the construction of facilities for this project. Staff members of the Northern Regional Office will be assigned to this position. The project body will not be in charge of this position by itself.

⑫ Community Liaison & PTF

- ○ Community Liaison & PTF Assistant Manager

  PTF and coordination with local people in cooperation with local administrative bodies for implementing the project.

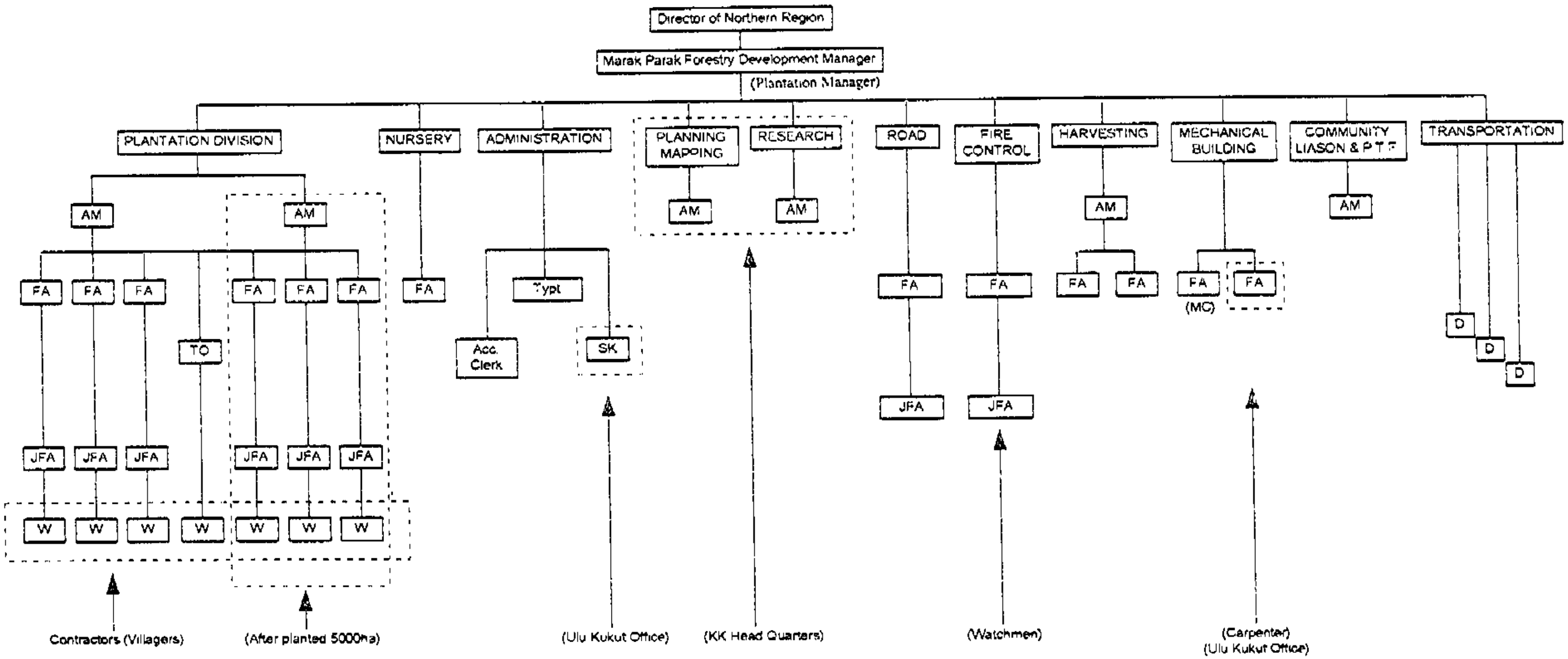
⑬ Transportation

- ○ Driver

  Two drivers for trucks owned by this project section.

These are the staff positions of the project body. In addition, local residents will be hired as temporary workers. Staff members in field assistant positions or higher will be employed on a salary basis, and those in lower positions will be hired as day laborers.

The annual personnel assignment of the execution body is shown in Table III-32.



PM	: Plantation Manager	MC	: Mechanic
AM	: Assistant Manager	Typt	: Typist
FA	: Field Assistant	SK	: Store Keeper
JFA	: Junior Field Assistant	D	: Driver
W	: Worker	Acc.	: Accounts
TO	: Toractor Operator		

Fig. III- 6 Organization Chart of the Execution Body

Table III-28 Annual Personnel Assignment

Section	Title		Number	Remark	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Project	Project Manager	PM	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
General Affairs	Typist	TYPT	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Store Keeper	SK	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Accounts	Accounts Clerk	AC	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Plantation	Plantation Assistant Manager	PAM	1/2	①	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	Plantation Field Assistant	PFA	3/6	②	3	3	3	3	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
	KUBOTA Operator	TO	4		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Nursery	Nursery Field Assistant	NFA	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Road	Road Field Assistant	RFA	1/2	①	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Fire Control	Fire Control Field Assistant	FFA	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Harvesting	Harvesting Assistant Manager	HAM	1	③	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Harvesting Field Assistant	HFA	1	④	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mechanical & Building	Mechanical Field Assistant	MFA	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Private Tree Farm & Community Liaison	Private Tree Farm & Community Liaison Assistant Manager	CDA M	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Transportation	Lorry Driver	D	2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Total			19/26		19	19	19	19	19	24	24	24	24	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26

(Chackroll Workers) Dairy Wage

Plantation	Junior Field Assistant	PJFA	9/18	②	9	9	9	9	9	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Road	Junior Field Assistant	RJFA	1/2		1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Fire Control	Junior Field Assistant (Watchman)	FJFA	8	⑤	0	0	2	2	4	4	6	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Total			10/28		10	10	12	12	14	24	26	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28

Grand Total			29/54		29	29	31	31	33	48	50	50	52	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54

① No. of staff to be increased to 2 after 5,000 ha forestation.
② No. of staff to be increased to 6 after 5,000 ha forestation.
③ From the 10th year after production starts
④ From the 11th year after production starts
⑤ 2 staff to be added at a time after construction of lookout tower has been built.

3) Administration and Management Costs

Salaries and wages for the staff working for this project will be determined based on the wage system (as of February 1997) used by SAFODA. Although the basic pay for the rank of each job in this system is subdivided, here the average basic pay for each rank will be used. The payroll will be based on a daily-wage plan. The basic pay for each rank is described below:

Job rank	Basic pay (RM)	Basic annual pay (1,000RM)
A Class (Manager)	2,395	28.7
B Class (Assistant Manager)	1,230	14.8
C Class. (Field Assistant, Administrative Assistant)	870	10.4
D Class (Junior Administrative Assistant, Driver)	700	8.4
Checkroll (Junior Field Assistant)	525	6.3

Based on this system, the annual personnel expenses have been calculated as shown in Table III-29. Total costs for administration and management is shown in Table III-30.

4) Cooperation with Community/People

This project will not be possible without mutual understanding with communities/people. Special system for coordinating with local people will be necessary to attain local people's understanding and cooperation for the project. This plan aims to achieve sustainable development and sound watershed conservation in the upper streams of Kota Marudu. The role of local government office is very important for this purpose. Therefore, the Kota Marudu District Office should take a lead agency to establish the following system for coordinating with communities/people.

(1) Project Appraisal, Monitoring, Evaluation

The Forestry Development Plan is likely to cause both positive and negative impacts to many communities/people. In particular, the communities/people are concerned about the negative impact on their existing land-use patterns: as such, they insist that they be invited to a project appraisal at the district level as the parties concerned in order to get familiar with the details of the proposed project and to be able to express their views on the matter. As community representatives, both Ketua Kampung and JKKK chairman should be invited. It is also important to monitor and evaluate the project impacts on the communities/people and to feed back the results into the project. It is necessary to agree with the communities/people (as an equal partner) on appropriate indicators for monitoring and evaluation, their frequency, methods, etc.

(2) Implementation

a. Organization at the Community Level

In implementing the Forestry Development Plan, community-level organizations which collaborate with the project as an equal partner, concerning land issues, fire control, employment, extension activities, monitoring and evaluation, etc., are necessary. Formation of the organizations could be based on the existing groups and institutions (such as JKKKs, Ketua Kampungs, etc.); new groups may be formed specifically for the project. In some villages, a single organization may better manage all the concerned issues, while in others a different group may be formed for a different issue. Each community has its own sociology; therefore the project should discuss suitable arrangements with each community rather than having a pre-determined way of organizing the community members. Some allowance to the members of the community- level organizations could be paid as an incentive.

b. Organization at the Project Level

Implementation of the project will involve constant negotiations and interactions with the communities/people. The section of Community Laison & P.T.F. set up in the project division will deal with the communities/people. Major responsibilities of this section would include: (1) liaison and negotiation with Ketua Kampungs/JKKKs as well as Native Chief Office and Community Development Office; (2)identification of the appropriate community level organizations and negotiation with them; (3) support of plantation activities on the alienated lands; (4) implementation of a pilot project on tree growing in the farming system and dissemination of its results; (5) monitoring of the project impacts; (6) liaison with other rural development agencies; (7) liaison with relevant officers in other sections of the implementing agency.

c. Organization at the District Level

A district-level coordination committee consisting of representatives of relevant agencies (e.g. District Office, Community Development Office, Native Chief Office, Forestry Department, Agricultural Department, SRFB, FELCRA, etc.) may be formed to coordinate the relevant development activities, in particular those related to land use agreements.

Table III-29 Annual Personnel Costs

1) No. of staff members

Job classification		No.	Annual pay	Personnel assignment by year																							
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Project Manager (Plantation Manager)	PM	1	28.7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<A Class Total>		1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Plantation Assistant Manager	PAM	1/2	14.8	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Harvesting Assistant Manager	HAM	1	14.8	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Community Assistant Manager	CAM	1	14.8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<B Class Total>		2/4		2	2	2	2	2	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Typist	TYP	1	10.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Plantation Field Assistant	PFA	3/6	10.4	3	3	3	3	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Nursery Field Assistant	NFA	1	10.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Road Field Assistant	RFA	1/2	10.4	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Fire Control Field Assistant	CFA	1	10.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Harvesting Field Assistant	HFA	1	10.4	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mechanical Field Assistant	MFA	1	10.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
<C Class Total>		8/13		8	8	8	8	8	12	12	12	12	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13
Store Keeper	SK	1	8.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Accounts Clerk	AC	1	8.4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Lorry Driver	D	2	8.4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Tractor Operator	TO	4	8.4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
<D Class Total>		8		8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Total		19/26		19	19	19	19	19	24	24	24	24	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
Checkroll																											
Plantation Junior Field Assistant	PJFA	9/18	6.3	9	9	9	9	9	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18
Road Junior Field Assistant	RJFA	1/2	6.3	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Fire Control Junioor Field Assistant	FJFA	0/8	6.3	1	1	2	2	4	4	6	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
<Casual Workers Total>		4/15		10	10	12	12	14	24	26	26	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
<Management Staff Total		23/41		29	29	31	31	33	48	50	50	52	54	54	54	54	54	54	54	54	54	54	54	54	54	54	54

2) Personnel expenses

Unit: RM1,000

				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
A Ckass Staff		1	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7
B Class Staff		2/4	14.8	29.6	29.6	29.6	29.6	29.6	44.4	44.4	44.4	44.4	59.2	59.2	59.2	59.2	59.2	59.2	59.2	59.2	59.2	59.2	59.2	59.2	59.2	59.2	59.2
C Class Staff		8/13	9.8	78.4	78.4	78.4	78.4	78.4	117.6	117.6	117.6	117.6	127.4	127.4	127.4	127.4	127.4	127.4	127.4	127.4	127.4	127.4	127.4	127.4	127.4	127.4	127.4
D Class Staff		8	8.4	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2	67.2
Sub-Total		19/26		203.9	203.9	203.9	203.9	203.9	257.9	257.9	257.9	257.9	282.5	282.5	282.8	282.5	282.5	282.8	282.5	282.5	282.8	282.5	282.5	282.8	282.5	282.5	282.5
Checkroll Workers		4/15	6.3	63.0	63.0	75.6	75.6	88.2	151.2	163.8	163.8	176.4	176.4	176.4	176.4	176.4	176.4	176.4	176.4	176.4	176.4	176.4	176.4	176.4	176.4	176.4	176.4
Grand Total		24/41		266.9	266.9	279.5	279.5	292.1	409.1	421.7	421.7	434.3	458.9	458.9	458.9	458.9	458.9	458.9	458.9	458.9	458.9	458.9	458.9	458.9	458.9	458.9	458.9

Table III-30 Administration and Management Costs

Unit: RM1,000

Year	Administrative expenses	Management expenses	Total
1	266.9	266.9	533.8
2	266.9	266.9	533.8
3	279.5	279.5	559.0
4	279.5	279.5	559.0
5	292.1	292.1	584.2
6	409.1	409.1	818.2
7	421.7	421.7	843.4
8	421.7	421.7	843.4
9	434.3	434.3	868.6
10	458.9	458.9	917.8
11	458.9	458.9	917.8
12	458.9	458.9	917.8
13	458.9	458.9	917.8
14	458.9	458.9	917.8
15	458.9	458.9	917.8
16	458.9	458.9	917.8
17	458.9	458.9	917.8
18	458.9	458.9	917.8
19	458.9	458.9	917.8
20	458.9	458.9	917.8
21	458.9	458.9	917.8
22	458.9	458.9	917.8
23	458.9	458.9	917.8
24	458.9	458.9	917.8
Total	9955.2	9955.2	19910.4

Note: Management expenses include welfare expenses, office expenses, miscellaneous expenses, etc. It is assumed that the administrative expenses match the management expenses in total amount.

2-2-10 Monitoring

Monitoring will be carried out by checking the progress of the project so that the project plan is carried out on schedule. When necessary, appropriate measures will be taken to obtain the desired results. Although there are many ways of monitoring, the monitoring here will deal with two aspects: operations checkout on a daily basis and adjustment of the entire operation.

This plan assumes that SAFODA will implement the project. Monitoring will also cover the headquarters and will be carried out systematically. Based on the daily checkout of operations, information at the very end, that is, at the field level, will be collected and reported through each level to the top as described below:

Field Assistant (FA)→Assistant Manager (AM)→
Project Manager (PM)→Director→Headquarters

The sections to be monitored are Planting, Nursery Production, Roads and Fire Control. The sales section will be monitored by the headquarters of SAFODA.

The following is the procedure:

① The field assistant (FA) secures a good understanding of the progress of daily operations and makes a daily report. Then the FA submits the daily report to the assistant manager.
② The assistant manager (AM) checks the daily report in terms of the progress of the project and addresses problems if reported. Then the AM puts together the daily reports into a progress report (monthly report) and submits it to the project manager.
③ The project manager (PM) reviews the monthly report and assesses the progress of the project. The PM also coordinates different sections and takes measures to solve problems. Then the PM puts together a quarterly report and submits it to the Director.
④ The Director summons the assistant managers of all the sections every quarter for checking actual performance against the plan based on the quarterly reports. Then the Director takes measures if necessary.
⑤ The Director prepares a quarterly report based on ④ and submits it to the Headquarters.
⑥ The Headquarters convenes a monitoring committee meeting consisting of concerned parties twice a year. The Auditing Department acts as the secretariat of the committee. The committee examines the progress of the project based on the quarterly report. At this point, the committee conducts a field survey if necessary. After the examination, the committee sends necessary information back to the Director for feedback and has the Director take measures necessary with respect to the implementation of the project.

For reference, field assistants and assistant managers should secure a good understanding of the following:

Forestation operations:

Site preparation:

Progress of operations, decision on the timing of burning and its preparation, conditions after the burning, etc.

Planting:

Progress of operations, confirmation of marking, condition of the temporary storage of seedlings in the field, survival of seedlings, the necessity of supplementary planting, the timing of supplementary planting, etc.

Tending:

Progress of operations, survey on survival and growth, survey on grass height and the decision on the necessity of weeding, decision on the timing of weeding, disease and insect damage, the extent of damage, damage by animals, other damage, etc.

Nursery:

Securing of seeds:

Situation of securing seeds, the quality of seeds, storage conditions, etc.

Seeding:

Progress of operations, state of germination, etc.

Transplanting:

Progress of operations, survival after transplanting, etc.

Watering/weeding:

Progress of operations, growth of seedings, estimation of the plant percent, etc.

Hardening:

Progress of operations, growth of seedlings, etc.

Planting:

Progress of operations, calculation of the number of planting stocks, calculation of the number of remaining stocks, etc.

Roads:

Construction/improvement:

Progress of operations (surveying, design, contracting, construction/improvement), progress of the construction of adjunct facilities, inspection of the design and the finished product, optimization of the volume of cutting/banking, optimization of waste sites, etc.

Maintenance:

Progress of operations, confirmation of sites of landslides, washouts, fallen trees, drainage conditions, the condition of structures, etc.

Fire Control:

Records of patrolling, inspection of factors that can cause forest fire, the number of fires and the extent of the damage, analysis of the cause of forest fire, etc.

Sales will be handled by the marketing division of the SAFODA headquarters together with sales of timber from other forestation areas. This is partly because the plan assumes that *A. mangium* timber will be sold in the foreign market and that *P. falcataria* timber will be sold in the market of Tawau or Sandakan.

Because the terms of sales contracts (sales prices, currency of payment, contract period, quality conditions, etc.) will directly influence the budget of SAFODA, it is necessary that after the Marketing Division negotiates, estimates profit, and assesses risks, the top executives come up with a final budget.

The marketing division will need to collect information on the following matters by making frequent business trips and contacting other institutions and companies. Then the marketing division will have to compile a sales report at least every quarter and a market research report at least every half year, and submit these reports to the top executives. It is also necessary for the marketing division to regularly survey and secure a good understanding of the production and sales of planted trees of species other than *A. mangium* and *P. falcataria* in all parts of the world. This is because only the division is in a position to cope with the market environment and provide materials based on which the future course of forestation operations by SAFODA will be decided.

a. Sales report

① Types of species to be sold, buyers of the timber, sales arrangement (stand or free on mill), sales date, the number of trees to be sold, price, quality
② In the case of "free on mill?," detailed records of the costs, manpower, the number of days required for the process from cutting to mills
③ Problems of sales activities
④ Sales forecast for the next quarter

b. Market research report

For *A. mangium*
① Regarding chips for pulp, market conditions, exporting/importing countries, the volume of exports/imports
② Trends of competitors, chip providers (forestation plans, terms of sales, etc.)
③ Conditions of the product markets of MDF, particleboard, etc. that are potential markets of *A. mangium* chip, conditions of material procurement
④ Trends in the construction of pulp mills in and outside Malaysia
⑤ Exploration of new uses of *A. mangium* other than chips

For *P. falcataria*
① Regarding blockboard, market conditions, exporting/importing countries
② Review of the management of blockboard mills
③ Trends of competitors, suppliers of *P. falcataria* (forestation plans, terms of sales, etc.)
④ Exploration of new uses of *P. falcataria* other than blockboard

2-3 Small-scale Forestation Program

2-3-1 Framework of the Program

Small-scale forestation will be applied to the alienated land indicated in Fig. III-1. Although farmers wish to use their land for rubber, oil palm or other crops, most of the land is not suitable for agricultural use due to its topographic condition or poor productivity. The land use idea of communities is not always based on the defined strategy of land use. It is apt to be prepared arbitrarily. Local people can be allowed to cultivate the land with relatively little possibility of soil erosion or land slide, but from the perspective of watershed conservation, forests should be maintained in the rest of the land. In order to attain efficiency in operation, a certain size of sequenced land should be assured for forestation or cultivation. Taking above conditions into consideration, the study proposed a land use plan indicated in Fig. III-3. The lands for forestry are the areas unsuitable for agricultural use. Judging from current land use, the life style of local people will not be changed fundamentally.

The forest road network to be constructed in the large-scale forestation program will also be used for the small-scale forestation program. Land right holders must be organized so that sequenced land is assured to achieve efficient forestation. The sales profit approach which is basically the same approach as PTF scheme by SAFODA will be applied to this small-scale forestation program (see Chapter I, 2-6-6).

Moreover, the small-scale forestation program is a local people's own plan. It will not be realizable without their consent. Accordingly, it is indispensable to get local people's understanding and cooperation for the project (As for implementing system, see Section 2-2-9-4).

2-3-2 Forestation Plan

The proposed land use in the alienated land is shown in Table III-31.

Table III-31 Proposed Land Use in the Alienated Land

Land Use Pattern	Area (ha)
Cultivated land etc.	363
Forestation Area	259
Natural Forests	86
Total Area	708

Re-afforestation will be applied to the forestation area (259 ha) in Table III-31. Although there is hesitation among the local people, *A. mangium*, the same species as that for the large-scale forestation program, was chosen as planting species, taking into account its market strategy conceived in this plan (see Section 4).

With regard to the areas for roads and reserved belts, the same ratio as that for the large-scale forestation program was applied to the small-scale forestation program to determine the re-afforestation area, which resulted in 215 ha, or 83% of the forestation area -259 ha. Since *A. mangium*'s cutting age is set at 9 years (215 ha / 9 years = 23.89 ha), an area of 24 ha is planted every year from Year 1 to Year 8, and 23 ha in Year 9. 1,250 seedlings per ha are to be planted at a 2m x 4m planting interval. Since 10% (125 seedlings) of supplementary planting is necessary, the total number of seedlings required per ha is 1,375.

The annual re-afforestation area, the number of seedlings and the harvest volume are shown in Table III-32.

2-3-3 Harvesting Plan

The harvesting starts from Year 10. The volume of trees to be harvested will be 180 m^3 per ha. Since the recovery rate is assumed at 80%, the expected volume of wood is 144 m^3 per ha . The annual harvest volume is shown in Table III-32.

Table III-32 Annual Plan for Re-afforestation and Harvest

Year	1	2	3	4	5	6	7	8	9
Re-afforestation Area of *A. mangium* (ha)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	23.0
Seedlings required (No.)	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	31,625
Harvest Volume (m^3)	0	0	0	0	0	0	0	0	0

Year	10	11	12	13	14	15	16	17	18
Re-afforestation Area of *A. mangium* (ha)	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	23.0
Seedlings required (No.)	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	31,625
Harvest Volume (m^3)	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,312

Year	19	20	21	22	23	24	Total
Re-afforestation Area of *A. mangium* (ha)	24.0	24.0	24.0	24.0	24.0	24.0	574.0
Seedlings required (No.)	33,000	33,000	33,000	33,000	33,000	33,000	789,250
Harvest Volume (m^3)	3,456	3,456	3,456	3,456	3,456	3,456	51,696

2-3-4 Costs

The costs for the small-scale forestation program were estimated in the following fashion.

Forestation: The Standard Work Process (Attachment 29) was applied to estimate the forestation costs. RM 973.5 per ha is needed in the first year for the activities such as site preparation, planting, tending, and RM 85.5 per ha is needed in the second year for tending.

Seedling Production: As is shown in Table III-32, the nursery stock needed for the above mentioned forestation is 33,000 seedlings (1,375 seedlings x 24 ha) from Year 1 to Year 8 and 31,625 seedlings (1,375 seedlings x 23 ha) in Year 9. Seedlings can be purchased from contractors or self-supplied by preparing a small nursery. The price of a seedling from contractors is RM 0.3, while the production of a seedling costs RM 0.28 (RM 0.24 for the production according to the Basis for Cost Calculation of Seedling Production - Attachment 31 - and RM 0.04 for transportation to the site). In this study, it is assumed that a half of seedlings necessary for the small-scale forestation program are purchased from contractors and the rest are produced by SAFODA. Thus the cost per seedling is RM 0.29, the average of these two cases.

Harvesting: Same as the large-scale forestation program, harvesting starts from Year 10. The harvesting cost including the transportation is RM 25 /m^3.

The total costs for the small-scale forestation program based on the above conditions are shown in Table III-33.

Table III-33 Costs for Small-scale Forestation Programme

Unit: RM 1,000

Year	1	2	3	4	5	6	7	8	9
Forestation	23.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	24.4
Seedling Production	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.00
Harvesting	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	33.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0	33.4

Year	10	11	12	13	14	15	16	17	18
Forestation	25.4	25.4	25.4	25.4	25.4	25.4	25.4	25.4	24.4
Seedling Production	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.57	9.00
Harvesting	86.4	86.4	86.4	86.4	86.4	86.4	86.4	86.4	82.8
Total	121.4	121.4	121.4	121.4	121.4	121.4	121.4	121.4	116.2

Year	19	20	21	22	23	24	Total
Forestation	25.4	25.4	25.4	25.4	25.4	25.4	576.7
Seedling Production	9.57	9.57	9.57	9.57	9.57	9.57	228.5
Harvesting	86.4	86.4	86.4	86.4	86.4	86.4	1,243.0
Total	121.4	121.4	121.4	121.4	121.4	121.4	2,127.2

3. Forestry Development Plan -B

3-1 Framework of the Plan

According to the social survey conducted on the villages within the model area (see Chapter I, 2-6), there is no "state land" in local residents' mind. Each community has its own boundary and most of the land within the boundary belong either to any one of the villagers or to the community, although the ownership is not definitive for some land. Communities have their own ideas on how to use the land. These ideas are formed based on their current land use situation, and are not necessarily appropriate from the perspective of proper land utilization including watershed conservation. It is necessary for the government to restrict land utilization since it is not only the problem in upstream areas but downstream areas are also affected by environmental degradation in upstream areas. The preparation of a land use plan which incorporates both the communities' land use ideas and the restrictions on land utilization is indispensable.

Although the land tenure has been settled in only some part of the model area, local people take all the land as substantially alienated land on which they will be given the tenure intime. Therefore, it is assumed that all the model area is alienated land. The model area covers five villages, but the study was conducted in three villages - Sunsui, Kotud and Polipikan - as the object of the forest development Plan -B.

Furthermore, since this study is to prepare a plan based on community's own plan of land use in the model area, the plan does not include a plan for total area in the study area as shown in the forestry development plan A.

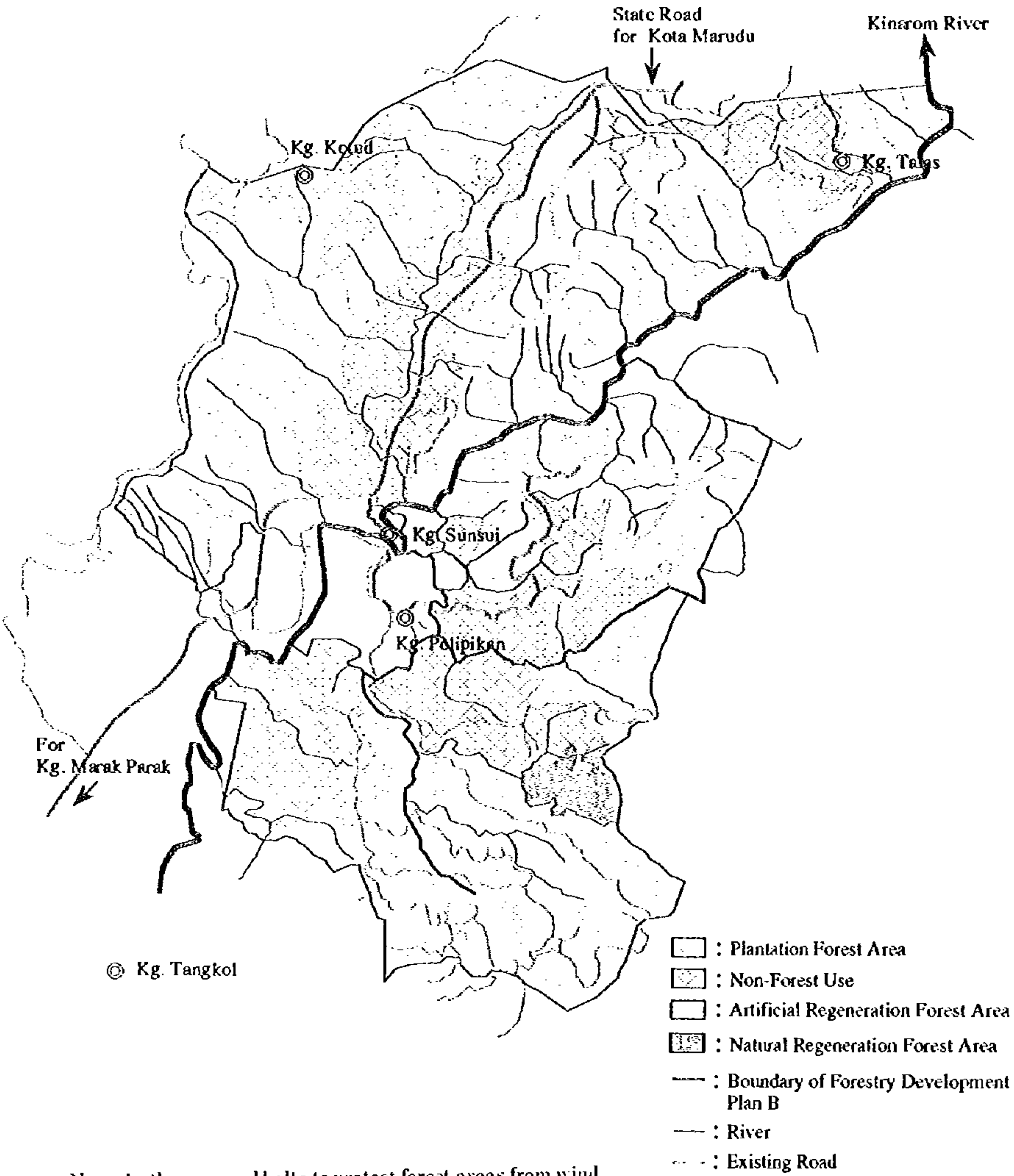
3-2 Land Use

According to the local peoples' land use ideas, little land is actually used for subsistence crops. Most of the land is planted or to be planted with rubber or oil palm, or reserved for the future (or for their offspring). The size of the land claimed by the communities is quite large compared to their population size, and only small pieces of land are actually used. The land use ideas of communities are not always based on the defined land use strategy, but apt to be prepared intentionally. They seem to be conceived with an aim to secure the land use right. Since the soil condition in the study area is generally poor except for low land areas along rivers, the possibility for the usage of land is quite limited. The study classified the area roughly in two categories -forests and non-forests (agricultural land), taking into consideration topographic conditions which are related to the possibility of soil erosion or land slide. Valleys, slopes (Attachment 34), topographical fold, and valley density were also taken into account in preparing the land use classification, shown in Fig. III-7. Table III-34 shows a land use classification in the Model Area. The Forest Development Plan -B covers proposed areas for re-afforestation and enrichment planting.

Since the lands for agricultural use include the current tillage, life style of the local people is not considered to be changed basically. The lands for forestry use are not suitable for agricultural use. Therefore, this plan will contribute to economical development in the region through promoting not only agriculture but forestry.

Table III-34 Land Use Classification -Model Area (ha)

Classification	Size of Area
Model Area	4,810
Agriculture	2,015
Forests	2,795
Re-afforestation	2,204
Enrichment Planting	536
Natural Forests	55



Note: As the reserved belts to protect forest areas from wind and fire is designed in the same manner of Plan-A, its illustration is omitted on this map.

Figure III-7 Forestry Development Plan - B

3-3 Framework of Implementation

Alienated land are principally controlled by the residents (owners) since it is private land. However, in order to conserve the watershed and promote local industries, the Government is expected to encourage forestation in the area. For this purpose, there is assistance by SAFODA's PTF program or by JKKK, but past experiences including poor *A. mangium* sales might give these schemes difficult to continue. Moreover, each forestation block should have a certain size of sequenced land to enable efficient forestation. Grouped forestation, such as the method taken by SRFB's rubber plantation, is conceivable for this purpose. This method's drawback is, however, that the profit will be generated ten to thirteen years after the planting, which is not attractive to local people. Furthermore, forestation requires road construction and maintenance, which is technically and financially difficult to implement for local people. Implementation of the forestation should be entrusted to a technically experienced organization.

Profit sharing system (sharing system of profit at harvesting) corresponding to the land rent approach is considered as an alternative approach. However, it follows a risk concerning the sales profit and cannot be high incentives for local people. While waiting until the harvesting time, local people can obtain income by working as labor of the project. However, there is no guarantee that all land owners could be employed by the project. There might bring about complaint among them.

It is recommended that an organization implements the project by renting the alienated land. A land rental forestation by SAFODA is applied in this study, and special organization is not considered here because of small size of the project. Furthermore, this plan depends on local people's consent and it is not realizable without their understanding and cooperation for the project. On the other hand, this project aims to achieve sound watershed conservation and sustainable development in this region. For this purpose, the District Office has a very important role as lead agency to attain understanding and cooperation of communities/people as equal partner of the project (see Section 2-2-9-4)).

3-4 Forestation Program

3-4-1 General

Since the size of the forestation area is fairly large, the same forestation methodology as that for the Forest Development Plan -A (Section 2) will be taken for this program. The work program and cost estimate were prepared in the same forestation system as those stated in Section 3, while land rental is added to this program.

3-4-2 Forestation Plan

As is indicated in Table III-34, the size of the forests within the areas for the Forest Development Plan -B is 2,795 ha, of which the forestation area represents 2,204 ha, the artificial regeneration area 536 ha and the natural forests 55 ha. Since 17% of the forestation area, or 375 ha, is assumed to be used for roads and reserved belts as is the case with the Forest Development Plan -A, 1,829 ha is designated as the re-afforestation area.

A. mangium would be the only species applicable in the re-afforestation area due to low land productivity. *P. falcataria* is not assumed to be planted since the land where the species can grow will be used rather for agriculture. Cutting age of *A. mangium* is set at 9 years, same as the case of the Forest Development Plan -A. 203 ha will be planted every year except Years 9 and 18, and 205 ha in Years 9 and 18. The same planting methodology as that for the Forest Development Plan -A will be applied.

The same artificial regeneration method (the same species and planting method) as that for the Forest Development Plan -A was adopted. The planting area is 536 ha in total, and the planting will be carried out for 24 years. 22 ha is planted from Year 1 to Year 16, and 23 ha from Year 17 to Year 24.

The plantation schedule for the re-afforestation and artificial regeneration is shown in Table III-36.

3-4-3 Seedling Production

Seedlings production is aimed at providing the seedlings necessary to carry out the above mentioned forestation.

The number of *A. mangium* seedlings required is:

Years except 9 and 18	203 ha/year x 1,719 /ha = 348,957 seedlings/year
Years 9 and 18	205 ha/year x 1,719 /ha = 352,395 seedlings/year

The number of seedlings required for the artificial regeneration is:

Year 1 to Year 16	22 ha/year x 229 /ha = 5,038 seedlings/year
Year 17 to Year 24	23 ha/year x 229 /ha = 5,267 seedlings/year

The same conditions for seedling production as those indicated for the Forest Development Plan -A were applied. The seedling production schedule is shown in Table III-360.

3-4-4 Forestry Infrastructure Construction

With regard to the forestry infrastructure, the same concept as that used for the Forest Development Plan -A is applied for the proposed program. The forest road density used for the Forest Development Plan -A was:

Re-afforestation area:	New Construction (main roads)	2.2m /ha
	(sub roads)	13.3m /ha
	Rehabilitation	9.8 m /ha
Artificial regeneration:	Rehabilitation	24.9 m/ha

The same density was applied to the re-afforestation area - 2,204 ha - for the proposed program and the artificial regeneration area -536 ha. The proposed program requires the same number of bridges and fords as that needed in the Forest Development Plan -A. The construction schedule of the forest roads is shown in Table III-37. Since SAFODA's existing facilities and equipment are assumed to be used, no new purchase or construction apart from roads will be needed in this program.

3-4-5 Harvesting and Transportation

Since the *A. mangium* planted in Year 1 is harvested in Year 10, the planting area in Year 1 corresponds the harvest area in Year 10. The wood volume at harvest was set at 180m^3 per ha and the recovery rate at 80%, as was assumed in the Forest Development Plan -A. The expected wood volume to be produced is:

Year 10 to Year 18	203 ha x 180 m^3 x 80% = 29,232 m^3/year
Year 19	205 ha x 180 m^3 x 80% = 29,520 m^3/year

The same conditions as those for the Forest Development Plan -A were applied for the proposed program. The harvesting schedule is shown in Table III-36.

3-4-6 Employment of Local Residents

With regard to the manpower requirement for the project which creates local employment opportunities, the same concept as that for the Forest Development Plan -A was applied to the proposed program.

Manpower Requirement for Forestation:

Manpower requirement for the Forest Development Plan -A indicated in Table III-7 was used as a basis of calculation of labor requirement for the proposed program. The annual labor requirement is shown in Table III-38.

Manpower Requirement for Seedling Production:

It is likely that contractors for seedling production use local people as was assumed in the Forest Development Plan -A. The study estimated that 7.02 man-day is needed to produce 1,000 *A. mangium* seedlings and 15.63 man-day to produce seedlings of traditional species for the artificial regeneration. The annual labor requirement for each species is:

For *A. mangium*:

Years except 9 and 18	348,957 seedlings / 1,000 seedlings x 7.02 man-day = 2,449.7 man-day /year
Year 9 and Year 18	352,395 seedlings / 1,000 seedlings x 7.02 man-day = 2,473.8 man-day /year

For artificial regeneration

Year 1 to Year 16	5,038 seedlings / 1,000 seedlings x 15.63 man-day = 78.7 man-day /year
Year 17 to Year 24	5,267 seedlings / 1,000 seedlings x 15.63 man-day = 82.3 man-day /year

The annual labor requirement based on the above conditions is shown in Table III-38.

Manpower Requirement for Forestry Infrastructure:

Contractors will be used for the construction and maintenance of the major part of the forestry infrastructure such as forest roads. It is likely that local people will be employed by the contractors as unskilled laborers. They can work as assistants for surveys or road maintenance work: total manpower requirement for the proposed program indicated in Table III-38 is almost the same as that for the Forest Development Plan -A indicated in Table III-17.

Apart from road construction/maintenance, there is no labor required for the construction of facilities since SAFODA's existing facilities are used in the proposed program.

Manpower Requirement for Harvesting and Transportation:

Harvesting is undertaken by contractors. Most of the work is such a specialized one that local employment is not applicable.

3-4-7 Cost Estimation

Forestation Costs:

Forestation costs in the first three years of *A. mangium* and the species for the artificial regeneration were estimated in accordance with the Standard Work Process (Attachment 29), and are shown in Table III-35.

Table III-35 Forestation Costs per ha

Plantation Species	1st Year	2nd Year	3rd Year	Total
A. mangium	976.5	85.5	0.0	1,062.0
Enrichment Planting	232.4	60.0	30.0	322.4

Table III-39 shows the annual forestation costs obtained by compiling the unit costs in Table III-35.

Seedling Production Costs:

The purchase price of seedlings is the same as that for the Forest Development Program -A: RM 0.3 per seedling for *A. mangium* and RM 1.05 per seedling for the native species for the artificial regeneration. After 10% of supplementary planting is added, the total number of seedlings necessary is 1,375 per ha for *A. mangium* and 161 per ha for the artificial regeneration.

The annual seedling purchase costs, shown in Table III-39, were calculated based on the seedling price, the number of seedlings per ha and the annual forestation area indicated in Table III-36.

Forest Infrastructure Costs:

The unit costs by type of work necessary for the construction, maintenance and rehabilitation of forest roads and also the unit costs for the construction of bridges and fords for the Forest Development Plan -A were given in Table III-19. The same unit costs were used for the proposed program. The annual forest infrastructure costs based on the forest road construction schedule (Table III-37) are shown in Table III-39.

Harvesting and Transportation Costs:

The same harvesting and transportation unit cost as those estimated for the Forest Development Plan -A -RM 25 /m^3 - was used for the proposed program. The annual harvesting and transportation costs based on the harvesting schedule (Table III-36) are shown in Table III-39.

Table III-36 Annual Plan for Re-afforestation and Harvest - Forestry Development Plan-B, Model Area

	Year	1	2	3	4	5	6	7	8	9
Re-afforestation Area (ha)	*A. mangium*	203.0	203.0	203.0	203.0	203.0	203.0	203.0	203.0	205.0
	Enrichment P.	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Seedling Production (/1,000)	*A. mangium*	349.0	349.0	349.0	349.0	349.0	349.0	349.0	349.0	352.4
	Enrichment P.	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Harvest Volume (/1,000m³)	*A. mangium*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

	Year	10	11	12	13	14	15	16	17	18
Re-afforestation Area (ha)	*A. mangium*	203.0	203.0	203.0	203.0	203.0	203.0	203.0	203.0	205.0
	Enrichment P.	22.0	22.0	22.0	22.0	22.0	22.0	22.0	23.0	23.0
Seedling Production (/1,000)	*A. mangium*	349.0	349.0	349.0	349.0	349.0	349.0	349.0	349.0	352.4
	Enrichment P.	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.3	5.3
Harvest Volume (/1,000m³)	*A. mangium*	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.5

	Year	19	20	21	22	23	24	Total
Re-afforestation Area (ha)	*A. mangium*	203.0	203.0	203.0	203.0	203.0	203.0	4,876.0
	Enrichment P.	23.0	23.0	23.0	23.0	23.0	23.0	536.0
Seedling Production (/1,000)	*A. mangium*	349.0	349.0	349.0	349.0	349.0	349.0	8,382.8
	Enrichment P.	5.3	5.3	5.3	5.3	5.3	5.3	122.4
Harvest Volume (/1,000m³)	*A. mangium*	29.2	29.2	29.2	29.2	29.2	29.2	701.4

Table III-37 Annual Forest Road Plan
- Forestry Development Plan-B, Model Area

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
		203 22	203 22	203 22	203 22	203 22	203 22	203 22	203 22	205 22	203 22	203 22	203 22
Forest road (km)													
New construction:													
main—re-afforestation	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5				
branch—re-afforestation	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.2				
Improvement:													
main—re-afforestation	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4				
branch—enrichment	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Subtotal	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.6	0.5	0.5	0.5	0.5
Repair		6.7	13.4	20.1	20.1	20.1	20.1	20.1	20.1	20.0	20.0	20.0	20.1
Bridge (No.)			1						1				
Overflow bridge (No.)			1										
Forest road cost													
New construction:													
main—re-afforestation	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8				
branch—re-afforestation	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.4				
Improvement:													
main—re-afforestation	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7				
branch—enrichment	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
Repair		10.1	20.1	30.2	30.2	30.2	30.2	30.2	30.2	30.0	30.0	30.0	30.2
Bridge (No.)			25.5						25.5				
Overflow bridge (No.)			172.8										
Total(RM1,000)	68.3	78.4	286.7	98.5	98.5	98.5	98.5	98.5	123.7	34.3	34.3	34.3	34.4

Year	13	14	15	16	17	18	19	20	21	22	23	24	Total
	203 22	203 22	203 22	203 22	203 23	205 23	203 23	203 23	203 23	203 23	203 23	203 23	
Forest road (km)													
New construction:													
main—re-afforestation													4.5
branch—re-afforestation													29.6
Improvement:													
main—re-afforestation													21.6
branch—enrichment	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	13.3
Subtotal	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	69.0
Repair	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.1	20.2	20.2	20.2	20.2	462.4
Bridge (No.)													2
Overflow bridge (No.)													1
Forest road cost													
New construction:													
main—re-afforestation													88.2
branch—re-afforestation													319.5
Improvement:													
main—re-afforestation													168.5
branch—enrichment	4.3	4.3	4.3	4.3	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	108.4
Repair	30.2	30.2	30.2	30.2	30.2	30.2	30.2	30.2	30.3	30.3	30.3	30.3	693.6
Bridge (No.)													51.0
Overflow bridge (No.)													172.8
Total(RM1,000)	34.4	34.4	34.4	34.4	34.6	34.6	34.6	34.6	34.8	34.8	34.8	34.8	1,950.2

Table III-38 Manpower Required for Forestry Development Plan-B (Model Area)

	Year	0	1	2	3	4	5	6	7	8
Forestation	*A. mangium*	0.0	10,271.8	11.428.9	11.428.9	11.428.9	11.428.9	11.428.9	11.428.9	11.428.9
	Enrichment P.	0.0	312.4	400.4	444.4	444.4	444.4	444.4	444.4	444.4
	Sub-total	0.0	10,584.2	11.829.3	11,873.3	11,873.3	11,873.3	11,873.3	11,873.3	11,873.3
Seeding Production	*A. mangium*	0.0	2,449.7	2,449.7	2,449.7	2,449.7	2,449.7	2,449.7	2,449.7	2,449.7
	Enrichment P.	0.0	78.7	78.7	78.7	78.7	78.7	78.7	78.7	78.7
	Sub-total	0.0	2,528.4	2,528.4	2,528.4	2,528.4	2,528.4	2,528.4	2,528.4	2,528.4
Infra.	Surveying	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0
	Repair	0.0	200.0	500.0	700.0	700.0	700.0	700.0	700.0	700.0
	Sub-total	300.0	500.0	800.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0
Total		300.0	13,612.6	15,157.7	15,401.7	15,401.7	15,401.7	15,401.7	15,401.7	15,401.7

	Year	9	10	11	12	13	14	15	16	17
Forestation	*A. mangium*	11,530.1	11,440.3	11,428.9	11,428.9	11,428.9	11,428.9	11,428.9	11,428.9	11,428.9
	Enrichment P.	444.4	444.4	444.4	444.4	444.4	444.4	444.4	444.4	458.6
	Sub-total	11,974.5	11,884.7	11,873.3	11,873.3	11,873.3	11,873.3	11,873.3	11,873.3	11,887.5
Seeding Production	*A. mangium*	2,473.8	2,449.7	2,449.7	2,449.7	2,449.7	2,449.7	2,449.7	2,449.7	2,449.7
	Enrichment P.	78.7	78.7	78.7	78.7	78.7	78.7	78.7	78.7	82.3
	Sub-total	2,552.5	2,528.4	2,528.4	2,528.4	2,528.4	2,528.4	2,528.4	2,528.4	2,532.0
Infra.	Surveying	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0
	Repair	700.0	700.0	700.0	700.0	700.0	700.0	700.0	700.0	700.0
	Sub-total	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0
Total		15,527.0	15,413.1	15,401.7	15,401.7	15,401.7	15,401.7	15,401.7	15,401.7	15,419.5

	Year	18	19	20	21	22	23	24	Total
Forestation	*A. mangium*	11,530.1	11,440.3	11,428.9	11,428.9	11,428.9	11,428.9	11,428.9	273,361.7
	Enrichment P.	462.6	464.6	464.6	464.6	464.6	464.6	464.6	10,643.2
	Sub-total	11,992.7	11,904.9	11,893.5	11,893.5	11,893.5	11,893.5	11,893.5	284,004.9
Seeding Production	*A. mangium*	2,473.8	2,449.7	2,449.7	2,449.7	2,449.7	2,449.7	2,449.7	58,841.0
	Enrichment P.	82.3	82.3	82.3	82.3	82.9	82.3	82.3	1,917.6
	Sub-total	2,556.1	2,532.0	2,532.0	2,532.0	2,532.0	2,532.0	2,532.0	60,758.6
Infra	Surveying	300.0	300.0	300.0	300.0	300.0	300.0	300.0	7,500.0
	Repair	700.0	700.0	700.0	700.0	700.0	700.0	700.0	16,100.0
	Sub-total	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	1,000.0	23,600.0
Total		15,548.8	15,436.9	15,425.5	15,425.5	15,425.5	15,425.5	15,425.5	368,363.5

Table III-39 Costs for Forestry Development Plan-B (Model Area)

Unit: RM 1,000

Year	Forestation		Seedling production		Forest road	Harvesting	Total
	A. mangium	Enrichment Plt	*A. mangium*	Enrichment Plt.		*A. mangium*	
0	0.0	0.0	0.0	0.0	68.3	0.0	68.3
1	198.2	5.1	83.7	3.7	78.4	0.0	396.1
2	215.6	6.4	83.7	3.7	286.7	0.0	596.1
3	215.6	7.1	83.7	3.7	98.5	0.0	408.6
4	215.6	7.1	83.7	3.7	98.5	0.0	408.6
5	215.6	7.1	83.7	3.7	98.5	0.0	408.6
6	215.6	7.1	83.7	3.7	98.5	0.0	408.6
7	215.6	7.1	83.7	3.7	98.5	0.0	408.6
8	215.6	7.1	83.7	3.7	123.7	0.0	408.6
9	217.6	7.1	84.6	3.7	34.3	0.0	347.3
10	215.7	7.1	83.7	3.7	34.3	730.8	1,075.3
11	215.6	7.1	83.7	3.7	34.3	730.8	1,075.2
12	215.6	7.1	83.7	3.7	34.4	730.8	1,075.3
13	215.6	7.1	83.7	3.7	34.4	730.8	1,075.3
14	215.6	7.1	83.7	3.7	34.4	730.8	1,075.3
15	215.6	7.1	83.7	3.7	34.4	730.8	1,075.3
16	215.6	7.1	83.7	3.7	34.4	730.8	1,075.3
17	215.6	7.3	83.7	3.9	34.6	730.8	1,075.9
18	217.6	7.4	84.6	3.9	34.6	738.0	1,086.1
19	215.7	7.4	83.7	3.9	34.6	730.8	1,076.1
20	215.6	7.4	83.7	3.9	34.6	730.8	1,076.0
21	215.6	7.4	83.7	3.9	34.8	730.8	1,076.2
22	215.6	7.4	83.7	3.9	34.8	730.8	1,076.2
23	215.6	7.4	83.7	3.9	34.8	730.8	1,076.2
24	215.6	7.4	83.7	3.9	34.8	730.8	1,076.2

4. Marketing Strategy for Plantation Trees

4-1 Framework of Marketing Strategy

A. mangium and *P. falcataria* are identified to be the species suitable for the plantation in Marak Parak, due to the area's low land productivity. However, there currently exists no market for *A. mangium*, while *P. falcataria* is used for blockboard on the eastern coast of Sabah.

Various techniques of processing *A. mangium*, such as moulding or fingerjoint, have been tested in several sawmills. However, *A. mangium*'s low recovery rate (normally less than 30%), heavy weight, inconsistent color and heart rot problems have prevented it from entering the timber market at competitive prices. SAFODA has recently awarded a contract with a wood processing company, Excella Wood Industries Sdn Bhd, to supply all Excella's requirement of *A. mangium* trees (except the trees in Bengkoka) standing for RM 35 / m^3 for a period of twenty-five years. Excella has not yet come close to selling *A. mangium* products. Furthermore, the price of RM 35 / m^3 is far lower than the break-even point for SAFODA's tree plantation.

Chip form is currently the only profitable utilization for *A. mangium*. It is envisaged, however, that the Marak Parak area cannot provide a large volume of trees on a regular basis due to its limited land availability, the complexity of land tenure, and the intention of farmers who want to diversify utilization of their farmland. Moreover, unless high value trees are to be planted, it will be quite difficult to secure an independent market for only the small volume of trees from Marak Parak. Therefore, outlets for Marak Parak *A. mangium* should be discussed in combination with those for SAFODA's other plantations in neighboring areas.

SAFODA's plantation close to Marak Parak and large enough to provide A. mangium trees to potential markets on a regular basis is found in Bengkoka, an area located 60 km away from Marak Parak. Since 1981, SAFODA has planted 16,000 ha of *A. mangium* within its gazetted area in Bengkoka, 38,000 ha of which is assessed to be plantable. The plantation is estimated to be able to provide at least 150,000m^3 of logs every year. SAFODA is currently considering two commercial options for the Bengkoka trees ready to be harvested: (1) supplying of *A. mangium* in chip form to MDF mills or pulp and paper mills in other areas; (2), constructing, in cooperation with a private partner, a pulp and paper mill or an MDF plant, possibly in combination with a sawmill.

In the following sections, the outlook of the markets for MDF, particle board, pulp and paper and blockboard will be presented, followed by a discussion of views on (1) supplying plantation trees to these markets and (2) constructing a wood processing mill in Sabah to make these products.

4-2 Medium Density Fiberboard (MDF)

4-2-1 Demand and Supply of MDF

The supply of MDF has rapidly increased recently worldwide because of the scarcity of plywood materials and the development of MDF applications for a wide variety of usage. MDF is a substitute for plywood, easier to process and stronger than particle board. MDF usage has expanded to include construction materials, furniture, boxes, doors and toys. To respond to the demand, many MDF plants have been built throughout the world, especially in the last two years. World production capacity is now approximately twenty million m^3 per year, and the current annual demand is estimated to be fifteen million m^3. The rapid increase in MDF production has driven its prices down by more than 20% since early 1995. The total export volume of MDF from Malaysia was 251,000 m^3 in 1995. The following graphs show the export volume of MDF from Malaysia and its average FOB price between Jan. 1995 and Oct. 1996.

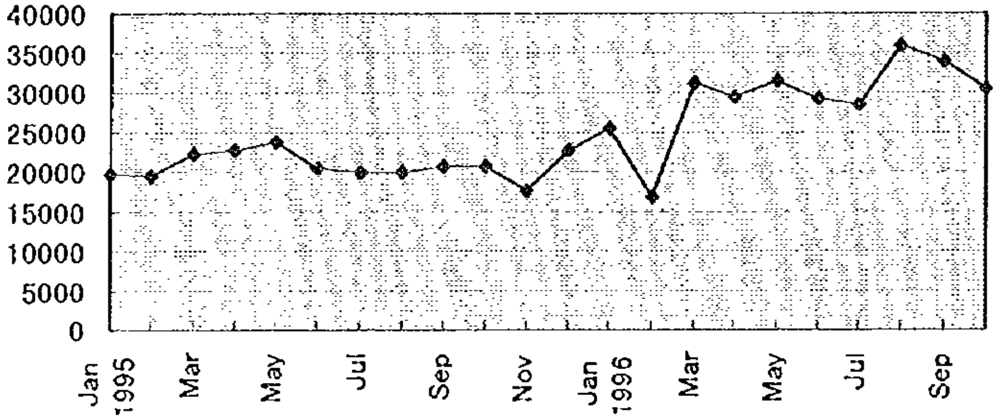


Fig. III-8 Export Volume of MDF from Malaysia (m^3)

Source: Malaysian Timber Industry Board

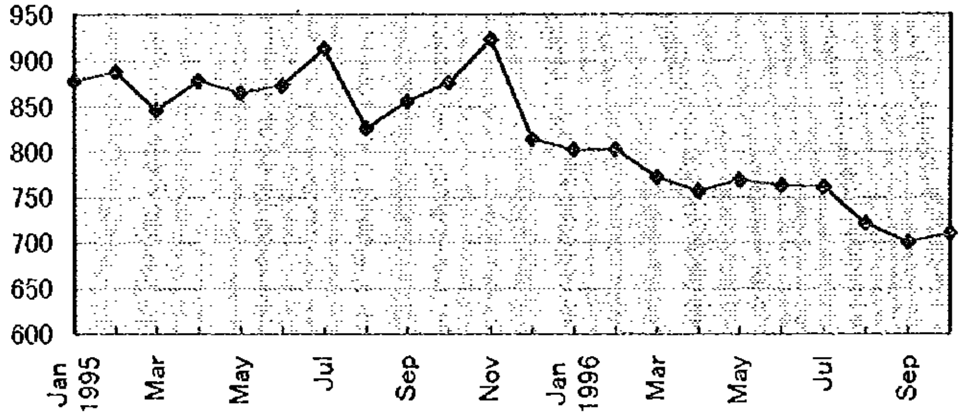


Fig. III-9 MDF FOB Price (RM thousand / m^3)

Source: Malaysian Timber Industry Board

Current global consumption of panel products amounts to 450 million m^3 per year, of which MDF represents only 20 million m^3. Although the supply of MDF currently exceeds demand, it is highly likely that the growing applications of MDF and the diminishing supply of tropical woods will further accelerate the replacement of MDF with plywood. Future prices of MDF are, however, quite difficult to predict since it is also possible that supply of MDF products continues to grow due to future mill construction.

4-2-2 MDF Plants Operating in Malaysia

There are currently seven MDF plants in West Malaysia and one in Sarawak as the following table indicates. The number of plants has increased rapidly since 1995. Total production capacity is already almost 1 million m^3 per year, and construction of more plants is said to be planned.

Table III-40 MDF Plants in Malaysia

Name of Plant	Year of Operation Started	Location	Production Capacity (m^3 / year)
Takeuchi MDF	1989 (1), 1993 (2)	Masai, Johor	100,000
Hume Fibreboard	1992 (1), 1997 (2)	Nilai, Negeri Sembilan	180,000
Golden Hope	1993	Nilai, Negeri Sembilan	100,000
Merbok MDF	1994 (1), 1995 (2)	Merbok, Kedah	250,000
Evergreen	1995	Parit Raja, Johor	60,000
Daiken MDF	1996	Bintulu, Sarawak	100,000
Guthrie	1996	Kulim	100,000
Robin Resources	1996	Mentakab	100,000

Out of the above seven MDF plants, four mills - Takeuchi, Hume, Merbok and Daiken - were visited by the study team. The following are the mill profiles:

Plant No. 1. Daiken Sarawak

a. Location: Bintulu, Sarawak.
b. Commercial Operations Started: March, 1996.
c. Plant Capacity: 100,000m^3/year.
d. Thickness: 2.5mm～15mm.
e. Current Production: 7,000m^3/month.
f. Total Investment: RM 220 million.
g. Shareholders (Equity RM 60 million): Daiken Corp. (50%), Itochu Corp. (20%), Sarawak Timber Industry Dev. Corp. (15%), Protexcel (10%), Limbang Trading (5%).
h. Major Loans: RM 70 million from EXIM Bank, Japan.
i. Raw Material: 50% heavy density wood, 20% light density, 30% mixed (core).
j. Supply of Material: Uses only wood waste from eleven sawmills. The price of the waste is negligible (5% of total cost): RM 4-5/t. Supply is said to be secured for the next ten years.
k. Machinery: From Europe, a fully automated system.
l. Water: Purchase from a water company.
   Electricity: Direct cable from a power plant.
m. Market: All to Japan (50% Daiken, 50% other housing/furniture makers)
   Focusing on high valued thin panels.
n. Shipping port: Bintulu.
o. Main usage: Furniture backs, drawer bottoms, door skins, wall and ceiling panels.
p. Other information: Employs twenty Japanese staff (high overhead costs). Plantation and construction of the second line are under consideration. Depreciation costs and interests are significant.

Plant No. 2. Hume Fibreboard Sdn Bhd

a. Location: Negeri Sembilan.
b. Commercial Operations Started: August 1992(first line), 1996 (second line).
c. Plant Capacity: 60,000 m^3/year (first line), 120,000 m^3/year (second line).
d. Thickness: 5.5mm～30mm.
e. Current Production: 60,000 m^3/year (first line).
f. Total Investment: RM 80 million (first line).
g. Shareholders (Equity RM 64 million): Hume Industries (70%), Marubeni Corp. (30%).
h. Major Loans: RM 16 million from local banks.
i. Raw Material: 100% rubberwood (both waste and logs are used).

j. Supply of Material: Buying contract with the JV between Hume Industries and RISDA (Rubber Industry Smallholdings Development Authority).
k. Machinery: Old machines (first line), automation (second line).
l. Water and Electricity: Purchase from local companies.
m. Market: 30% to Japan, the rest to HK, TW, China, Philippines, Middle East.
n. Shipping port: Port Klang.
o. Main usage: Furniture systems, kitchen systems, construction material, TV racks, speaker boxes.
p. Other information: MDF prices were good in 1993 when sales started. However, since 1995, the prices have dropped by 40%, while the rubberwood price has increased by 30%. Labor cost and glue price have also increased. As a result, the company does not seem profitable.

Plant No. 3. Merbok MDF
a. Location: Kedah.
b. Commercial Operations Started: April 1994 (first line), 1995 (second line).
c. Plant Capacity: 250,000 m^3/year (two lines).
d. Thickness: 2.5mm～30mm.
e. Current Production: 200,000 m^3/year.
f. Total Investment: RM 200 million.
g. Shareholders (Equity RM 64 million): Takeuchi (35%), Mitsubishi Corp affiliate (5%), Ashika Sales (5%), Aokam (Malaysia 45%), Dutch (10%).
h. Major Loans: Local banks.
i. Raw Material: 100% rubberwood.
j. Supply of Material: Purchase from loggers at open market (waste only), also started a trial plantation of rubberwood (70ha, no tapping).
k. Machinery: European equipment, deeply discounted because of oversupply when purchased.
l. Water and Electricity: Purchase from local companies.
m. Market: HK, TW, China, Europe, US, Malaysia, Japan (4% only).
n. Shipping port: Penang.
o. Main Usage: Furniture, panels, doors, beds, speaker cabinets, etc.
p. Other information: Recorded RM20 million profit (Group total) in 1996 due to the low transport cost (US$450/ 40ft container to Japan) and the low capital depreciation. MDF per m^3 prices are decreasing from RM 420 to 265 (thick) and from 350 to 210 (thin) in the Malaysian market. Producing first grade products 89%, second grade 11%. Loss from latex problems: 3%.

Plant No. 4. Takeuchi MDF
a. Location: Johor.
b. Commercial Operations Started: November 1989 (first line), December 1993 (second line).
c. Plant Capacity: 100,000 m^3/year (two lines).
d. Thickness: 2.5mm～18mm.
e. Current Production: 85,000 m^3/year.
f. Total Investment: RM 95 million.
g. Shareholders (Equity RM 10 million): Takeuchi (100%), Currently under Merbok Hilir Bhd (Japan 45%, Malaysia 45%, Holland 10%).
h. Major Loans: Japan Exim Bank.
i. Raw Material: 100% rubberwood.
j. Supply of Material: Purchase from loggers (waste only).

k. Machinery: European equipment.
l. Water and Electricity: Purchase from local companies.
m. Market: 50% to MATAK (a 100% Japanese capital company in Malaysia, making color boxes), the rest to Japan, Hong Kong, Taiwan, China.
n. Shipping port: Johor Baru.
o. Main Usage: Color boxes (occupying 70% of Japanese market), furniture etc.
p. Other information: All panels must be checked since latex sometimes results in an uneven surface. Focusing on thin MDF because it has the same weight as plywood.

4-2-3 Raw Material (Wood) Supply Conditions

Out of the four MDF mills that the study team visited, the three in West Malaysia use rubberwood and the one in Sarawak uses tropical wood as raw material. Because of the heavy weight of raw materials, all the MDF plants are located close to raw material supply sources. Since Merbok, Takeuchi and Daiken use waste wood (branches and cores of logs), raw material costs are mostly negligible, and only the transport cost is significant. On the other hand, since Hume is obliged to purchase the whole rubberwood due to competition with another MDF plant located in the same area, the increase in rubberwood log price (RM 42/m^3 in 1992 to RM 62/m^3 at the end of 1996 at sawmill for logs exceeding 15 cm in diameter) is eroding the plant's profitability.

In West Malaysia, the total land area planted with rubber trees is estimated to be 1.5 million ha. After fifteen to twenty years' tapping, a significant amount of rubberwood is burned without being used for sawn timber or MDF. The Malaysian Timber Industry Board (MTIB) estimates that in 1995, 2.1 million m^3 of rubberwood logs were consumed by sawmills, 120,000 m^3 by plymills and 505,000 m^3 by MDF plants and cement board factories, out of 3.8 million m^3 of rubberwood available for sawlogs and 3.4 million m^3 for MDF. Although the current capacity of sawmills is large enough to consume all existing rubberwood logs, MTIB claims that inaccessibility by roads, high transport costs and seasonal unavailability of rubberwood explain the gap between supply and demand. In other words, the price of rubberwood logs, which reflects prices of rubberwood products such as sawntimber, furniture or MDF, is currently not high enough to absorb the increase in transport costs. This is the reason why Hume Fibreboard buys whole rubberwood rather than transporting wood waste from remote areas.

Latex, which often results in an uneven surface in MDF, is a problem when using rubberwood as MDF raw material. Approximately 5 % of MDF panels have small holes on their surface, which must be manually filled with paste. However, this problem is presently being solved since new plant machinery enables elimination of latex during the processing.

4-2-4 Possibility to Supply *A. mangium* for Raw Materials

Since MDF mills require a large volume of wood supply, it is theoretically possible for SAFODA to supply *A. mangium* as raw material for MDF mills. None of the existing plants in Malaysia, however, uses *A. mangium* for raw material. The possibility for MDF plants in Malaysia to use *A. mangium* is low in the near future for the following reasons: 1) In general, consumers prefer light color to dark color for furniture. The dark color that *A. mangium* yields in MDF cannot be concealed even when it is laminated; 2) There are still enough rubberwood logs in West Malaysia; the Peninsula can provide 3.2 million m^3 of rubberwood per year while current MDF mills request approximately 2.0 million m^3 in total; and 3) A lot of wood waste generated by wood processing mills is still available in Malaysia.

It is possible that *A. mangium* will be used, in spite of its dark color, as raw material for

MDF plants in the medium or long term when wood waste becomes scarce and rubberwood is no longer abundant. At that time, raw material supply conditions for MDF plants will become the same as those for pulp and paper mills, which will be discussed in section 5-4.

4-2-5 Constructing an MDF Plant in Northern Sabah

In this section, the feasibility for SAFODA to form a Joint Venture (JV) company with a private partner to construct an MDF plant in northern Sabah will be discussed. Several companies have already submitted JV proposals to SAFODA. Although the Bengkoka plantation is not large enough to supply all the logs required for the production, a secure supply of *A. mangium* will be achieved by giving strong incentives, such as rental payment or a guarantee of purchase, to smallholders in the Bengkoka and Marak Parak areas.

There are, however, several disadvantages that the JV company has to overcome in order to compete with MDF plants in other regions.

① Dark color of *A. mangium* Since a market for dark colored MDF products does not currently exist, distributors will be reluctant to deal with *A. mangium* MDF. The JV company must make a concerted effort to develop a market, either by changing the consumers' (or distributors') perception of dark-colored products' desirability, and/or by reducing product prices.

② Water and Electricity Supply Although the average precipitation in northern Sabah is roughly 2,000 mm per year, this region does not have a water catchment area large enough to continue supplying water throughout the year; river water dries up during the dry season. The JV company msut build its own reservoir as well as its own electricity generator. The construction of these facilities will increase capital costs.

③ Transport Infrastructure The JV company will suffer from increase in capital and operating costs due to the poor infrastructure in Sabah State where conditions are far worse than those in West Malaysia. MDF products must be shipped by container in order to secure product quality. Kota Kinabalu is a secondary port equipped with a small container yard, but it lacks a direct sea route to major markets such as Japan. As a result, handling and shipping costs of MDF products in Kota Kinabalu will be much higher than those in the five main ports of Malaysia; Klang, Johor Bahru, Butterworth, Penang and Bintulu. Ground transport from northern Sabah to Kota Kinabalu is also costly because of the poor road conditions; the steep topography of Sabah State has significantly delayed construction of first grade roads like those commonly seen in West Malaysia.

Although this study does not estimate cost performance of the MDF plant to be constructed in northern Sabah, it is conceivable that the new plant will not be able to easily overcome the comparative disadvantages of the region. Thus due to these factors as well as current prices of MDF products, plant profitability will be difficult to attain.

4-3 Particle Board

4-3-1 Demand and Supply of Particle Board

The world market for particle board is mature; worldwide consumption has stabled at 50 million m^3 since 1988. In Asia, however, it is reported that the demand and supply of particle board have rapidly increased in the last two years. Particle board production is growing also in Malaysia, where total capacity currently exceeds 700,000 m^3 per year (MTIB). The export of particle board from Malaysia, which amounted to 61,000 m^3 in 1995, is also rapidly expanding as the following graph shows.

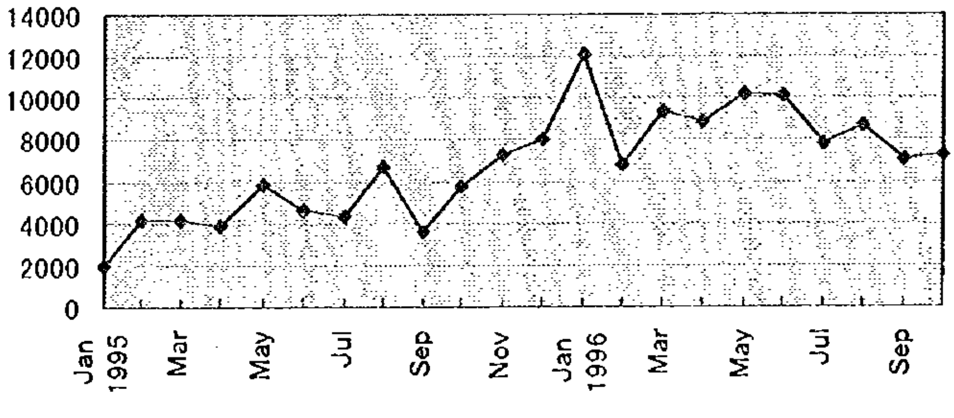


Fig. III-10 Export Volume of Particle Board (m^3) from Malaysia

Source: Malaysian Timber Industry Board

The price of particle board is stable. The following graph shows the evolution of the FOB price of particle board from Malaysia since Jan. 1995.

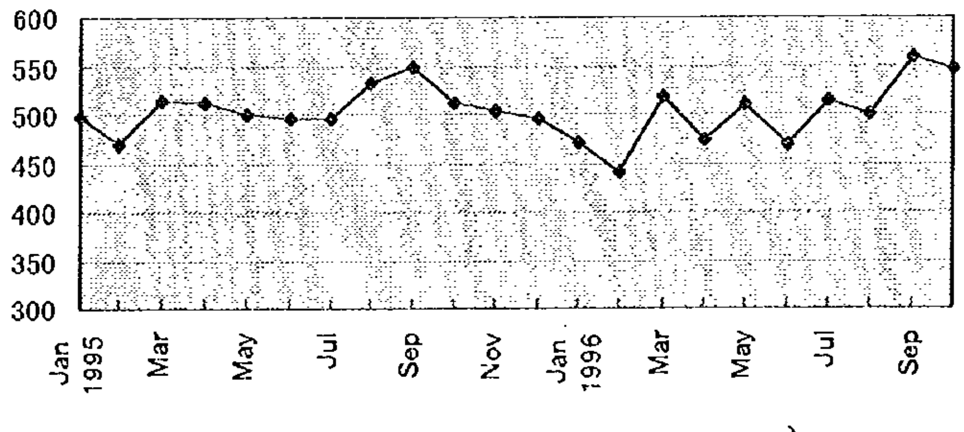


Fig. III-11 Particle Board FOB Price (RM thousand / m^3)

Source: Malaysian Timber Industry Board

4-3-2 Raw Material (Wood) Supply Conditions

Although detailed data for particle board plants in Malaysia are not available, it was learned from interviews that the primary factor which determines the location of a particle board plant is the proximity of available raw materials to the plant, either rubberwood or wood waste from sawmills. Although particle board plants are not suffering from the drop of product prices that MDF plants are experiencing, the pressure to keep production costs low is stronger because of the low prices of final products.

4-3-3 Possibility to Supply *A. mangium* for Raw Materials

Raw material supply conditions for particle board plants are mostly the same as those for MDF plants. None of the plants are willing to use *A. mangium* at the moment because of the availability of wood waste (plantation trees are too expensive to use as raw materials of particle board), the tree's heavy weight, and dark color. It is also possible that *A. mangium* can be used in the medium or long term as discussed for MDF, although it is quite difficult to predict when it will be.

4-3-4 Constructing a Particle Board Plant in Northern Sabah

A particle board plant at Pingan Pingan in Pitas is currently in operation. It uses wood waste coming from its own timber processing complex in the same area. Products are reloaded to ships offshore from barges and shipped mainly to West Malaysia.

The biggest factor that will prevent SAFODA from having its own particle board plant is the price of wood materials. The current low product price does not allow for the purchase of plantation logs, even at the break-even price. Constructing a particle board plant close to tree plantation areas will become an advantage only when wood waste from natural logs becomes scarce.

4-4 Pulp and Paper

4-4-1 Demand and Supply of Pulp and Paper

Pulp and paper mills are currently the biggest users of wood chips. The demand for paper is expected to increase as the world economy grows. The following table shows the worldwide demand forecast for paper in 2010 by the FAO.

Table III-41 Demand Forecast of Paper in 2010 (million tons)

Region / Country	Demand in 1993	Share (%)	Demand in 2010	Share (%)	Annual Growth Rate
World Total	252.2	100	479.2	100	3.8
North America	87.9	35	135.1	28	2.6
Europe	69.7	28	120.5	25	3.3
Asia	74.4	30	183.3	38	5.4
Korea	5.6	2	16.5	3	6.5
China	25.9	10	71.8	15	6.2
ASEAN (10 countries)	6.6	26	15.8	33	5.3
Indonesia	2.1	1	4.1	1	3.9
Thailand	1.8	1	4.3	1	5.4
Malaysia	1.2	1	4.2	1	7.5

Source: FAO, 1995

While most developed countries producing pulp self-supply wood chips, Japan is the biggest importer of wood chips in the world. The following table shows the production of wood pulp and import volume of wood chips/particles for major countries/regions in 1994.

Table III-42 Production of Wood Pulp and Import Volume of Wood Chips/Particles of Major Countries/Regions in 1994('000 m^3)

Region / Country	Production of wood pulp	Import Amount of Wood Chips/Particles
North and Central America	84,694	1,697
U.S.A.	59,824	551
Canada	24,703	1,143
South America	8,754	2
Asia	17,166	25,066
Japan	10,575	23,194
China	2,704	716
South Korea	532	932
Europe	36,460	6,189
Finland	10,054	518
France	2,791	960
Germany	1,957	186
Sweden	10,416	729
Other Regions	8,294	6
Total	155,368	32,960

Source: FAO Yearbook Forest Products, 1996

The demand for pulp in Japan is expected to continue growing, although at a gradual pace. The demand for wood chips will also continue to increase since Japan depends on imports for roughly 65% of the wood chips necessary for pulp production. The characteristics of the Japanese wood chip market will be discussed in section 4-4-3.

4-4-2 Pulp and Paper Plant in Malaysia

Sabah Forest Industries (SFI) is the only pulp and paper mill currently operating in Malaysia. According to MTIB, there are three paper production companies which utilize recycled fiber. Total production of paper in Malaysia was 678,200 m.t. in 1995, while consumption was 1,855,000 m.t. The balance was imported from foreign countries.

The following is the profile of Sabah Forest Industries (SFI):

a. Location: Sipitang.
b. Commercial Operations Started: January 1988.
c. Plant Capacity: 150,000 t/year.
d. Current Production: 150,000 t/year.
e. Total Investment: US$ 335.2 million.
f. Shareholders: Lion Group (80%), Sabah State (20%).
g. Major Loans: Exim banks in Canada, West Germany and Austria, totaling RM 546.6 million.
h. Raw Material: Using wood in its allocated forest area (291,834ha) and *A. mangium* wood (5～10% of wood chips) are supplied from a 30 to 120 km range.
i. Plantation area: Currently 12,000 ha. 10,000 ha (mixed plantation for *A. mangium*, Maraena, *Eucalyptus*, etc.) is planned to be extended every year.
j. Market : 60% West Malaysia, 40% foreign countries, mainly Asia.
k. Shipping port: From its own jetty.
l. Product: Writing and printing paper.
m. Other information: Currently planning to increase its capacity (size and products unknown).

The following tables show the evolution of pulp and paper production in Sabah and the volume and FOB price of paper exported from SFI by country of destination:

Table III-43 SFI's Pulp and Paper Production

Year	Pulp (BDT)	Paper (m.t.)
1990	93,723	126,731
1991	74,719	100,606
1992	98,119	126,109
1993	88,086	112,722
1994	103,160	142,331
1995	105,624	147,421

Source: Forestry Department, Sabah
Note: BDT means Born Dry Ton.

Table III-44 Volume and FOB Price of Paper Exported from Sabah

Country	1993	1994	1995	Total
Vol (m.t.)				
P. Malaysia	—	64,852	59,762	124,614
Singapore	13,611	23,172	22,114	58,897
Hong Kong	10,117	15,223	13,544	38,884
Egypt	14,519	5,942	6,956	27,417
Thailand	7,277	12,673	6,056	26,006
Indonesia	4,183	8,553	3,064	15,800
Taiwan	224	2,843	6,875	9,942
Philippines	2,918	2,762	875	6,555
Iran	—	—	6,292	6,292
Vietnam	882	1,355	550	2,787
Sarawak	—	720	1,003	1,723
Bangladesh	1,114	—	494	1,608
Cambodia	—	298	472	770
Australia	147	294	—	441
Kuwait	—	363	—	363
China	149	149	—	298
Others	9,724	415	193	10,332
Total Export (m.t.)	55,406	139,614	128,250	323,270
Total FOB (RM '000)	83,740	209,706	314,277	607,724
Ave. Unit Price (RM / m.t.)	1,291	1,502	2,451	—

Source: Forestry Department, Sabah

SAFODA once sold *A. mangium* to SFI in 1988 at a low price, RM 25 /m^3. It is unlikely that SFI will need SAFODA's *A. mangium* in the future because SFI holds an ample forest area capable of providing a large and constant supply amount of either natural wood or plantation wood.

4-4-3 Raw Material (Wood) Supply Conditions

Since Japan is the biggest importer of wood chips in the world, it is worthwhile to examine the raw material supply situation of the Japanese market.

The share of imported hardwood in the Japanese wood chip market is increasing significantly. Since 1989, it has represented the biggest share of pulp wood in Japan and the share is still growing. The following graph shows the evolution of pulp wood consumption in Japan.

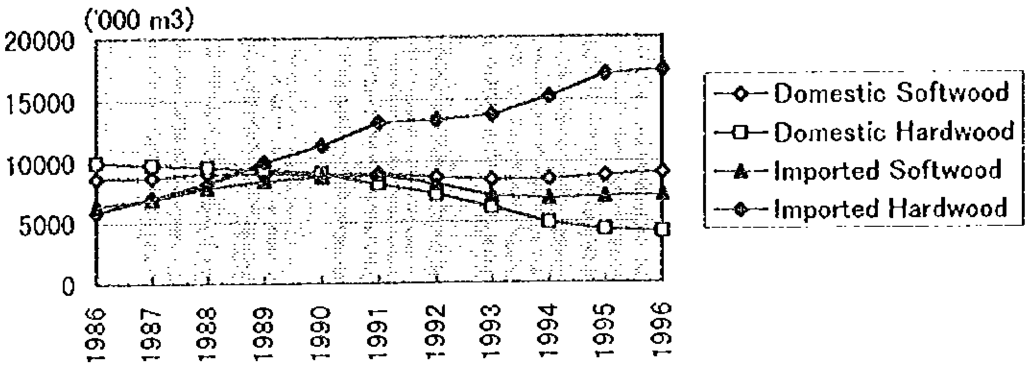


Fig. III-12 Evolution of Pulp Wood Consumption in Japan

Source: Ministry of Trade and Industry, Japan

Japan has diversified its sources of wood chip supply. Australia's share of the supply decreased from 61% in 1987 to 23% in 1996, while the U.S7s supply increased from 14% in 1987 to 35% in 1996. Japan is also currently importing wood chips from Brazil, Thailand, Indonesia, Vietnam, Argentina, and other countries. The following graph shows the share of wood chip import volume from major provenance countries.

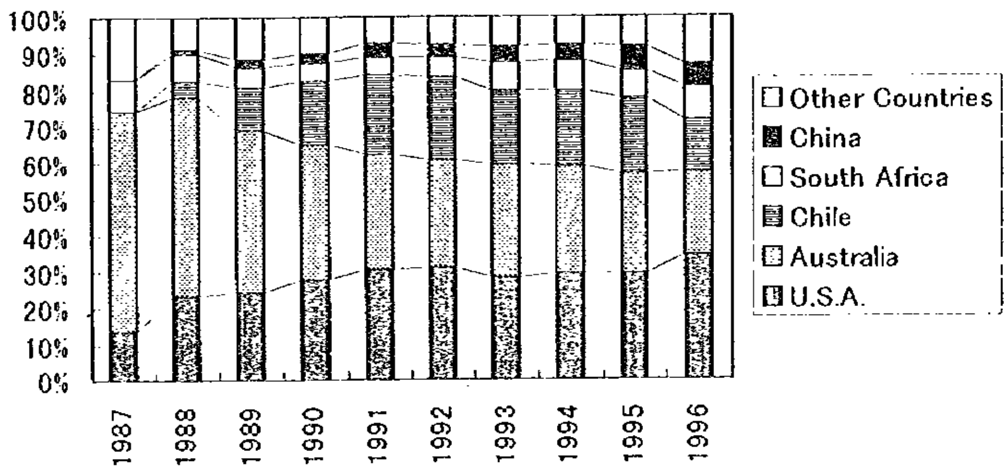


Fig. III-13 Share of Import Volume of Hardwood Chips from Major Provenance Countries.

Source: Custom Statistics, Ministry of Finance

Japanese CIF price of hardwood chips denominated in US dollars (weighted average) has been stable or rising since 1986, as the graph below shows. It increased from US$ 105 /BDT (Bone Dry Ton) in 1986 to US$ 164 /BDT in 1995. It should be noted, however, that the price of wood chips varies significantly depending on species and conditions of trade such as quantity of shipment.

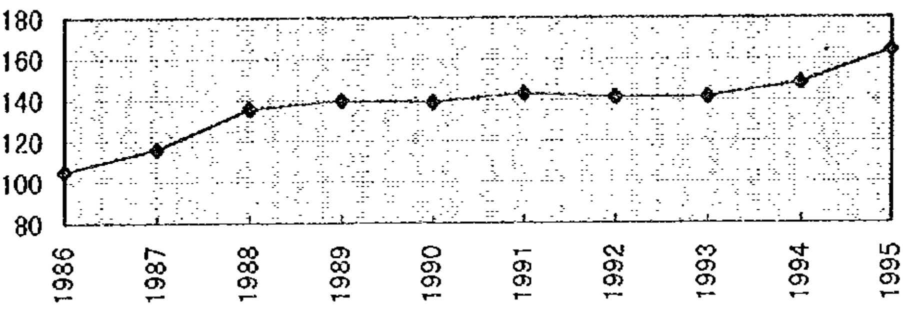


Fig. III-14 Japanese CIF Price (US$/BDT) of Imported Hardwood Chips (Weighted Average)

Source: Monthly Trade Statistics, Ministry of Finance, Japan

4-4-4 Possibility to Supply A. mangium for Raw Materials

In the case of pulp and paper plants, it is not necessary for the supply base of wood chips to be located close to the mills. The most important factors that determine wood chip supply sources for a pulp and paper plant are that 1) a large volume of wood chips is supplied on a regular basis; 2) the species of the tree is suitable for the paper; and 3) the log price, the chipping cost and the operating costs of other facilities are low enough to support the shipment of wood chips at a competitive FOB price. The shipping distance between the plant and the supply base is not a major factor, as long as the above factor 3) is attainable.

A. mangium is proved to be suitable as pulp material. To ship wood chips from northern Sabah to Japan would be a viable option, since the Japanese hardwood chip market is expanding. As a matter of fact, a shipping arrangement of *A. mangium* has already been made between a Japanese trading company and SSSB, whereby 5,000 BDT of wood chips will be transported to Japan every month from summer 1997. The problem with the Bengkoka and Marak Parak areas, however, is that there are currently no shipping facilities for chips in northern Sabah. To solve this problem, the following options are conceivable:

Option (a) Construct a special jetty. Efficient chip loading requires a special jetty equipped with a belt conveyor. An engineering study must be conducted to determine the best location for the jetty (a depth of at least 11 m is needed for a ship with 7,000t) and the construction costs. It is ideal if the loading point is close to SAFODA'S biggest plantation area, Bengkoka, to minimize transport costs of logs or chips, since the volume of logs to be shipped from Bengkoka would be large enough to bear the capital costs. If the jetty were constructed at another location, wood chips from Bengkoka would have to be either transported by barge and unloaded at a chip yard, from where they would be carried into the ship by belt conveyor or reloaded directly to the ship from barges, as Option (b) describes. Loading would be, to some extent, inefficient in these cases.

Option (b) Reload chips offshore from barges. Another possibility is that the chip ship stays offshore where wood chips are reloaded from barges. This procedure will be implemented by SSSB in Tawau. Capital costs in this option are relatively low, since only barges and tugboats are needed. However, reloading of wood chips is a cumbersome process and handling costs will be higher than the direct shipment from a chip yard because of an increase in shipment lay time.

Option (a) will need more capital expenditure than Option (b), but operating costs for

Option (b) will be higher than those for Option (a). In either case, financing has to be sought; SAFODA should either find joint financiers for the construction of the jetty, borrow money from banks, or issue debenture stock.

4-4-5 Construct a Pulp and Paper Plant in Northern Sabah

The following are the major problems in this option.

① Capital Requirement Even a decade ago, SFI's pulp and paper mill required US $335 million investment, including the infrastructure construction cost. It is extremely difficult to raise such a huge sum. Moreover, the capacity of pulp and paper mills nowadays in the world is over 500,000 tons per year. Small mills cannot compete with large mills in terms of economies of scale. Construction of infrastructure will also impose a heavy burden on the new plant.

② Supply of Wood Chips Suppose the capacity of the pulp and paper plant is 150,000 tons per year, which is the same size as SFI's plant. The plant needs around 450,000 m^3 wood per year, which requires a 23,000 ha plantation area with an MAI (Mean Annual Increment) of 20 m^3 / ha. Because SAFODA's plantation areas are rather scattered and thus unable to supply this volume of wood at a reasonable price, the plant will have to import wood chips from abroad. As a result, it is not justifiable to build such a plant in northern Sabah, except with the politically motivated intention to promote economic growth in this undeveloped area.

4-5 Blockboard

4-5-1 Demand and Supply of Blockboard

In Malaysia, blockboard is produced mainly in Sabah. Although there are no detailed data available for blockboard production, the total 1995 export of blockboard in Sabah was 116,000 m^3, and 6,400m^3 in West Malaysia. Most of the products are shipped to Taiwan and Japan. The following graphs show the export and FOB price of blockboard from Sabah. The export volume fluctuates due to the infrequency of shipments resulting from the relatively small size of the market. The price of blockboard is slightly higher than MDF.

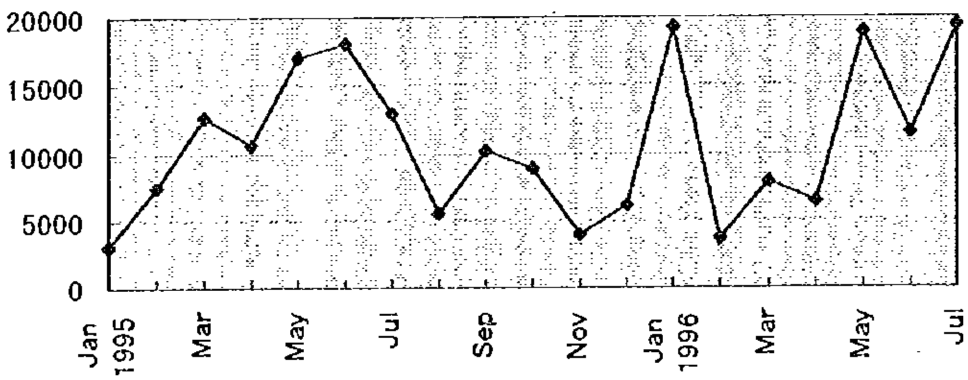


Fig. III-15 Export Volume of Blockboard (m^3) from Sabah

Source: Malaysian Timber Industry Board

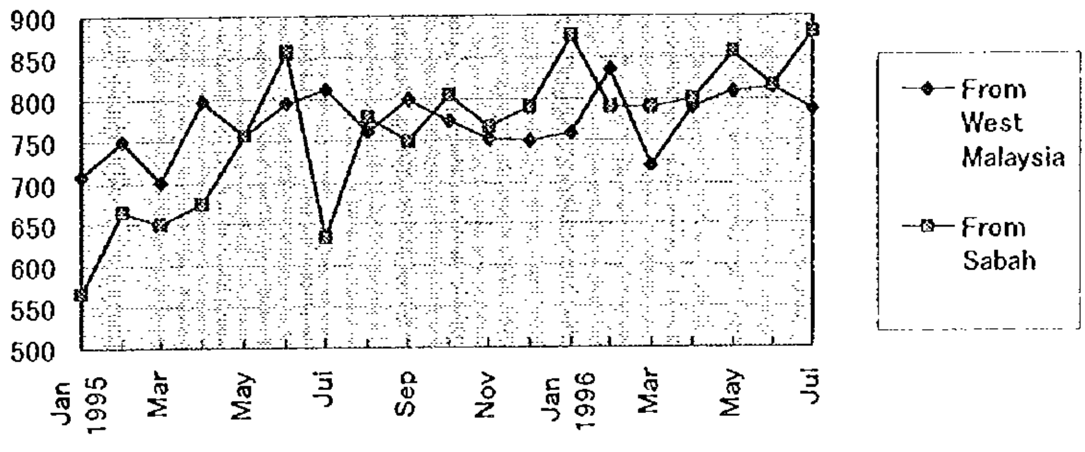


Fig. III-16 Blockboard FOB Price (RM thousand / m³)

Source: Malaysian Timber Industry Board

4-5-2 Blockboard Plants Operating in Sabah

The study team identified five blockboard plants in Sandakan (Sinora, Yung Chen) and Tawau (Ladalam, Salimponpon, Tawau Plywood) which are using solely *P. falcataria* or a mixture of *P. falcataria* and other species. The total production of the five blockboard plants is currently 17,000 m^3 per month. The overall recovery rate is 40% to 50%.

4-5-3 Raw Material (Wood) Supply Conditions

SSSB is providing a total of 9,000 m^3 to 9,500 m^3 of *P. falcataria* per month to the above-mentioned blockboard plants. FOB Prices of *P. falcataria* at SSSB in Tawau are most typically:

Diameter 15 - 19 cm	US$ 25 - 32 / m^3
Diameter 21 -39 cm	US$ 35 - 48 / m^3
Diameter > 40 cm	US$ 51 - 55 / m^3

The voluime of *P. falcataria* trees in SSSB is not large enough for all the blockboard plants. Yung Chen Wood Industry is transporting 2,000 m^3 / month of *P. falcataria* from Kota Marudu. Salimponpon is also transporting *P. falcataria* from Kudat. These companies pay higher prices for *P. falcataria* in northern Sabah than those for *P. falcataria* from SSSB. The FOB prices for northern Sabah's *P. falcataria* that the plants pay are approximately:

Diameter 15 - 25 cm	RM 125 / m^3
Diameter > 25 cm	RM 145 / m^3

Transportation cost from Kota Marudu to Sandakan by barge is RM 28 / m^3, while the cost from SSSB in Tawau to Sandakan is RM 18 / m^3.

4-6 Conclusions

Exporting this species in chip form to a pulp and paper plant in Japan is the most reasonable option since it is an excellent material for pulp. *A. mangium*'s disadvantages - dark color and heavy weight - will be stressed if it is used for MDF or particle board. Owning an

MDF, particle board or pulp and paper mill is not recommendable from the financial point of view. If the JV company chooses to manufacture such products, it will suffer great financial losses due to the poor infrastructure in the region. Instead, SAFODA should continue to be a supplier of plantation trees. This is the best strategy to make SAFODA's business steady and profitable like other plantation companies in the world.

With regard to *P. falcataria,* since each of blockboard plants showed their strong interest in buying this species in northern Sabah and the marketability of blockboard is quite good, the marketing strategy for *P. falcataria* should target these blockboard plants.

Chapter IV Project Evaluation

1. Basis for Financial Analysis

1-1 Framework of Financial Analysis

Financial analysis for the project was performed on two cases, Forestry Development Plan (A) and Forestry Development Plan (B). For the small-scale plantation program under (A), incremental cash flow was evaluated. In each case, the present values of costs and profits as of January 1998 that occur in different time periods were compared. Financial analysis was conducted for the plantation activities of *A. mangium* and *P. falcataria*, while enrichment planting was excluded from the financial analysis since it does not generate revenue. The project costs are composed of nursery production, infrastructure construction and maintenance, planting, fire protection, harvest and transportation, administration, and training. Planting is assumed to continue for 24 years, while harvesting will be started from the 10th year for *A. mangium* and from the 13th year for *P. falcataria*. *A. mangium* and *P. falcataria* harvesting will be completed in years 33 and 36, respectively.

1-2 Selling Price of *A. mangium* and *P. falcataria*

As is described in Section 3 of Chapter III, *A. mangium* will be sold to the Japanese market in chip form. Chipping facilities and shipping equipment for *A. mangium* are assumed to be prepared in the Bengkoka plantation scheme, while part of depreciation and operation costs are to be borne by the Marak Parak plantation scheme.

The price of *A. mangium* was estimated in the following fashion:

<u>FOB Price</u>

A. mangium's FOB price is not known since no market exists so far for *A. mangium*. The FOB price of Australian eucalyptus chip price was used as a proxy of *A. mangium* chip price since the performance of these two species as pulp material is reported to be similar (for details, see "The Master Plan Study for Forest Plantation Development in Northern Sabah in Malaysia", Japan International Cooperation Agency). The FOB price of Australian eucalyptus chips exported to Japan was A$(Australian Dollar) 152 per BDT (Bone Dry Ton) between January and June 1997, which is equivalent to US$ 118 at the average exchange rate in the first quarter of 1997.

<u>Chipping and Loading Costs</u>

The chipping and loading costs were calculated based on empirical figures from Thailand. In 1990, the chipping cost was reported to be US$16 /BDT and the loading cost US$10 /BDT in Thailand. Considering higher labor costs in Malaysia, higher loading cost due to the reloading of chips, and the price increase since 1990, US$22 /BDT was applied for the chipping cost and US$14 /BDT for the loading cost (see Attachment 35 for details).

Log Price at the Mill

Based on the above assumptions, the log price at the mill was estimated as follows:

FOB Price	US$ 118 /BDT
- Loading Cost	(US$ 14 /BDT)
- Chipping Cost	(US$ 22 /BDT)
- Chipping Loss (8%)	(US$ 7 /BDT)
Balance	US$ 75 /BDT

Since volumetric weight is 420 kg/m^3, the *A. mangium* log price at the mill of is US$ 31.5 /m^3, which is approximately equivalent to RM 80/m^3 at an exchange rate of RM 2.53 /US$ (as of January 1997).

P. falcataria is assumed to be sold to a blockboard mill in Tawau or Sandakan. As is discussed in Chapter III (5-5-3), the scarcity of the species has increased its on-barge price from northern Sabah to as much as RM 125 /m^3. The study applied this price for *P. falcataria* from the Marak Parak plantation.

1-3 Contingency Allowances

For price contingencies, an annual price increase of 3.6 percent has been used for the project cost from 1998 to 2007, which is the average of consumer price increase from 1993 to 1996 in Malaysia, and 2.8 percent; an expected annual price increase in US Dollars, was used from 2008 through the duration of the project.

On the revenue side, the increase in the weighted average of Japanese wood chip CIF prices, denominated in US dollars, was used as the basis of the increase rate in the *A. mangium* wood chip price. (The study assumed that SAFODA would make transactions in US dollars in order to avoid foreign currency fluctuation, since the Malaysian Ringgit is basically linked to the US dollar.) Since the weighted average increased roughly 5.03% per year on average from 1986 to 1995, the study applied 5.0% per year for the first ten years and 2.8% from Year 11. With regard to *P. falcataria*, an expected annual price increase in the world economy, 2.8% in US Dollars, has been used for the increase in the wood price for the project duration, since the demand and supply of blockboard is not substantial to provide a basis for the reasonable future price projection.

Physical contingencies were estimated at 10 percent for all physical components and harvesting and at 5 percent for administration and operation, vehicles and training.

2. Financial Analysis

2-1 Forestry Development Plan-A

2-1-1 Base Case

The total project costs for the Forestry Development Plan (A) from Year 0 to Year 24 including contingency allowances are RM 198.7 million. A breakdown of the costs is shown in Table IV-1.

In order to assess the financial viability of the project, the cost for the enrichment planting, which represents approximately 2 percent of the total cost, was deducted from the total project costs and the harvesting was extended until Year 36. A breakdown of the costs excluding the enrichment planting is shown in Table IV-2 .

The expected revenues from the sales of *A. mangium* and *P. falcataria* which were calculated based on assumptions of wood price increases mentioned above in Section 1-3. Future cash flow is shown in Table IV-3. Although cost recovery for this project needs significant time and thus the investment risk is high, a 12% rate was applied as the cost of capital for this project. As a result, the project is judged feasible since its Internal Rate of Return (IRR) is 13.9% and Net Present Value (NPV) at a 12% discount rate is RM 5,016,000 (Table IV-4).

Table IV-1 Total Project Costs

Unit: RM 1,000

Year	Roads and Bridges	Other Facilities	Vehicles	Nursery	Planting	Administration	Training	Harvesting	Total	Physical Contingencies	Price Contingencies	Total Costs
0	335	563							898	90	0	988
1	377	3	1,363	343	803	534	18		3,441	248	133	3,822
2	592	3	268	343	878	534	18		2,636	223	210	3,068
3	461	56	268	343	881	559			2,569	216	312	3,097
4	483	3	268	343	881	559			2,538	212	418	3,168
5	461	19	268	343	881	584	18		2,575	214	539	3,328
6	483	3	707	343	881	818			3,235	247	823	4,306
7	461	19	342	343	882	843			2,891	230	877	3,998
8	483	3	342	343	882	843			2,897	230	1023	4,150
9	197	19	1,437	345	885	869			3,751	260	1503	5,515
10	219	3	517	343	883	918		2,675	5,557	484	2563	8,604
11	197	3	371	343	882	918		2,675	5,389	474	2722	8,585
12	197	3	371	343	882	918		2,675	5,389	474	2962	8,826
13	197	3	371	343	881	918		2,953	5,666	502	3376	9,545
14	197	3	736	343	881	918		2,953	6,031	520	3870	10,421
15	197	3	459	343	881	918		2,953	5,754	507	3977	10,237
16	197	3	386	343	881	918		2,953	5,681	503	4211	10,395
17	197	3	1,481	343	881	918		2,953	6,776	558	5339	12,673
18	197	3	532	345	884	918		2,964	5,843	512	4934	11,289
19	197	3	386	343	882	918		2,957	5,686	503	5114	11,303
20	197	3	386	343	882	918		2,957	5,686	503	5430	11,619
21	197	3	386	343	882	918		2,957	5,686	503	5755	11,945
22	197	3	751	343	882	918		2,957	6,051	522	6467	13,039
23	197	3	459	343	882	918		2,957	5,759	507	6513	12,779
24	197	3	386	343	882	918		2,957	5,686	503	6787	12,976
Total	7,311	736	13,238	8,243	21,087	19,910	53	43,495	113,175	9,657	75,856	198,689

Table IV-2 Project Costs excluding Enrichment Planting

Unit: RM 1,000

Year	Roads and Bridges	Other Facilities	Vehicles	Nursery	Planting	Administration	Training	Harvesting	Total	Physical Contingencies	Price Contingencies	Total Costs
0	313	563	0	0	0	0			876	88	0	963
1	355	3	1,309	326	780	512	18		3,303	238	127	3,669
2	570	3	258	326	849	512	18		2,536	214	202	2,952
3	439	56	258	326	849	537			2,465	207	299	2,971
4	461	3	258	326	849	537			2,434	204	401	3,038
5	439	19	258	326	849	561	18		2,470	205	517	3,192
6	461	3	678	326	849	785			3,103	237	790	4,130
7	439	19	328	327	850	810			2,773	220	841	3,834
8	461	3	328	327	850	810			2,778	221	981	3,980
9	175	19	1,379	328	853	834			3,588	248	1,438	5,274
10	197	3	496	327	850	881		2,675	5,429	474	2,504	8,407
11	175	3	356	327	850	881		2,675	5,267	465	2,660	8,392
12	175	3	356	327	850	881		2,675	5,267	465	2,895	8,627
13	175	3	356	326	849	881		2,953	5,544	493	3,304	9,340
14	175	3	707	326	849	881		2,953	5,894	510	3,782	10,187
15	175	3	440	326	849	881		2,953	5,628	497	3,890	10,015
16	175	3	370	326	849	881		2,953	5,558	493	4,120	10,171
17	175	3	1,421	326	849	881		2,953	6,609	546	5,209	12,364
18	175	3	510	329	852	881		2,964	5,714	502	4,826	11,042
19	175	3	370	327	850	881		2,957	5,563	494	5,004	11,060
20	175	3	370	327	850	881		2,957	5,563	494	5,313	11,370
21	175	3	370	327	850	881		2,957	5,563	494	5,632	11,688
22	175	3	721	327	850	881		2,957	5,913	511	6,321	12,745
23	175	3	440	327	850	881		2,957	5,633	497	6,372	12,502
24	175	3	370	327	850	881		2,957	5,563	494	6,641	12,698
25								2,953	2,953	295	3,753	7,001
26								2,953	2,953	295	3,949	7,197
27								2,964	2,964	296	4,165	7,425
28								2,953	2,953	295	4,357	7,606
29								2,953	2,953	295	4,570	7,818
30								2,953	2,953	295	4,789	8,037
31								2,957	2,957	296	5,021	8,273
32								2,957	2,957	296	5,252	8,505
33								2,957	2,957	296	5,491	8,743
34								282	282	28	547	857
35								282	282	28	571	881
36								282	282	28	596	906
Total	6,761	736	12,709	7,837	20,326	19,114	53	70,940	138,476	12,254	117,130	267,860

Table IV-3 Costs, Benefits and Cash Flow

Year	Total Cost (RM 1000)	*A. mangium* Production (1000m^3)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	*P. falcataria* Production (1000m^3)	*P. falcataria* Revenue (RM 1000)	Total Revenue (RM 1000)	Cash Flow (RM 1000)
0	963			80	1.050				-963
1	3,688								-3,688
2	2,972								-2,972
3	2,992								-2,992
4	3,059								-3,059
5	3,215								-3,215
6	4,153								-4,153
7	3,858								-3,858
8	4,005								-4,005
9	5,299								-5,299
10	8,433	107.0	13,943					13,943	5,510
11	8,419	107.0	14,334		1.028			14,334	5,915
12	8,655	107.0	14,735					14,735	6,081
13	9,369	107.0	15,148			12.1	2,166	17,313	7,945
14	10,216	107.0	15,572			12.1	2,226	17,798	7,582
15	10,045	107.0	16,008			12.1	2,289	18,297	8,251
16	10,203	107.0	16,456			12.1	2,353	18,809	8,606
17	12,396	107.0	16,917			12.1	2,419	19,335	6,940
18	11,075	107.4	17,455			12.1	2,486	19,942	8,867
19	11,094	107.0	17,877			12.3	2,598	20,476	9,381
20	11,405	107.0	18,378			12.3	2,671	21,049	9,644
21	11,724	107.0	18,893			12.3	2,746	21,638	9,914
22	12,782	107.0	19,422			12.3	2,823	22,244	9,462
23	12,540	107.0	19,965			12.3	2,902	22,867	10,327
24	12,737	107.0	20,524			12.3	2,983	23,507	10,771
25	7,001	107.0	21,099			12.1	3,017	24,116	17,115
26	7,197	107.0	21,690			12.1	3,101	24,791	17,594
27	7,425	107.4	22,381			12.1	3,188	25,568	18,143
28	7,606	107.0	22,921			12.1	3,277	26,199	18,593
29	7,818	107.0	23,563			12.1	3,369	26,932	19,114
30	8,037	107.0	24,223			12.1	3,463	27,686	19,649
31	8,273	107.0	24,901			12.3	3,619	28,520	20,247
32	8,505	107.0	25,599			12.3	3,720	29,319	20,814
33	8,743	107.0	26,315			12.3	3,825	30,140	21,397
34	857	0.0	0			12.3	3,932	3,932	3,074
35	881	0.0	0			12.3	4,042	4,042	3,160
36	906	0.0	0			12.3	4,155	4,155	3,249
IRR	13.9%								
NPV at 12%	5,016,000								

2-1-2 Sensitivity Analysis

Sensitivity analysis was performed by changing the following parameters:

1) Cost movement at ± 10%
2) Initial wood chip price at +10%, - 10% or -15%
3) Yearly growth rate of wood chip price at 2.8% (same as the inflation rate) or 1.0% (1.75% decrease in real terms)
4) A combination of (2) and (3)

The following table shows the results of the sensitivity analysis, the details of which are given in Tables IV-5 to 12:

Table IV-4 Results of Sensitivity Analysis

	Conditions Changed	IRR	NPV at 12% (RM '000)
Case 1	Base Case	13.9%	5,016
Case 2	Cost - 10%	15.7%	9,245
Case 3	Cost + 10%	12.3%	787
Case 4	Initial Chip Price +10%	15.4%	9,273
Case 5	Initial Chip Price -10%	12.3%	759
Case 6	Initial Chip Price -15%	11.4%	- 1,369
Case 7	Chip Price Increase Rate 2.8%	10.7%	- 3,108
Case 8	Chip Price Increase Rate 1.0%	5.0%	- 12,187
Case 9	Initial Chip Price +10% Chip Price Increase Rate 2.8%	12.1%	337

The exact chip price will not be known until substantial pulp production with *A. mangium* is started. The project will be barely feasible if the real chip price is 10 percent lower than this study's expectation (Case 5). On the other hand, a 10% increase in costs will push the viability of the project down to the marginal point where no more revenue movement downward is allowed (Case 3). The financial viability of the project is also strongly influenced by future price movement of wood chips. The project will be feasible if the wood chip price follows its historical trend for the next ten years or so, namely increasing 5% every year in nominal terms. However, if the chip price increase rate is the same as the expected inflation rate (2.8%), the Net Present Value (NPV) of the project at a 12 percent discount rate will become negative (Case 7). On the other hand, an IRR of higher than 12 percent can be achieved under the same condition if the initial price of wood chips is 10 percent higher than the Study's estimate - RM80 (Case 9). In any case, the transaction price of *A. mangium* between SSSB and a Japanese company should be watched closely. SAFODA should also continue its efforts to collect and examine all information regarding both supply and demand movements of wood chips which seriously affect future prices of plantation trees.

2-2 Small-scale Plantation under the Forestry Development Plan-A

As is mentioned in Chapter III (2-3), the small scale plantation under the Forestry Development Plan (A) does not require additional infrastructure or equipment. The incremental costs, revenues and resulting cash flow for the small-scale plantation are shown in Table IV-13. Since the IRR and NPV at a 12 percent discount rate are 31.4 percent and RM 912,000, respectively, it is financially feasible to promote a small-scale plantation when the large-scale plantation materializes. Moreover, SAFODA will be able to purchase smallholders' *A.*

mangium with attractive prices because of this scheme's high marginal revenues, which is a result of infrastructure costs being borne by large scale plantations. However, it should be noted that the introduction of a small-scale plantation raises the project's IRR only by 0.3%: the size of the small-scale plantation is so modest that it does not affect the feasibility of the total project.

Table IV-5 Sensitivity Analysis: Case 2

Year	Total Cost (RM 1000)	Total Costs - 10 percent (RM 1000)	*A. mangium* Production (1000m^3)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	*P. falcataria* Production (1000m^3)	*P. falcataria* Revenue (RM 1000)	Total Revenue (RM 1000)	Cash Flow (RM 1000)
0	963	867			80	1.050				-867
1	3,688	3,319								-3,319
2	2,972	2,674								-2,674
3	2,992	2,692								-2,692
4	3,059	2,753								-2,753
5	3,215	2,893								-2,893
6	4,153	3,738								-3,738
7	3,858	3,472								-3,472
8	4,005	3,604								-3,604
9	5,299	4,770								-4,770
10	8,433	7,590	107.0	13,943					13,943	6,353
11	8,419	7,577	107.0	14,334		1.028			14,334	6,757
12	8,655	7,789	107.0	14,735					14,735	6,946
13	9,369	8,432	107.0	15,148			12.1	2,166	17,313	8,882
14	10,216	9,194	107.0	15,572			12.1	2,226	17,798	8,604
15	10,045	9,041	107.0	16,008			12.1	2,289	18,297	9,256
16	10,203	9,182	107.0	16,456			12.1	2,353	18,809	9,626
17	12,396	11,156	107.0	16,917			12.1	2,419	19,335	8,179
18	11,075	9,967	107.4	17,455			12.1	2,486	19,942	9,975
19	11,094	9,985	107.0	17,877			12.3	2,598	20,476	10,491
20	11,405	10,264	107.0	18,378			12.3	2,671	21,049	10,785
21	11,724	10,552	107.0	18,893			12.3	2,746	21,638	11,087
22	12,782	11,504	107.0	19,422			12.3	2,823	22,244	10,740
23	12,540	11,286	107.0	19,965			12.3	2,902	22,867	11,581
24	12,737	11,463	107.0	20,524			12.3	2,983	23,507	12,044
25	7,001	6,301	107.0	21,099			12.1	3,017	24,116	17,815
26	7,197	6,477	107.0	21,690			12.1	3,101	24,791	18,314
27	7,425	6,683	107.4	22,381			12.1	3,188	25,568	18,886
28	7,606	6,845	107.0	22,921			12.1	3,277	26,199	19,354
29	7,818	7,037	107.0	23,563			12.1	3,369	26,932	19,896
30	8,037	7,234	107.0	24,223			12.1	3,463	27,686	20,453
31	8,273	7,446	107.0	24,901			12.3	3,619	28,520	21,074
32	8,505	7,655	107.0	25,599			12.3	3,720	29,319	21,664
33	8,743	7,869	107.0	26,315			12.3	3,825	30,140	22,271
34	857	772	0.0	0			12.3	3,932	3,932	3,160
35	881	793	0.0	0			12.3	4,042	4,042	3,248
36	906	816	0.0	0			12.3	4,155	4,155	3,339

IRR	15.7%
NPV at 12%	9,245,000

Table IV-6 Sensitivity Analysis: Case 3

Year	Total Cost (RM 1000)	Total Cost + 10 percent (RM 1000)	*A. mangium* Production (1000m^3)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	*P. falcataria* Production (1000m^3)	*P. falcataria* Revenue (RM 1000)	Total Revenue (RM 1000)	Cash Flow (RM 1000)
0	963	1,060			80	1.050				-1,060
1	3,688	4,057								-4,057
2	2,972	3,269								-3,269
3	2,992	3,291								-3,291
4	3,059	3,365								-3,365
5	3,215	3,536								-3,536
6	4,153	4,568								-4,568
7	3,858	4,243								-4,243
8	4,005	4,405								-4,405
9	5,299	5,829								-5,829
10	8,433	9,277	107.0	13,943					13,943	4,667
11	8,419	9,261	107.0	14,334		1.028			14,334	5,073
12	8,655	9,520	107.0	14,735					14,735	5,215
13	9,369	10,306	107.0	15,148			12.1	2,166	17,313	7,008
14	10,216	11,238	107.0	15,572			12.1	2,226	17,798	6,560
15	10,045	11,050	107.0	16,008			12.1	2,289	18,297	7,247
16	10,203	11,223	107.0	16,456			12.1	2,353	18,809	7,586
17	12,396	13,635	107.0	16,917			12.1	2,419	19,335	5,700
18	11,075	12,182	107.4	17,455			12.1	2,486	19,942	7,760
19	11,094	12,204	107.0	17,877			12.3	2,598	20,476	8,272
20	11,405	12,545	107.0	18,378			12.3	2,671	21,049	8,504
21	11,724	12,896	107.0	18,893			12.3	2,746	21,638	8,742
22	12,782	14,060	107.0	19,422			12.3	2,823	22,244	8,184
23	12,540	13,794	107.0	19,965			12.3	2,902	22,867	9,073
24	12,737	14,010	107.0	20,524			12.3	2,983	23,507	9,497
25	7,001	7,701	107.0	21,099			12.1	3,017	24,116	16,415
26	7,197	7,917	107.0	21,690			12.1	3,101	24,791	16,874
27	7,425	8,168	107.4	22,381			12.1	3,188	25,568	17,400
28	7,606	8,366	107.0	22,921			12.1	3,277	26,199	17,833
29	7,818	8,600	107.0	23,563			12.1	3,369	26,932	18,332
30	8,037	8,841	107.0	24,223			12.1	3,463	27,686	18,845
31	8,273	9,101	107.0	24,901			12.3	3,619	28,520	19,420
32	8,505	9,356	107.0	25,599			12.3	3,720	29,319	19,963
33	8,743	9,617	107.0	26,315			12.3	3,825	30,140	20,522
34	857	943	0.0	0			12.3	3,932	3,932	2,988
35	881	970	0.0	0			12.3	4,042	4,042	3,072
36	906	997	0.0	0			12.3	4,155	4,155	3,158
IRR		12.3%								
NPV at 12%		787,000								

Table IV-7 Sensitivity Analysis: Case 4

Year	Total Cost (RM 1000)	*A. mangium* Production (1000m^3)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	*P. falcataria* Production (1000m^3)	*P. falcataria* Revenue (RM 1000)	Total Revenue (RM 1000)	Cash Flow (RM 1000)
0	963			88	1.050				-963
1	3,688								-3,688
2	2,972								-2,972
3	2,992								-2,992
4	3,059								-3,059
5	3,215								-3,215
6	4,153								-4,153
7	3,858								-3,858
8	4,005								-4,005
9	5,299								-5,299
10	8,433	107.0	15,338					15,338	6,904
11	8,419	107.0	15,767		1.028			15,767	7,348
12	8,655	107.0	16,209					16,209	7,554
13	9,369	107.0	16,662			12.1	2,166	18,828	9,459
14	10,216	107.0	17,129			12.1	2,226	19,355	9,139
15	10,045	107.0	17,609			12.1	2,289	19,897	9,852
16	10,203	107.0	18,102			12.1	2,353	20,454	10,252
17	12,396	107.0	18,608			12.1	2,419	21,027	8,632
18	11,075	107.4	19,201			12.1	2,486	21,687	10,613
19	11,094	107.0	19,665			12.3	2,598	22,263	11,169
20	11,405	107.0	20,216			12.3	2,671	22,887	11,482
21	11,724	107.0	20,782			12.3	2,746	23,528	11,804
22	12,782	107.0	21,364			12.3	2,823	24,186	11,404
23	12,540	107.0	21,962			12.3	2,902	24,864	12,324
24	12,737	107.0	22,577			12.3	2,983	25,560	12,823
25	7,001	107.0	23,209			12.1	3,017	26,226	19,225
26	7,197	107.0	23,859			12.1	3,101	26,960	19,763
27	7,425	107.4	24,619			12.1	3,188	27,807	20,381
28	7,606	107.0	25,214			12.1	3,277	28,491	20,885
29	7,818	107.0	25,920			12.1	3,369	29,289	21,470
30	8,037	107.0	26,645			12.1	3,463	30,109	22,071
31	8,273	107.0	27,391			12.3	3,619	31,011	22,737
32	8,505	107.0	28,158			12.3	3,720	31,879	23,374
33	8,743	107.0	28,947			12.3	3,825	32,771	24,028
34	857	0.0	0			12.3	3,932	3,932	3,074
35	881	0.0	0			12.3	4,042	4,042	3,160
36	906	0.0	0			12.3	4,155	4,155	3,249
IRR		15.4%							
NPV at 12%		9,273,000							

Table IV-8 Sensitivity Analysis: Case 5

Year	Total Cost (RM 1000)	*A. mangium* Production (1000m^3)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	*P. falcataria* Production (1000m^3)	*P. falcataria* Revenue (RM 1000)	Total Revenue (RM 1000)	Cash Flow (RM 1000)
0	963			72	1.050				-963
1	3,688								-3,688
2	2,972								-2,972
3	2,992								-2,992
4	3,059								-3,059
5	3,215								-3,215
6	4,153								-4,153
7	3,858								-3,858
8	4,005								-4,005
9	5,299								-5,299
10	8,433	107.0	12,549					12,549	4,116
11	8,419	107.0	12,900		1.028			12,900	4,482
12	8,655	107.0	13,262					13,262	4,607
13	9,369	107.0	13,633			12.1	2,166	15,799	6,430
14	10,216	107.0	14,015			12.1	2,226	16,241	6,025
15	10,045	107.0	14,407			12.1	2,289	16,696	6,651
16	10,203	107.0	14,810			12.1	2,353	17,163	6,961
17	12,396	107.0	15,225			12.1	2,419	17,644	5,248
18	11,075	107.4	15,710			12.1	2,486	18,196	7,122
19	11,094	107.0	16,090			12.3	2,598	18,688	7,594
20	11,405	107.0	16,540			12.3	2,671	19,211	7,807
21	11,724	107.0	17,003			12.3	2,746	19,749	8,025
22	12,782	107.0	17,479			12.3	2,823	20,302	7,520
23	12,540	107.0	17,969			12.3	2,902	20,871	8,331
24	12,737	107.0	18,472			12.3	2,983	21,455	8,718
25	7,001	107.0	18,989			12.1	3,017	22,006	15,005
26	7,197	107.0	19,521			12.1	3,101	22,622	15,425
27	7,425	107.4	20,142			12.1	3,188	23,330	15,905
28	7,606	107.0	20,629			12.1	3,277	23,907	16,301
29	7,818	107.0	21,207			12.1	3,369	24,576	16,757
30	8,037	107.0	21,801			12.1	3,463	25,264	17,227
31	8,273	107.0	22,411			12.3	3,619	26,030	17,757
32	8,505	107.0	23,039			12.3	3,720	26,759	18,254
33	8,743	107.0	23,684			12.3	3,825	27,508	18,765
34	857	0.0	0			12.3	3,932	3,932	3,074
35	881	0.0	0			12.3	4,042	4,042	3,160
36	906	0.0	0			12.3	4,155	4,155	3,249
IRR		12.3%							
NPV at 12%		759,000							

Table IV-9 Sensitivity Analysis: Case 6

Year	Total Cost (RM 1000)	*A. mangium* Production (1000m³)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	*P. falcataria* Production (1000m³)	*P. falcataria* Revenue (RM 1000)	Total Revenue (RM 1000)	Cash Flow (RM 1000)
0	963			68	1.050				-963
1	3,688								-3,688
2	2,972								-2,972
3	2,992								-2,992
4	3,059								-3,059
5	3,215								-3,215
6	4,153								-4,153
7	3,858								-3,858
8	4,005								-4,005
9	5,299								-5,299
10	8,433	107.0	11,852					11,852	3,418
11	8,419	107.0	12,184		1.028			12,184	3,765
12	8,655	107.0	12,525					12,525	3,870
13	9,369	107.0	12,876			12.1	2,166	15,041	5,673
14	10,216	107.0	13,236			12.1	2,226	15,462	5.246
15	10,045	107.0	13,607			12.1	2,289	15,895	5,850
16	10,203	107.0	13,988			12.1	2,353	16,340	6,138
17	12,396	107.0	14,379			12.1	2,419	16,798	4,402
18	11,075	107.4	14,837			12.1	2,486	17,324	6,249
19	11,094	107.0	15,196			12.3	2,598	17,794	6,700
20	11,405	107.0	15,621			12.3	2,671	18,292	6,888
21	11,724	107.0	16,059			12.3	2,746	18,804	7,081
22	12,782	107.0	16,508			12.3	2,823	19,331	6,549
23	12,540	107.0	16,971			12.3	2,902	19,872	7,333
24	12,737	107.0	17,446			12.3	2,983	20,429	7.692
25	7,001	107.0	17,934			12.1	3,017	20,951	13,950
26	7,197	107.0	18,436			12.1	3,101	21,537	14.341
27	7,425	107.4	19,023			12.1	3,188	22,211	14,786
28	7,606	107.0	19,483			12.1	3,277	22,760	15,155
29	7,818	107.0	20,029			12.1	3,369	23,398	15,579
30	8,037	107.0	20,590			12.1	3,463	24,053	16,015
31	8,273	107.0	21,166			12.3	3,619	24,785	16,512
32	8,505	107.0	21,759			12.3	3,720	25,479	16,974
33	8,743	107.0	22,368			12.3	3,825	26,193	17,449
34	857	0.0	0			12.3	3,932	3,932	3,074
35	881	0.0	0			12.3	4,042	4,042	3,160
36	906	0.0	0			12.3	4,155	4,155	3.249

IRR 11.4%

NPV at 12% -1,369,000

Table IV-10 Sensitivity Analysis: Case 7

Year	Total Cost (RM 1000)	*A. mangium* Production (1000m³)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	*P. falcataria* Production (1000m³)	*P. falcataria* Revenue (RM 1000)	Total Revenue (RM 1000)	Cash Flow (RM 1000)
0	963			80	1.028				-963
1	3,688								-3,688
2	2,972								-2,972
3	2,992								-2,992
4	3,059								-3,059
5	3,215								-3,215
6	4,153								-4,153
7	3,858								-3,858
8	4,005								-4,005
9	5,299								-5,299
10	8,433	107.0	11,282					11,282	2,849
11	8,419	107.0	11,598		1.028			11,598	3,180
12	8,655	107.0	11,923					11,923	3,269
13	9,369	107.0	12,257			12.1	2,166	14,423	5,054
14	10,216	107.0	12,600			12.1	2,226	14,827	4,610
15	10,045	107.0	12,953			12.1	2,289	15,242	5,197
16	10,203	107.0	13,316			12.1	2,353	15,668	5,466
17	12,396	107.0	13,689			12.1	2,419	16,107	3,712
18	11,075	107.4	14,124			12.1	2,486	16,611	5,536
19	11,094	107.0	14,466			12.3	2,598	17,064	5,970
20	11,405	107.0	14,871			12.3	2,671	17,542	6,137
21	11,724	107.0	15,287			12.3	2,746	18,033	6,309
22	12,782	107.0	15,715			12.3	2,823	18,538	5,756
23	12,540	107.0	16,155			12.3	2,902	19,057	6,517
24	12,737	107.0	16,608			12.3	2,983	19,591	6,854
25	7,001	107.0	17,073			12.1	3,017	20,089	13,088
26	7,197	107.0	17,551			12.1	3,101	20,652	13,455
27	7,425	107.4	18,110			12.1	3,188	21,298	13,872
28	7,606	107.0	18,547			12.1	3,277	21,825	14,219
29	7,818	107.0	19,067			12.1	3,369	22,436	14,617
30	8,037	107.0	19,601			12.1	3,463	23,064	15,026
31	8,273	107.0	20,149			12.3	3,619	23,768	15,495
32	8,505	107.0	20,713			12.3	3,720	24,434	15,929
33	8,743	107.0	21,293			12.3	3,825	25,118	16,375
34	857	0.0	0			12.3	3,932	3,932	3,074
35	881	0.0	0			12.3	4,042	4,042	3,160
36	906	0.0	0			12.3	4,155	4,155	3,249
IRR		10.7%							
NPV at 12%		-3,108,000							

Table IV-11 Sensitivity Analysis: Case 8

Year	Total Cost (RM 1000)	*A. mangium* Production (1000m³)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	*P. falcataria* Production (1000m³)	*P. falcataria* Revenue (RM 1000)	Total Revenue (RM 1000)	Cash Flow (RM 1000)
0	963			80	1.010				-963
1	3,688								-3,688
2	2,972								-2,972
3	2,992								-2,992
4	3,059								-3,059
5	3,215								-3,215
6	4,153								-4,153
7	3,858								-3,858
8	4,005								-4,005
9	5,299								-5,299
10	8,433	107.0	9,456					9,456	1,022
11	8,419	107.0	9,550		1.010			9,550	1,131
12	8,655	107.0	9,646					9,646	991
13	9,369	107.0	9,742			12.1	2,166	11,908	2,539
14	10,216	107.0	9,839			12.1	2,226	12,066	1,850
15	10,045	107.0	9,938			12.1	2,289	12,227	2,182
16	10,203	107.0	10,037			12.1	2,353	12,390	2,187
17	12,396	107.0	10,138			12.1	2,419	12,556	161
18	11,075	107.4	10,277			12.1	2,486	12,764	1,689
19	11,094	107.0	10,341			12.3	2,598	12,940	1,845
20	11,405	107.0	10,445			12.3	2,671	13,116	1,711
21	11,724	107.0	10,549			12.3	2,746	13,295	1,571
22	12,782	107.0	10,655			12.3	2,823	13,477	695
23	12,540	107.0	10,761			12.3	2,902	13,663	1,123
24	12,737	107.0	10,869			12.3	2,983	13,852	1,115
25	7,001	107.0	10,978			12.1	3,017	13,994	6,993
26	7,197	107.0	11,087			12.1	3,101	14,188	6,992
27	7,425	107.4	11,240			12.1	3,188	14,428	7,003
28	7,606	107.0	11,310			12.1	3,277	14,587	6,982
29	7,818	107.0	11,423			12.1	3,369	14,792	6,974
30	8,037	107.0	11,538			12.1	3,463	15,001	6,963
31	8,273	107.0	11,653			12.3	3,619	15,272	6,999
32	8,505	107.0	11,769			12.3	3,720	15,490	6,985
33	8,743	107.0	11,887			12.3	3,825	15,712	6,969
34	857	0.0	0			12.3	3,932	3,932	3,074
35	881	0.0	0			12.3	4,042	4,042	3,160
36	906	0.0	0			12.3	4,155	4,155	3,249
IRR									
NPV at 12%									

Table IV-12 Sensitivity Analysis: Case 9

Year	Total Cost (RM 1000)	*A. mangium* Production (1000m³)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	*P. falcataria* Production (1000m³)	*P. falcataria* Revenue (RM 1000)	Total Revenue (RM 1000)	Cash Flow (RM 1000)
0	963			88	1.028				-963
1	3,688								-3,688
2	2,972								-2,972
3	2,992								-2,992
4	3,059								-3,059
5	3,215								-3,215
6	4,153								-4,153
7	3,858								-3,858
8	4,005								-4,005
9	5,299								-5,299
10	8,433	107.0	12,411					12,411	3,977
11	8,419	107.0	12,758		1.028			12,758	4,339
12	8,655	107.0	13,115					13,115	4,461
13	9,369	107.0	13,483			12.1	2,166	15,648	6,280
14	10,216	107.0	13,860			12.1	2,226	16,087	5,871
15	10,045	107.0	14,248			12.1	2,289	16,537	6,492
16	10,203	107.0	14,647			12.1	2,353	17,000	6,797
17	12,396	107.0	15,057			12.1	2,419	17,476	5,080
18	11,075	107.4	15,537			12.1	2,486	18,023	6,949
19	11,094	107.0	15,912			12.3	2,598	18,511	7,416
20	11,405	107.0	16,358			12.3	2,671	19,029	7,624
21	11,724	107.0	16,816			12.3	2,746	19,562	7,838
22	12,782	107.0	17,287			12.3	2,823	20,110	7,327
23	12,540	107.0	17,771			12.3	2,902	20,673	8,133
24	12,737	107.0	18,268			12.3	2,983	21,251	8,515
25	7,001	107.0	18,780			12.1	3,017	21,797	14,796
26	7,197	107.0	19,306			12.1	3,101	22,407	15,210
27	7,425	107.4	19,921			12.1	3,188	23,108	15,683
28	7,606	107.0	20,402			12.1	3,277	23,679	16,074
29	7,818	107.0	20,973			12.1	3,369	24,342	16,524
30	8,037	107.0	21,561			12.1	3,463	25,024	16,986
31	8,273	107.0	22,164			12.3	3,619	25,783	17,510
32	8,505	107.0	22,785			12.3	3,720	26,505	18,000
33	8,743	107.0	23,423			12.3	3,825	27,247	18,504
34	857	0.0	0			12.3	3,932	3,932	3,074
35	881	0.0	0			12.3	4,042	4,042	3,160
36	906	0.0	0			12.3	4,155	4,155	3,249
IRR		12.1%							
NPV at 12%		337,000							

Table IV-13 Small-Scale Plantation: Incremental Revenues and Cash Flow

Year	Nursery (RM 1000)	Planting (RM 1000)	Harvesting (RM 1000)	Total Cost (RM 1000)	*A. mangium* Production (1000m³)	*A. mangium* Revenue (RM 1000)	Incremental Cash Flow (RM 1000)
0	0	0		0			0
1	10	23.4		33			-33
2	10	25.4		35			-35
3	10	25.4		35			-35
4	10	25.4		35			-35
5	10	25.4		35			-35
6	10	25.4		35			-35
7	10	25.4		35			-35
8	10	25.4		35			-35
9	9	24.4		33			-33
10	10	25.4	86	121	3.5	450	329
11	10	25.4	86	121	3.5	463	342
12	10	25.4	86	121	3.5	476	355
13	10	25.4	86	121	3.5	489	368
14	10	25.4	86	121	3.5	503	382
15	10	25.4	86	121	3.5	517	396
16	10	25.4	86	121	3.5	532	410
17	10	25.4	86	121	3.5	546	425
18	9	24.4	83	116	3.3	538	422
19	10	25.4	86	121	3.5	577	456
20	10	25.4	86	121	3.5	594	472
21	10	25.4	86	121	3.5	610	489
22	10	25.4	86	121	3.5	627	506
23	10	25.4	86	121	3.5	645	523
24	10	25.4	86	121	3.5	663	542
25			86	86	3.5	681	595
26			86	86	3.5	701	614
27			83	83	3.3	690	607
28			86	86	3.5	740	654
29			86	86	3.5	761	675
30			86	86	3.5	782	696
31			86	86	3.5	804	718
32			86	86	3.5	827	740
33			86	86	3.5	850	764
34					0.0	0	0
35					0.0	0	0
36					0.0	0	0
IRR	31.6%						
NPV at 12%	914,000						

2-3 Forestry Development Plan-B

2-3-1 Sales Profit Approach versus Land Rent Approach

As is stated in Chapter I, Section 2-6-6, two approaches - sales profit approach and land rent approach - are conceivable in implementing the Forestry Development Plan (B). Land rent approach is applied for the financial analysis for the following reasons: 1) farmers are skeptical about *A. mangium* plantation and thus would not be willing to provide labor for future "uncertain" revenues, although the expected income increase is theoretically large in sales profit approach; 2) even if SAFODA guaranteed future revenues to farmers, they would not trust SAFODA due to their past experiences. On the other hand, land rent approach is more attractive to farmers since it will provide them with not only unearned income by renting their unused land but also cash income through employment by SAFODA, even though expected revenues are lower than those in sales profit approach.

2-3-2 Rent Rate

In principle, the opportunity costs of land utilization at the study area must be estimated to decide the appropriate rent rate of the land. However, opportunity costs for the land proposed for this project vary significantly depending on whether the land is used for rubber or oil plantation.

Scenario 1: SRFB and FELCRA turn down the farmers' application.

If both SRFB and FELCRA turn down farmers' application, the opportunity costs of the land utilization are considered to be quite low and thus a low rent rate is applicable.

Scenario 2: Only SRFB agrees to start rubber plantation

From the economic point of view, opportunity costs of land utilization are still considered low in this case, since the profit to be achieved from rubber plantation - a highly labor intensive industry - is low. However, under the current living standard in the study area, farmers will definitely prefer rubber to *A. mangium* since the former provides them with a more significant amount of cash flow in exchange for their labor. (One farmer can collect latex from two to four hectares of rubber field with a revenue of RM 25 to 30 per hectare per day.) In order to promote the project, SAFODA would have to offer a high rent in spite of low opportunity costs for the land. This would in turn jeopardize the feasibility of the project.

Scenario 3: FELCRA agrees to start oil plantation

Oil plantation will provide farmers with a better income than rubber plantation due to better market prices for oil palm; four hectares of oil palm plantation will provide a revenue of RM 10,000 per month. The current value added of oil plantation is so high that SAFODA will not be able to offer a competitive rent.

Forestry Development Plan (B) will materialize only under Scenario 1. Since the opportunity costs of the land are judged to be quite low in this case, the study applied a marginal rate for land rental in the base case - RM 15 per hectare per month. As a result, the rent payment for the total plantation area will be RM 27,435 per month. This additional income per family will be RM 193 per month since there are 142 families in Polipikan, Kotud and Sunsui, which is presumably equivalent to about half their current average monthly income. The rent is assumed to be raised in accordance with the general price increase, namely 3.6% per year for the first ten years and 2.8% for the rest of the project duration.

It should also be noted on negotiating the rent that in addition to rent payment, Forest Development Program (B) will offer local residents approximately 2,500 person-day employment opportunities every year as stated in Section 3-4-6.

2-3-3 Base Case

Total project costs for the Forestry Development Plan (B) from Year 0 to Year 24, including contingency allowances, are RM 15.0 million. A breakdown of the costs is shown in Table IV-14.

In order to assess the financial viability of the project, the cost for the enrichment planting was deducted from the total project cost and the harvesting was extended until Year 33. A breakdown of the costs excluding the enrichment planting is shown in Table IV-15 .

The expected revenues from the sales of *A. mangium* were calculated on the assumption of the wood price increase mentioned in Section 1-3 and the future cash flow are shown in Table IV-16. The project is feasible since its Internal Rate of Return (IRR) is 15.8% and Net Present Value (NPV) at a 12% discount rate is RM 1,908,000.

Table IV-14 Forestry Development Plan (B): Total Project Cost (in RM thousand)

Year	Roads and Bridges	Nursery	Planting	Total	Physical Contingencies	Price Contingencies	Total Cost
0	68	0	0	68	7	0	75
1	78	87	203	369	37	15	421
2	287	87	222	596	60	48	704
3	99	87	222	408	41	50	499
4	99	87	222	408	41	68	517
5	99	87	222	408	41	87	536
6	99	87	222	408	41	106	555
7	99	87	222	408	41	126	575
8	124	87	222	433	43	156	632
9	34	88	225	347	35	143	525
10	34	87	223	345	34	161	540
11	34	87	223	344	34	176	555
12	34	87	223	345	34	191	570
13	34	87	223	345	34	207	586
14	34	87	223	345	34	224	603
15	34	87	223	345	34	241	620
16	34	87	223	345	34	258	637
17	35	88	223	345	35	276	656
18	35	89	225	348	35	297	680
19	35	88	223	345	35	314	694
20	35	88	223	345	35	333	713
21	35	88	223	345	35	353	733
22	35	88	223	345	35	374	754
23	35	88	223	345	35	395	775
24	35	88	223	345	35	417	797
Total	1,602	2,101	5,328	9,031	903	5,016	14,951

Table IV-15 Forestry Development Plan (B)

Project Costs excluding Enrichment Planting (in RM thousand)

Year	Roads and Bridges	Nursery	Planting	Harvesting	Total	Physical Contingencies	Price Contingencies	Total Costs
0	64	0	0		64	6	0	70
1	74	84	198		356	36	14	405
2	282	84	216		581	58	47	686
3	94	84	216		393	39	48	481
4	94	84	216		393	39	66	498
5	94	84	216		393	39	84	516
6	94	84	216		393	39	102	534
7	94	84	216		393	39	121	554
8	119	84	216		418	42	150	610
9	30	85	218		332	33	137	502
10	30	84	216	731	1,060	106	495	1,660
11	30	84	216	731	1,060	106	541	1,707
12	30	84	216	731	1,060	106	589	1,755
13	30	84	216	731	1,060	106	638	1,804
14	30	84	216	731	1,060	106	688	1,854
15	30	84	216	731	1,060	106	740	1,906
16	30	84	216	731	1,060	106	794	1,959
17	30	84	216	731	1,060	106	849	2,015
18	30	85	218	738	1,070	107	914	2,091
19	30	84	216	731	1,060	106	963	2,129
20	30	84	216	731	1,060	106	1,023	2,189
21	30	84	216	731	1,060	106	1,084	2,250
22	30	84	216	731	1,060	106	1,147	2,313
23	30	84	216	731	1,060	106	1,212	2,378
24	30	84	216	731	1,060	106	1,279	2,445
25				731	731	73	929	1,733
26				731	731	73	977	1,781
27				738	738	74	1,037	1,849
28				731	731	73	1,078	1,882
29				731	731	73	1,131	1,935
30				731	731	73	1,185	1,989
31				731	731	73	1,241	2,045
32				731	731	73	1,298	2,102
33				731	731	73	1,357	2,161
Total	1,482	2,011	5,161	17,554	26,208	2,621	23,959	52,787

Table IV-16 Costs, Benefits and Cash Flow

Year	Plantation Cost (RM 1000)	Rent (RM 1000)	Rent Rate	Total Cost (RM 1000)	*A. mangium* Production ($1000m^3$)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	Cash Flow (RM 1000)
0	70		15	70			80	1.050	-70
1	405	38		443					-443
2	686	78		765					-765
3	481	122		603					-603
4	498	168		666					-666
5	516	218		734					-734
6	534	271		806					-806
7	554	328		881					-881
8	610	388		998					-998
9	502	453		954					-954
10	1,660	469		2,129	29.2	3,805			1,676
11	1,707	482		2,189	29.2	3,912		1.028	1,723
12	1,755	496		2,250	29.2	4,021			1,771
13	1,804	509		2,313	29.2	4,134			1,821
14	1,854	524		2,378	29.2	4,250			1,872
15	1,906	538		2,444	29.2	4,368			1,924
16	1,959	553		2,513	29.2	4,491			1,978
17	2,015	569		2,584	29.2	4,617			2,033
18	2,091	585		2,676	29.5	4,795			2,119
19	2,129	601		2,730	29.2	4,879			2,148
20	2,189	618		2,807	29.2	5,015			2,209
21	2,250	635		2,886	29.2	5,156			2,270
22	2,313	653		2,967	29.2	5,300			2,334
23	2,378	671		3,050	29.2	5,448			2,399
24	2,445	690		3,135	29.2	5,601			2,466
25	1,733	710		2,442	29.2	5,758			3,316
26	1,781	729		2,510	29.2	5,919			3,409
27	1,849	750		2,599	29.5	6,147			3,549
28	1,882	771		2,653	29.2	6,255			3,602
29	1,935	792		2,727	29.2	6,430			3,703
30	1,989	815		2,804	29.2	6,610			3,807
31	2,045	837		2,882	29.2	6,795			3,913
32	2,102	861		2,963	29.2	6,986			4,023
33	2,161	885		3,046	29.2	7,181			4,136
Total	52,787	17,808		70,596	701	127,874			57,278

2-3-4 Sensitivity Analysis

Sensitivity analysis was performed by changing the following parameters:

1) Cost movement at ±10%
2) Initial wood chip price at +10%, - 10% or -15%
3) Yearly growth rate of wood chip price at 2.8% (same as the inflation rate) or 1.0% (1.75% decrease in real terms)
4) A combination of (2) and (3)
5) Rent rate at RM 25 / ha / month

The following table shows the results of the sensitivity analysis, the details of which are given in Table IV-17:

Table IV-17 Results of Sensitivity Analysis - Forestry Development Plan (B)

	Conditions Changed	IRR	NPV at 12% (RM '000)
Case 1	Base Case	15.8%	1,908
Case 2	Cost - 10%	17.5%	2,646
Case 3	Cost + 10%	14.3%	1,171
Case 4	Initial Chip Price +10%	17.8%	3,070
Case 5	Initial Chip Price -10%	13.6%	746
Case 6	Initial Chip Price -15%	12.4%	165
Case 7	Chip Price Increase Rate 2.8%	11.3%	-310
Case 8	Chip Price Increase Rate 1.0%	n.a.	- 2,789
Case 9	Initial Chip Price +10% Chip Price Increase Rate 2.8%	13.4%	631
Case 10	Rent rate at RM 25 / ha / month	12.7%	347

The feasibility of the project is marginal if the future chip price stays the same in real terms. In order to make land rental more attractive to farmers, SAFODA could even offer RM 25 per hectare as a monthly rent, although the viability of this option depends on the future chip price. It should also be noted that in addition to rent payment, Forestry Development Plan (B) will offer local residents approximately 15,000 person-day employment opportunities every year as stated in Chapter III (3-4-6).

Table IV-18 Forestry Development Plan (B) Sensitivity Analysis: Case 2

Year	Plantation Cost (RM 1000)	Costs - 10% (RM 1000)	Rent (RM 1000)	Rent Rate	Total Cost (RM 1000)	*A. mangium* Production (1000m^3)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	Cash Flow (RM 1000)
0	70	63		15	63			80	1.050	-63
1	405	365	38		402					-402
2	686	618	78		696					-696
3	481	433	122		555					-555
4	498	448	168		617					-617
5	516	464	218		682					-682
6	534	481	271		752					-752
7	554	498	328		826					-826
8	610	549	388		937					-937
9	502	451	453		904					-904
10	1,660	1,494	469		1,963	29.2	3,805			1,842
11	1,707	1,536	482		2,018	29.2	3,912		1.028	1,894
12	1,755	1,579	496		2,075	29.2	4,021			1,947
13	1,804	1,623	509		2,133	29.2	4,134			2,001
14	1,854	1,669	524		2,192	29.2	4,250			2,057
15	1,906	1,715	538		2,254	29.2	4,368			2,115
16	1,959	1,763	553		2,317	29.2	4,491			2,174
17	2,015	1,813	569		2,382	29.2	4,617			2,234
18	2,091	1,882	585		2,467	29.5	4,795			2,328
19	2,129	1,916	601		2,518	29.2	4,879			2,361
20	2,189	1,970	618		2,588	29.2	5,015			2,427
21	2,250	2,025	635		2,661	29.2	5,156			2,495
22	2,313	2,082	653		2,735	29.2	5,300			2,565
23	2,378	2,140	671		2,812	29.2	5,448			2,637
24	2,445	2,200	690		2,891	29.2	5,601			2,711
25	1,733	1,559	710		2,269	29.2	5,758			3,489
26	1,781	1,603	729		2,332	29.2	5,919			3,587
27	1,849	1,664	750		2,414	29.5	6,147			3,733
28	1,882	1,694	771		2,465	29.2	6,255			3,790
29	1,935	1,741	792		2,534	29.2	6,430			3,897
30	1,989	1,790	815		2,605	29.2	6,610			4,006
31	2,045	1,840	837		2,678	29.2	6,795			4,118
32	2,102	1,892	861		2,753	29.2	6,986			4,233
33	2,161	1,945	885		2,830	29.2	7,181			4,352
Total	52,787	47,509	17,808		65,317	701	127,874			62,557

IRR 17.5%

NPV at 12% 2,646,000

Table IV-19 Forestry Development Plan (B) Sensitivity Analysis: Case 3

Year	Plantation Cost (RM 1000)	Cost + 10% (RM 1000)	Rent (RM 1000)	Rent Rate	Total Cost (RM 1000)	*A. mangium* Production ($1000m^3$)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	Cash Flow (RM 1000)
0	70	77		15	77			80	1.050	-77
1	405	446	38		483					-483
2	686	755	78		833					-833
3	481	529	122		651					-651
4	498	548	168		716					-716
5	516	568	218		786					-786
6	534	588	271		859					-859
7	554	609	328		937					-937
8	610	672	388		1,059					-1,059
9	502	552	453		1,004					-1,004
10	1,660	1,826	469		2,295	29.2	3,805			1,510
11	1,707	1,877	482		2,359	29.2	3,912		1.028	1,552
12	1,755	1,930	496		2,426	29.2	4,021			1,596
13	1,804	1,984	509		2,493	29.2	4,134			1,640
14	1,854	2,040	524		2,563	29.2	4,250			1,686
15	1,906	2,097	538		2,635	29.2	4,368			1,733
16	1,959	2,155	553		2,709	29.2	4,491			1,782
17	2,015	2,216	569		2,785	29.2	4,617			1,831
18	2,091	2,300	585		2,885	29.5	4,795			1,910
19	2,129	2,342	601		2,943	29.2	4,879			1,935
20	2,189	2,408	618		3,026	29.2	5,015			1,990
21	2,250	2,475	635		3,111	29.2	5,156			2,045
22	2,313	2,545	653		3,198	29.2	5,300			2,102
23	2,378	2,616	671		3,287	29.2	5,448			2,161
24	2,445	2,689	690		3,379	29.2	5,601			2,222
25	1,733	1,906	710		2,615	29.2	5,758			3,143
26	1,781	1,959	729		2,689	29.2	5,919			3,231
27	1,849	2,034	750		2,784	29.5	6,147			3,364
28	1,882	2,070	771		2,841	29.2	6,255			3,414
29	1,935	2,128	792		2,921	29.2	6,430			3,510
30	1,989	2,188	815		3,003	29.2	6,610			3,608
31	2,045	2,249	837		3,087	29.2	6,795			3,709
32	2,102	2,312	861		3,173	29.2	6,986			3,813
33	2,161	2,377	885		3,262	29.2	7,181			3,919
Total	52,787	58,066	17,808		75,874	701	127,874			52,000
IRR	14.3%									
NPV at 12%	1,171,000									

Table IV-20 Forestry Development Plan (B) Sensitivity Analysis: Case 4

Year	Plantation Cost (RM 1000)	Rent (RM 1000)	Rent Rate	Total Cost (RM 1000)	*A. mangium* Production (1000m³)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	Cash Flow (RM 1000)
0	70		15	70			88	1.050	-70
1	405	38		443					-443
2	686	78		765					-765
3	481	122		603					-603
4	498	168		666					-666
5	516	218		734					-734
6	534	271		806					-806
7	554	328		881					-881
8	610	388		998					-998
9	502	453		954					-954
10	1,660	469		2,129	29.2	4,186			2,056
11	1,707	482		2,189	29.2	4,303		1.028	2,114
12	1,755	496		2,250	29.2	4,423			2,173
13	1,804	509		2,313	29.2	4,547			2,234
14	1,854	524		2,378	29.2	4,674			2,297
15	1,906	538		2,444	29.2	4,805			2,361
16	1,959	553		2,513	29.2	4,940			2,427
17	2,015	569		2,584	29.2	5,078			2,495
18	2,091	585		2,676	29.5	5,274			2,598
19	2,129	601		2,730	29.2	5,367			2,636
20	2,189	618		2,807	29.2	5,517			2,710
21	2,250	635		2,886	29.2	5,671			2,786
22	2,313	653		2,967	29.2	5,830			2,864
23	2,378	671		3,050	29.2	5,993			2,944
24	2,445	690		3,135	29.2	6,161			3,026
25	1,733	710		2,442	29.2	6,334			3,892
26	1,781	729		2,510	29.2	6,511			4,001
27	1,849	750		2,599	29.5	6,762			4,163
28	1,882	771		2,653	29.2	6,881			4,228
29	1,935	792		2,727	29.2	7,073			4,346
30	1,989	815		2,804	29.2	7,271			4,468
31	2,045	837		2,882	29.2	7,475			4,593
32	2,102	861		2,963	29.2	7,684			4,721
33	2,161	885		3,046	29.2	7,900			4,854
Total	52,787	17,808		70,596	701	140,661			70,066

IRR	17.8%
NPV at 12%	3,070,000

Table IV-21 Forestry Development Plan (B) Sensitivity Analysis: Case 5

Year	Plantation Cost (RM 1000)	Rent (RM 1000)	Rent Rate	Total Cost (RM 1000)	*A. mangium* Production ($1000m^3$)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	Cash Flow (RM 1000)
0	70		15	70			72	1.050	-70
1	405	38		443					-443
2	686	78		765					-765
3	481	122		603					-603
4	498	168		666					-666
5	516	218		734					-734
6	534	271		806					-806
7	554	328		881					-881
8	610	388		998					-998
9	502	453		954					-954
10	1,660	469		2,129	29.2	3,425			1,295
11	1,707	482		2,189	29.2	3,520		1.028	1,332
12	1,755	496		2,250	29.2	3,619			1,369
13	1,804	509		2,313	29.2	3,720			1,407
14	1,854	524		2,378	29.2	3,825			1,447
15	1,906	538		2,444	29.2	3,932			1,487
16	1,959	553		2,513	29.2	4,042			1,529
17	2,015	569		2,584	29.2	4,155			1,571
18	2,091	585		2,676	29.5	4,315			1,639
19	2,129	601		2,730	29.2	4,391			1,660
20	2,189	618		2,807	29.2	4,514			1,707
21	2,250	635		2,886	29.2	4,640			1,754
22	2,313	653		2,967	29.2	4,770			1,804
23	2,378	671		3,050	29.2	4,904			1,854
24	2,445	690		3,135	29.2	5,041			1,906
25	1,733	710		2,442	29.2	5,182			2,740
26	1,781	729		2,510	29.2	5,327			2,817
27	1,849	750		2,599	29.5	5,533			2,934
28	1,882	771		2,653	29.2	5,630			2,977
29	1,935	792		2,727	29.2	5,787			3,060
30	1,989	815		2,804	29.2	5,949			3,146
31	2,045	837		2,882	29.2	6,116			3,234
32	2,102	861		2,963	29.2	6,287			3,324
33	2,161	885		3,046	29.2	6,463			3,417
Total	52,787	17,808		70,596	701	115,087			44,491
IRR	13.6%								
NPV at 125	7,46,000								

Table IV-22 Forestry Development Plan (B) Sensitivity Analysis: Case 6

Year	Plantation Cost (RM 1000)	Rent (RM 1000)	Rent Rate	Total Cost (RM 1000)	*A. mangium* Production (1000m^3)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	Cash Flow (RM 1000)
0	70		15	70			68	1.050	-70
1	405	38		443					-443
2	686	78		765					-765
3	481	122		603					-603
4	498	168		666					-666
5	516	218		734					-734
6	534	271		806					-806
7	554	328		881					-881
8	610	388		998					-998
9	502	453		954					-954
10	1,660	469		2,129	29.2	3,234			1,105
11	1,707	482		2,189	29.2	3,325		1.028	1,136
12	1,755	496		2,250	29.2	3,418			1,168
13	1,804	509		2,313	29.2	3,514			1,201
14	1,854	524		2,378	29.2	3,612			1,234
15	1,906	538		2,444	29.2	3,713			1,269
16	1,959	553		2,513	29.2	3,817			1,304
17	2,015	569		2,584	29.2	3,924			1,340
18	2,091	585		2,676	29.5	4,075			1,400
19	2,129	601		2,730	29.2	4,147			1,416
20	2,189	618		2,807	29.2	4,263			1,456
21	2,250	635		2,886	29.2	4,382			1,497
22	2,313	653		2,967	29.2	4,505			1,539
23	2,378	671		3,050	29.2	4,631			1,582
24	2,445	690		3,135	29.2	4,761			1,626
25	1,733	710		2,442	29.2	4,894			2,452
26	1,781	729		2,510	29.2	5,031			2,521
27	1,849	750		2,599	29.5	5,225			2,626
28	1,882	771		2,653	29.2	5,317			2,664
29	1,935	792		2,727	29.2	5,466			2,738
30	1,989	815		2,804	29.2	5,619			2,815
31	2,045	837		2,882	29.2	5,776			2,894
32	2,102	861		2,963	29.2	5,938			2,975
33	2,161	885		3,046	29.2	6,104			3,058
Total	52,787	17,808		70,596	701	108,693			38,097

IRR	12.4%
NPV at 12%	165,000

Table IV-23 Forestry Development Plan (B) Sensitivity Analysis: Case 7

Year	Plantation Cost (RM 1000)	Rent (RM 1000)	Rent Rate	Total Cost (RM 1000)	*A. mangium* Production ($1000m^3$)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	Cash Flow (RM 1000)
0	70		15	70			80	1.028	-70
1	405	38		443					-443
2	686	78		765					-765
3	481	122		603					-603
4	498	168		666					-666
5	516	218		734					-734
6	534	271		806					-806
7	554	328		881					-881
8	610	388		998					-998
9	502	453		954					-954
10	1,660	469		2,129	29.2	3,079			950
11	1,707	482		2,189	29.2	3,165		1.028	977
12	1,755	496		2,250	29.2	3,254			1,004
13	1,804	509		2,313	29.2	3,345			1,032
14	1,854	524		2,378	29.2	3,439			1,061
15	1,906	538		2,444	29.2	3,535			1,090
16	1,959	553		2,513	29.2	3,634			1,121
17	2,015	569		2,584	29.2	3,736			1,152
18	2,091	585		2,676	29.5	3,880			1,204
19	2,129	601		2,730	29.2	3,948			1,217
20	2,189	618		2,807	29.2	4,058			1,251
21	2,250	635		2,886	29.2	4,172			1,286
22	2,313	653		2,967	29.2	4,289			1,322
23	2,378	671		3,050	29.2	4,409			1,359
24	2,445	690		3,135	29.2	4,532			1,397
25	1,733	710		2,442	29.2	4,659			2,217
26	1,781	729		2,510	29.2	4,790			2,279
27	1,849	750		2,599	29.5	4,974			2,375
28	1,882	771		2,653	29.2	5,062			2,408
29	1,935	792		2,727	29.2	5,203			2,476
30	1,989	815		2,804	29.2	5,349			2,545
31	2,045	837		2,882	29.2	5,499			2,617
32	2,102	861		2,963	29.2	5,653			2,690
33	2,161	885		3,046	29.2	5,811			2,765
Total	52,787	17,808		70,596	701	103,471			32,876
IRR	11.3%								
NPV at 12%	-310,000								

Table IV-24 Forestry Development Plan (B) Sensitivity Analysis: Case 8

Year	Plantation Cost (RM 1000)	Rent (RM 1000)	Rent Rate	Total Cost (RM 1000)	*A. mangium* Production (1000m^3)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	Cash Flow (RM 1000)
0	70		15	70			80	1.010	-70
1	405	38		443					-443
2	686	78		765					-765
3	481	122		603					-603
4	498	168		666					-666
5	516	218		734					-734
6	534	271		806					-806
7	554	328		881					-881
8	610	388		998					-998
9	502	453		954					-954
10	1,660	469		2,129	29.2	2,580			451
11	1,707	482		2,189	29.2	2,606		1.010	418
12	1,755	496		2,250	29.2	2,632			382
13	1,804	509		2,313	29.2	2,659			346
14	1,854	524		2,378	29.2	2,685			307
15	1,906	538		2,444	29.2	2,712			268
16	1,959	553		2,513	29.2	2,739			226
17	2,015	569		2,584	29.2	2,767			183
18	2,091	585		2,676	29.5	2,823			147
19	2,129	601		2,730	29.2	2,822			92
20	2,189	618		2,807	29.2	2,850			44
21	2,250	635		2,886	29.2	2,879			-7
22	2,313	653		2,967	29.2	2,908			-59
23	2,378	671		3,050	29.2	2,937			-113
24	2,445	690		3,135	29.2	2,966			-169
25	1,733	710		2,442	29.2	2,996			554
26	1,781	729		2,510	29.2	3,026			515
27	1,849	750		2,599	29.5	3,087			489
28	1,882	771		2,653	29.2	3,087			434
29	1,935	792		2,727	29.2	3,117			390
30	1,989	815		2,804	29.2	3,149			345
31	2,045	837		2,882	29.2	3,180			298
32	2,102	861		2,963	29.2	3,212			249
33	2,161	885		3,046	29.2	3,244			198
Total	52,787	17,808		70,596	701	69,662			(933)
IRR	N/A								
NPV at 12%	2,789,000								

Table IV-25 Forestry Development Plan (B) Sensitivity Analysis: Case 9

Year	Plantation Cost (RM 1000)	Rent (RM 1000)	Rent Rate	Total Cost (RM 1000)	*A. mangium* Production ($1000m^3$)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	Cash Flow (RM 1000)
0	70		15	70			88	1.028	-70
1	405	38		443					-443
2	686	78		765					-765
3	481	122		603					-603
4	498	168		666					-666
5	516	218		734					-734
6	534	271		806					-806
7	554	328		881					-881
8	610	388		998					-998
9	502	453		954					-954
10	1,660	469		2,129	29.2	3,387			1,258
11	1,707	482		2,189	29.2	3,482		1.028	1,293
12	1,755	496		2,250	29.2	3,579			1,329
13	1,804	509		2,313	29.2	3,679			1,366
14	1,854	524		2,378	29.2	3,782			1,405
15	1,906	538		2,444	29.2	3,888			1,444
16	1,959	553		2,513	29.2	3,997			1,484
17	2,015	569		2,584	29.2	4,109			1,526
18	2,091	585		2,676	29.5	4,268			1,592
19	2,129	601		2,730	29.2	4,342			1,612
20	2,189	618		2,807	29.2	4,464			1,657
21	2,250	635		2,886	29.2	4,589			1,703
22	2,313	653		2,967	29.2	4,718			1,751
23	2,378	671		3,050	29.2	4,850			1,800
24	2,445	690		3,135	29.2	4,985			1,850
25	1,733	710		2,442	29.2	5,125			2,683
26	1,781	729		2,510	29.2	5,268			2,758
27	1,849	750		2,599	29.5	5,472			2,873
28	1,882	771		2,653	29.2	5,568			2,915
29	1,935	792		2,727	29.2	5,724			2,996
30	1,989	815		2,804	29.2	5,884			3,080
31	2,045	837		2,882	29.2	6,049			3,166
32	2,102	861		2,963	29.2	6,218			3,255
33	2,161	885		3,046	29.2	6,392			3,346
Total	52,787	17,808		70,596	701	113,818			43,223
IRR	13.4%								
NPV at 12%	631,000								

Table IV-26 Forestry Development Plan (B) Sensitivity Analysis: Case 10

Year	Plantation Cost (RM 1000)	Rent (RM 1000)	Rent Rate	Total Cost (RM 1000)	*A. mangium* Production (1000m³)	*A. mangium* Revenue (RM 1000)	AM Price	Price Increase	Cash Flow (RM 1000)
0	70		25	70			80	1.050	-70
1	405	63		468					-468
2	686	131		817					-817
3	481	203		684					-684
4	498	281		779					-779
5	516	363		879					-879
6	534	452		986					-986
7	554	546		1,100					-1,100
8	610	647		1,257					-1,257
9	502	754		1,256					-1,256
10	1,660	782		2,442	29.2	3,805			1,363
11	1,707	803		2,510	29.2	3,912		1.028	1,402
12	1,755	826		2,580	29.2	4,021			1,441
13	1,804	849		2,653	29.2	4,134			1,481
14	1,854	873		2,727	29.2	4,250			1,523
15	1,906	897		2,803	29.2	4,368			1,565
16	1,959	922		2,882	29.2	4,491			1,609
17	2,015	948		2,963	29.2	4,617			1,654
18	2,091	975		3,066	29.5	4,795			1,729
19	2,129	1,002		3,131	29.2	4,879			1,747
20	2,189	1,030		3,219	29.2	5,015			1,797
21	2,250	1,059		3,309	29.2	5,156			1,846
22	2,313	1,089		3,402	29.2	5,300			1,898
23	2,378	1,119		3,497	29.2	5,448			1,951
24	2,445	1,150		3,595	29.2	5,601			2,006
25	1,733	1,183		2,915	29.2	5,758			2,843
26	1,781	1,216		2,997	29.2	5,919			2,922
27	1,849	1,250		3,099	29.5	6,147			3,049
28	1,882	1,285		3,167	29.2	6,255			3,088
29	1,935	1,321		3,256	29.2	6,430			3,175
30	1,989	1,358		3,347	29.2	6,610			3,264
31	2,045	1,396		3,440	29.2	6,795			3,355
32	2,102	1,435		3,537	29.2	6,986			3,449
33	2,161	1,475		3,636	29.2	7,181			3,546
Total	52,787	29,680		82,468	701	127,874			45,406
IRR		12.7%							
NPV at 12%		347,000							

2-4 Project's Benefit on Local People's Income

The proposed project will directly benefit local people in two fashions: employment opportunities and/or land rental revenues. As is described in Section 3-2-8, Forestry Development Plan (A) will provide employment opportunities of approximately 60,000 man-days per year. Since the market price of labor in northern Sabah is RM 15 per day, the project will provide RM 375 per month to 200 people. On the other hand, Forestry Development Plan (B) will provide employment opportunities of 15,000 man-days at a rate of RM 375 per month to three villages (Polipikan, Kotud and Sunsui), which is equivalent to full-time employment of 50 people. In addition, each village family will be entitled to receive, on average, RM 193 per month as a land rent in Plan (B).

Considering that average monthly income of around 70% of the people in Marak Parak Area is less than RM 200, the project will contribute to an income increase to these people. It should be noted, however, that rubber or oil palm plantation will provide more cash income to the farmers if the land is proved to be suitable for these crops. The revenue per person from latex collecting is at least RM 50 per day per two to three hectares, which is equivalent to RM 1,250 per month - far above the poverty line (RM 601 per month), and land preparation and planting are subsidized by the SRFB. On the other hand, although oil palm is more land selective and requires initial investments by farmers themselves since it is not subsidized, four hectare of oil palm plantation will provide a revenue of RM 10,000 per month; a significant income increase for farmers. As a consequence, *A. mangium* or *P. falcataria* tree plantation will attract local people only when the site is not suitable to rubber or oil palm plantation.

2-5 Financial Consideration

Expenses for chipping and loading facilities were not included as capital costs but as depreciation costs since these capital costs do not necessarily have to be borne by the project itself. SAFODA can outsource the chipping and loading activities, or buy second hand equipment to decrease initial capital investment. Total chipping and loading costs are basically the same in either case from the financial point of view.

The Marak Parak plantation can be financed through *A. mangium* sales revenues from the Bengkoka plantation, since the project is assessed to be feasible based on the assumption that a market for *A. mangium* will be formed. Since Bengkoka is estimated to have a capacity to provide 190,000 m^3 of *A. mangium* every year with its current 16,000 ha plantation area, the expected sales revenue per year is RM 10,450,000 (190,000 m^3 ×(RM 80 /m^3 <selling price>- RM 25 /m^3 <harvesting cost>)). This amount of money is more than enough to finance not only re-planting in Bengkoka but also new plantation in Marak Parak, although expansion of Bengkoka plantation will be needed to finance all the operating costs in SAFODA headquarters (around RM 12 million per year).

Alternatively, a joint-venture option can be sought to finance the project. The private partner could be a buyer of *A. mangium* chips or a trading company. However, it is not easy to find an investor for the project since the capital recovery takes fifteen years.

3. Environmental Impact Assessment

3-1 Project Concept

The proposed forest development plantation was conceptualized based on several main objectives.

First, the once abundance supply of forest product that contributes a major portion of the state economy is rapidly depleting in an unprecedented rate that, if no effort is made to replenish the resources, could be detrimental to the state economy.

Secondly, the increase in logged-over areas and the conversion of the once virgin forest into degraded grassland has resulted in numerous negative consequences including the reduction in commercial harvestable forest product, degradation of water quality due to soil erosion, migration of rural population to urban areas resulting in over population in urban areas.

Thirdly, the siting of the Forest Plantation in northern region of the state is viewed as more fitting in uplifting the economy of the hard core poor of this part of Sabah by inducing creation of employment and the growth of the economy as a whole.

Fourthly, the development of this projects also provides better infrastructure to this part of the state.

In addition to the numerous advantage from this development, income generated from the sales of timber from the large scale forest development would stimulate the growth of the state's economy.

The siting of the forest plantation in this area will also result in the increase of land value in the area and restore the vast area of degraded and underutilized land areas.

3-2 Project Component and Activities

The proposed forest development project (M/P) has a total area of 236, 000 hectares subjected to forest practices of which only 54,000 hectare is covered in the feasibility study. The area is a mountainous land with altitude ranging from 500 to 600 meters above mean sea level (AMSL). The land status of the area at the time of this study has not been fully determined. Accordingly, two project options in the Model Area as indicated in Chapter III, have been identified to be carried out taking into account the different land status. This project will consist of two project options. The components of the two project options are as follows.

Option A: Plantation plan, seedling production plan. Forestry infrastructure (forest road, building, vehicles, lookout tower, etc.), fire control, harvesting, employment of local people, organization, monitoring, small scale plantation plan for alienated land (planting and harvesting), etc.

Option B: Plantation plan, seedling production plan, forestry infrastructure, harvesting, etc.

Development of the proposed forestry development project consists of three main stages:

- Investigation;
- Development and Construction;
- Operation and Maintenance; and

The project activities of every stages are shown in Table IV-27.

Table IV-27 Project Activities of Forestry Development Project

Stage	Activity
Investigation	• Topographic Survey • Soil Investigation and Geological Survey • Forest Inventory • Market Survey • Infrastructures Investigation and Designing • Area Boundary Survey • Socio-Economic Survey • Environmental Study
Development and Construction	• Access Road and Bridge Construction • Site Clearing • Nursery • Planting
Operation and Maintenance	• Trees Maintenance • Harvesting and Transport • Infrastructural and Support

Investigative stage was carried out by the study team (JOFCA) commissioned by JICA in cooperation with SAFODA and local consultants. The stages except for the investigation stage are the ones related to implementation process of the project. The EIA study was conducted at each stage.

3-3 Description of the Existing Environment

The existing environment is divided into three components: physico-chemical environment, biological environment and human environment . Description of existing environment in this sub-section focuses only specific environment relevant to the potential impacts assessed based on field surveys and data collection carried out in March, 1997, and references made to secondary information from previous study carried out by other members of the study team.

The general description of the topography, climate and geological features of existing environment is described in detail in Chapter I and is not described in this sub-section.

Geology and Soil: geologically, the project area is made of mostly marine sedimentary rocks of the Eocene and Oligocene in the Palaegocene period. The rocks are composed of Flysch-type sandstone, shale and siltstone, the layer of which contain tuff, limestone, breccia and agglomerate. The soil is predominantly of the Crocker on the mountainous area and Binalik and Labau Association on the valley floors. The project could be considered mountainous with dominant parent materials derived from sandstone and mudstone of the Crocker Association and alluvium derived from ultrabasic rock on the valley floor. They are drained by five river basins of the Bandau, Pangapuyan, Kinaromu, Manuradiang, and Bengkoka basins. system.

Water Quality: Visual observation of several streams and rivers along Kota Marudu road which traverse the project area showed that in some area such as Sunsui and Kg. Marak Parak, domestic solid waste were found on river banks. Thin film of oil was also observe in some streams. A more serious pollutants in the form of total coliform and E-coli were found to contaminate Sungai Kinarom at Kg. Timbang Batu, Sg. Nahapas at Kg. Lombiding and Sg. Lombiding at Kg. Natu.

Climate: The climate of this area is like the rest of the west coast of Sabah, which is of equatorial coastal climate with uniform temperatures (24-34 degrees Celsius), high humidity and a substantial amount of rainfall (2,361 mm (average)/year, 1981-1995).

Air Quality: Air pollution from the area derives from the vehicles using the numerous feeder unsealed roads in the area. However, gravel road with vehicular emission contributes to air pollution at a very small part due to small number of vehicles plying the area compared to urban area. Generally, air quality of the area is considered good without major source of pollution.

Land Use: The present land use of the project area consist of secondary (logged-over)forests, some agricultural crops, rubber plantation, degraded grassland areas, shifting cultivation and residential areas. The major use of the river system in the area are for source of water for the local communities, for fishing and hunting ground.

Biological Environment: The proposed project is expected to have minimal loss and effect on the biodiversity of the existing flora, terrestrial and aquatic fauna.

The terrestrial flora found in the project are secondary forest, shrubs and grassland. Secondary forest is the most predominant as well as shrubs and herbaceous plants (usually on road side). The project will also have minimal impact on the biological environment as the this project is forest development and it can only improve the degraded land area as well as restore the degraded forest.

Human Environment : The implementation of this project is envisaged to uplift the economy of the rural people in terms of better infrastructural development and better job opportunity. However, the result of the human environment survey reveal that the local people in the area support the project only if the land they are occupying and have applied for are excluded from the project area. The survey also revealed that according to the local communities, there is no more empty land in this area large enough for this project. From the positive impact point of view, this project would be beneficial in terms of employment creation, business opportunities for the local, increased land values and improvement of infrastructural facilities.

3-4 Potential Impacts Assessment

The main objective of an EIA is to study and identify the potential impacts of a proposed project to the socio-economic and biophysical environment taking into account the legislative requirement, policies, program and operational procedures. This sub-section describes the potential impacts arising from the project activities described in 3-1. Description of potential impacts are presented as an overview of the stages and activities of the project development and operation. An EIA matrix was used in the identification of the potential impacts as shown in Table IV-28. In this matrix, potential impacts are categorized into six levels according to its significance, respectively designated as follows:

D - Potentially significant adverse environmental impact for which a design solution has been identified.

U - Adverse environmental impact but insufficient information has been obtained to make reliable prediction, close monitoring and control required.
S - Short-term and localized effect.
R - Residual and significant adverse environmental impact.
E/B - Significant environmental enhancement/Beneficial.
F - Insignificant impact.

Based on the studies and findings on the existing environment of the proposed *Forestry Development Project*, the potential impacts predicted during investigation, development and operation stages are discussed in the section. The discussion will focus on three aspects of the impact:

a. Nature and source of the impact
b. The sensitivity of the impact to certain environmental component
c. The magnitude, duration, frequency, risks, importance and expected applicability of mitigatory measures.

The implementation of this project is expected to produce the following environmental impacts on the environment:

Land Use: Restoration of the present degraded grassland area and will produce productive land able to support timber growth. In turn, the idle land will be put to productive use and the implementation of this project helps create employment and business opportunities as well as increasing the values of the surrounding land.

Soil: The potential impacts associated with soil is the mainly from the construction of roads, preparation of bridge foundation, nursery site preparation and land preparation for planting. The massive earthworks resulting from these operations is expected to have adverse effect on the environment such as soil erosion resulting in creek sedimentation, air pollution from excessive suspended particles (dusts) and spillage of earth on road surface. However, these impacts are temporary in nature since all these works are only during the initial stage and will cease once the forest are established.

Table IV-28 Environmental Impact Assessment Matrix

PROJECT ACTIVITIES — Forestry

HUMAN ENVIRONMENT

PROJECT ACTIVITIES (Forestry)	ODOUR	LANDSCAPE	MAN MADE OBJECT	COMMUNITY STRUCTURES	SENSE OF COMMUNITY	TRANQUILITY	ATMOSPHERIC QUALITY	WATER QUALITY	WILDERNESS	BIRDS	LANDFORMS
ACCESS ROAD	F	E	F	F	F	S	D	S	F	U	R
SITE CLEARING	F	E	F	F	F	S	D	S	F	U	R
DRAINAGE ALTERATION	F	F	F	F	F	F	F	F	F	U	R
STREAM CROSSING	F	S	F	F	R	D	D	D	D	D	R
EARTHWORKS	F	S	F	F	F	S	D	S	F	F	S
BRIDGE CONSTRUCTION	F	E	F	F	F	D	D	D	D	F	R
RECLAMATION	F	E	F	F	F	S	S	D	R	R	R
MATERIALS & EQUIPMENT	F	S	F	F	F	F	F	D	F	F	F
TRANSPORTATION	F	F	F	F	F	S	D	S	F	U	F
LABOUR FORCE	F	F	F	F	F	D	F	D	F	F	F
BASE CAMP	F	S	D	D	D	D	F	F	F	F	F
WASTE DISPOSAL & Mgnt.	F	D	F	F	F	F	F	D	F	F	F
SURFACING & PAVING	F	F	F	F		S	F	F	F	F	F
TRANSPORTATION	F	F	F	F	D	D	D	E	E	R	D

PROJECT ACTIVITIES (Forestry)	SOCIAL & ECONOMIC: COMMERCE	AMENITIES	UTILITIES	EDUCATION	HOUSING	EMPLOYMENT	HEALTH & SAFETY: PHYSIOLOGICAL DISEASE	COMMUNICABLE DISEASE	PARASITIC DISEASE	PSYCHOLOGICAL WELL-BEING	PHYSICAL HEALTH SAFETY
ACCESS ROAD	B	B	B	B	B	B	F	F	F	B	D
SITE CLEARING	F	F	F	E	B	B	F	E	E	E	D
DRAINAGE ALTERATION	F	F	F	F	F	F	F	F	F	F	F
STREAM CROSSING	E	E	E	F	F	E	F	F	F	F	D
EARTHWORKS	F	F	F	F	F	B	F	F	F	F	D
BRIDGE CONSTRUCTION	E	E	F	F	F	E	F	F	F	F	F
RECLAMATION	E	F	E	F	F	E	F	F	F	F	F
MATERIALS & EQUIPMENT	F	F	F	F	F	B	F	F	F	F	F
TRANSPORTATION	F	F	F	F	F	F	F	F	F	F	D
LABOUR FORCE	B	F	F	F	B	B	F	F	F	B	F
BASE CAMP	F	F	F	F	F	E	D	D	D	D	D
WASTE DISPOSAL & Mgnt.	F	F	F	F	E	B	F	F	F	D	D
SURFACING & PAVING	E	E	E	E	E	E	F	F	F	F	F
TRANSPORTATION	E	E	E	E	E	E	F	F	F	F	D

BIOLOGICAL

PROJECT ACTIVITIES (Forestry)	HABITAT / COMMUNITY: MARINE COMMUNITIES	MARINE HABITATS	AQUATIC COMMUNITIES	AQUATIC HABITATS	TERRESTRIAL HABITATS	SPECIES & POPULATION: FISH	AQUATIC - MARINE FLORA	OTHER TERRESTRIAL FAUNA	TERRESTRIAL WILDLIFE	TERRESTRIAL VEGETATION
ACCESS ROAD	F	F	F	F	F	F	F	F	F	R
SITE CLEARING	F	F	F	F	D	F	F	F	D	R
DRAINAGE ALTERATION	F	F	F	F	F	F	F	F	F	F
STREAM CROSSING	D	D	D	D	D	D	D	D	D	B
EARTHWORKS	F	F	F	F	D	F	F	F	F	R
BRIDGE CONSTRUCTION	U	U	U	U	F	U	U	F	F	F
RECLAMATION	R	R	R	R	R	R	R	R	R	R
MATERIALS & EQUIPMENT	F	F	F	F	F	F	F	F	F	F
TRANSPORTATION	F	F	F	F	D	F	F	F	D	F
LABOUR FORCE	F	F	F	F	F	Y	F	F	F	F
BASE CAMP	F	F	F	F	F	F	F	F	F	F
WASTE DISPOSAL & Mgnt.	F	F	F	F	F	F	F	F	F	F
SURFACING & PAVING	F	F	F	F	F	F	F	F	F	F
TRANSPORTATION	F	F	F	F	F	F	F	F	R	R

PHYSICO-CHEMICAL

PROJECT ACTIVITIES (Forestry)	NOISE: FREQUENCY	DURATION	INTENSITY	ATMOSPHERE: DUST	VISIBILITY	AIR FLOW	AIR QUALITY	GROUND WATER: EXISTING USE	AQUIFER CHARACTERISTICS	FLOW REGIME	WATER QUALITY	WATER TABLE
ACCESS ROAD	S	S	D	D	D	F	D	F	F	F	F	F
SITE CLEARING	S	S	S	F	F	F	D	F	F	F	F	F
DRAINAGE ALTERATION	F	F	F	F	F	F	F	F	F	D	F	U
STREAM CROSSING	S	S	S	S	S	F	F	F	F	F	F	F
EARTHWORKS	F	F	S	F	D	F	D	F	F	D	D	F
BRIDGE CONSTRUCTION	S	S	S	S	S	S	S	F	F	F	F	F
RECLAMATION	S	S	S	S	S	S	S	D	F	D	D	F
MATERIALS & EQUIPMENT	F	F	F	F	F	F	F	F	F	F	F	F
TRANSPORTATION	S	S	S	D	D	F	D	F	F	F	F	F
LABOUR FORCE	F	F	D	F	F	F	F	F	F	F	F	F
BASE CAMP	F	F	F	F	F	F	F	F	F	F	F	F
WASTE DISPOSAL & Mgnt.	F	F	F	F	F	F	F	F	U	F	F	F
SURFACING & PAVING	S	S	S	S	S	S	S	F	F	F	F	D
TRANSPORTATION	D	R	R	D	D	D	D	E	E	E	E	E

PROJECT ACTIVITIES (Forestry)	SURFACE WATER: FLOODING	EXISTING USE	DRAINAGE PATTERN	WATER QUALITY	FLOW VARIATION	LAND: LAND USE	FLOOD PLAIN / SWAMP	SEISMICITY	SUBSIDENCE & COMPACTION	SLOPE STABILITY	SOIL COMPOSITION	SOIL PROFILES
ACCESS ROAD	F	F	D	S	F	D	F	F	F	D	F	F
SITE CLEARING	D	F	F	S	F	D	D	F	F	D	F	F
DRAINAGE ALTERATION	D	F	F	F	D	F	D	F	F	F	F	F
STREAM CROSSING	D	S	S	S	S	S	D	U	F	F	F	F
EARTHWORKS	D	F	S	S	F	F	D	F	F	D	F	U
BRIDGE CONSTRUCTION	D	D	D	D	D	E	D	D	D	D	F	F
RECLAMATION	D	D	D	D	D	D	D	U	F	F	F	D
MATERIALS & EQUIPMENT	F	F	F	D	F	F	F	F	F	F	F	F
TRANSPORTATION	F	F	F	S	F	D	F	F	F	F	F	F
LABOUR FORCE	F	D	F	D	F	E	F	F	F	F	F	F
BASE CAMP	F	F	F	F	F	S	F	F	F	F	F	F
WASTE DISPOSAL & Mgnt.	F	D	F	D	F	F	F	F	F	F	F	F
SURFACING & PAVING	F	F	F	D	F	F	D	U	D	D	F	D
TRANSPORTATION	E	E	E	E	E	E	D	U	U	U	U	U

D - Potentially adverse environmental impact for which a design solution has been identified
U - Unknown Impact
S - Short Term
R - Residual impact
E - Enhancement
F - Unsignificant

Water Quality: The potential impact is an increase in erosion due to construction and development activities, an increase in sediment load in water bodies downstream of the site, and possible leaching of fertilizer and pesticide before and after cultivation. Although erosion at the area is only expected to be temporary and only during the initial stage, some reduction in the water quality can be expected during site clearing, earthwork, waste disposal, land preparation and other construction activities if proper mitigation measures are not taken. Proper management of fertilizer will reduce its potential leaching to the nearby water. During the operational stage of the project, it is obligatory of the proponent to comply to the Standard B stipulated in the Environmental Quality Act 1974 (Sewage and Industrial Effluent) Regulation 1978.

Air Quality: Deterioration of air quality can be expected only during the road construction stage of the project. Dust pollution is anticipated to be significant during the road construction when earthwork is carried out and also from transportation using the present gravel road and dirt roads. Dust pollution is expected to be especially severe during the dry period. However, as the other pollutants, dust pollution is also temporary as this is a land restoration project and air quality is anticipated to be improved from the release of oxygen by the plants during the process of photosynthesis. This thick forest communities will also help filter dust as well as provide a cooling effect to the environment.

Noise: Noise is expected to be produced only at the road and bridge construction and land preparation stages of the project but will cease after forest establishment. The noise would be concentrated to machines working in the plantation area, construction of buildings, and transport of earth and equipment. Noise from the road and bridge construction affect the surrounding community as well as the workers within the construction area. Excessive exposure to noise may cause health problems.

Biological Component: The construction of bride at several location and the clearing of land for nursery and planting may affect vegetation along the river bank and at the nursery area and cause permanent loss of natural vegetation. However the effect will not be significant. the loss of unproductive natural vegetation and grassland will be greatly compensated by the planting of the timber forest and restore the land into more aesthetically pleasing vegetation.

Wildlife displacement in the area is expected to be very minimal due to low population count as a result of unfavorable conditions in the area. The loss of natural habitat may drive some migratory birds observed in the area to relocate temporarily until the forest is well established. Impact on aquatic life will not be significant as long as water quality is maintained in the water body. Since most of the habitat will remain intact, impact on aquatic life will be less significant.

Socio-Economic and Human Environment: Several villages in the project areas will be positively affected by the project. The immediate villages in particular and the surrounding area in general would greatly benefit from the implementation of this project in terms of employment and business opportunities as well as improve infrastructural amenities like roads and bridges. Impact on health due to dust, noise, air and water pollution, is expected to be temporary and very negligible.

3-5 Mitigation Measures

This sub-section discusses and proposes appropriate mitigation measures that can be taken to mitigate the potential impacts described in 6-4. The mitigation measures should be incorporated in the project design and implementation plans so as to minimize the possible negative impacts on the environment.

Physical Environment: Effective mitigation and abatement measures that have been recommended to minimize the potential adverse impacts on the physical environment during the development and construction stages include a) limiting construction works and any earthwork site clearing and land preparation to dry periods where low precipitation is expected, b) following closely the Guidelines for Prevention and Control of Soil Erosion and Siltation issued by the DOE,c) proper handling and management of all wastes and sewage at the construction stage.

The mitigation measures during the operation stage of the project include: a) proper handling and responsible management of fertilizer and pesticide, b) proper management of waste and sewage from the worker's quarters, c) adherence and compliance to relevant Regulations and Orders in force.

Socio-economic and Human Environment: As has been described, the project will greatly benefit the surrounding community in terms of employment opportunities, business opportunities and infrastructural development. The local communities of the area should be given priority for job opportunities both during construction and operational stage. The relevant authority, e.g. District Office, should play a role in getting the local community involved in the project.

Monitoring Programme: Monitoring programme has been suggested to ensure compliance to the environmental requirement as stipulated in the Environmental Quality Act 1974 (Act 127) and Regulations. This is also to ensure success of the mitigation measures taken during the development and operation stage of the project.

3-6 Conclusions

This *Proposed Forestry Development Project* to be undetaken by SAFODA on behalf of the Government of Malaysia is proposed for the Northern Sabah, East Malaysia. It is aimed at establishing a Forest Development Program that is environmentally friendly with degraded land restoration objectives.

In line with the requirement of the Environmental Quality Act (Prescribed Activities) (Environmental Impact Assessment) Order 1987, Schedule (c), this EIA was carried out to determine the potential environmental impact of the project if implemented and to suggest the possible mitigation measures to minimize the potential environmental impacts.

Based on these guidelines, the project was evaluated on the normal environmental impact parameters of land use, soil and hydrology, water quality, tranquility, biological components and socio-economic and human environment at the investigative, development and construction, and operation and maintenance stages

Based on the research data and analysis undertaken of each of the factors, the potential environmental impacts were found to be acceptable even in the extreme cases (i.e. loss of natural habitat to the migratory bird).

It is seen in the mitigation measures that the potential impacts especially concerning the technical components generated by the project can be alleviated by the formulation and implementation of a monitoring programme.

On the other hand this project can bring tremendous positive environmental impacts in terms land use and socio-economic/human environment. As far as land use is concerned a hitherto unproductive, idle wasteland is transformed into productive arable land. In addition, the transformation of this land into something useful can enable the proponent to set up an important and crucial project as this project could provide the much-needed development impact in this economically depressed Marak Parak area. On the micro level, the people in the area could have the opportunity of more job and business and the chance to generate a higher level income. The private tree farming introduced by the proponent will allow direct participation of the local community in the project, and enable them to gain benefits directly from the implementation of the project.

A 'no project' option approach to this project would certainly be a loss to the state government as well as to the people especially to the people of Marak Parak consolidation and deny them the opportunity for better infrastructures and access to better facilities.

In conclusion, considering the benefits of the project and the relatively inadverse environmental impact (even before mitigation measures are applied) this project brings positive development to the area.

4. Conclusions

The Marak Parak area is located in the upstream of Kota Marudu District, the center of the northern Sabah. The lack of watershed conservation measures in the Marak Parak area has resulted in the degradation of forests and the disorderly land utilization. It is highly likely that the forests continue degrading unless human activities are controlled in the area. The Marak Parak forestation program is aimed at achieving sustainable development of the region and effective watershed conservation.

The financial analysis and environmental impact assessment were discussed in above sections. The overall conclusions of the study are the following:

① Financial feasibility of both of the forest development Plan (A) and (B) has been confirmed under certain future circumstances assumed through the observation of the current land tenure situation. In the sales strategy of *A. mangium*, the Marak Parak area has been considered as part of wood supply base including the Bengkoka plantation.

② With regard to the environmental impact, the proposed project basically contributes to the improvement of the environment, and no significant negative impact on the environment is expected. In constructing facilities, disturbance to local people's life should be avoided as much as possible. The infrastructure to be built in this project will contribute to the improvement of the local life, while the project will directly benefit local people through the creation of employment.

③ The land tenure situation in the watershed is the major problem which could jeopardize the implementation of the project. Although a large number of land applications have been submitted to the authorities based on customary rights, there currently exists an enormous backlog of applications due to the slow processing capacity of the authorities. It is highly likely that a significant size of public land will be transformed to alienated land after being processed. In fact, the final land tenure situation of the Marak Parak area will be neither what was assumed for the forestation development Plan (A) nor (B); it will be rather something between Plan (A) and (B), which means that both public and alienated land exist in the watershed. When foreseeing the future development of land ownership, a large-scale plantation - a combination of the state land forestation and the land rental forestation - is suggested as practical system since either of the forestation development Plan (A) and (B) has financial viability. Forestation management will become more viable by acquiring a large forestation area since the infrastructure and the sales activities will benefit from the economies of scale. If the land application review takes much time, the project must be modified to accomodate new physical/managerial conditions.

④ The land rental forestation, which is to be conducted in alienated (private) land, is possible only when local people agree to rent their land; it is not realizable without their consent and cooperation to the plan. Local residents' cooperation as equal partners of the project is also indispensable for the effective watershed conservation which could directly affect peoples' life in Kota Marudu.

⑤ Since the proposed project is aimed at watershed conservation and development of the local economy, the local government office has an important role. It is indispensable that in implementing the project, the Kota Marudu District Office attains local people's understanding and cooperation for the project as lead agency through establishing the special organizations in community and district levels.

Recommendations

The study area includes all the areas in Marak Parak except forest reserves. From the legal point of view, all the land could be transformed for the agricultural usage in accordance with customary rights of residents. Degradation or disappearance of forests does not cause any problems in terms of land utilization. On the other hand, SAFODA is a public organization created for the promotion of reforestation in the land degraded by human activities such as tree harvesting and slash-and-burn agriculture. The principal idea for the creation of SAFODA is that forests must be restored and protected in the areas whose land should be conserved from the national environmental perspectives.

Unused land rather predominates the study area, and many local people live in the watershed, which results in the degradation of forests. Forest conservation in Marak Parak is important since residents living in Kota Marudu, which is located in the downstream of Marak Parak, are benefited from the forests in Marak Parak by way of flood control, water conservation and protection of rivers and coastline from sediment discharge. Although the population is not dense within the watershed and no significant problems have so far been found in the downstream except for water quality degradation after the rain, new environmental problems could happen in the near future due to population growth and continuous deterioration of natural environment.

Proper land utilization combined with forest management is indispensable in the study area apart from forest reserves in order to avoid future problems mentioned above. The proposed project must be implemented within the framework of a future land use plan in which a harmony between human activities and watershed conservation is attained. From this perspective, it is recommended that the following measures be taken:

① Administrative agencies should make a decision on land use classification for the watershed as a whole; and

② Acceleration of land application processing.

Attachment

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MINUTES OF THE MEETING ON THE INCEPTION REPORT OF THE FEASIBILITY STUDY ON THE FOREST DEVELOPMENT PROJECT IN MARAK PARAK, NORTHERN SABAH, IN MALAYSIA

In pursuance to the objectives of the scope of work for the Feasibility Study on the Forest Development Project in Marak Parak in Northern Sabah, Malaysia, (hereinafter referred to as "the Study") signed on December 15, 1995, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Study Team headed by Mr.Tsutomu HANDA from April 7 to April 22, 1996.

The Study Team submitted 20 copies of the Inception Report to the Malaysian side on April 9, 1996 and held a meeting with the Malaysian authorities and counterparts headed by Mr.IDRUS BIN HJ. ABDUL GHANI, General Manager of the Sabah Forestry Development Authority (SAFODA) at Kota Kinabalu, Sabah on April 10, 1996. The list of attendants in the meeting is shown in Appendix 1.

The results as well as comments from the meeting are as follows:

1. The Malaysian side and the Study Team of JICA discussed the Inception Report and both sides agreed on the contents of the Report with some modification as shown in Appendix 2.

2. The meeting was informed that the definition of native customary right in relation to land is well defined under the law. However, ascertaining the areas can only be done on the ground during the Study. In doing so, it is important that the natives be informed of the purpose.

3. The actual duration of the study is eighteen (18) months and not three (3) years as stated in the report. It was agreed that this statement be revised to avoid confusion. A summarised work schedule was also suggested for monitoring purposes.

4. Regarding the preparation of maps for the Study, the Study Team was requested to provide the data in digital format if available, to SAFODA.

5. The meeting was informed that the purchase of equipments and two vehicles for the Study would be done by August 1996. The quotations for the vehicles have already been handed over to the Study Team.

6. It was noted by the Malaysian side that some important analysis were done in Japan. The meeting was thus informed that the Malaysian counterparts should be involved in doing the analysis in Japan as much as possible as part of the technology transfer programme. It was further suggested that this be incorporated in the technology transfer programme.

7. The Malaysian side will provide to the Study Team the list of names of the nominated counterparts for the Study by the end of July 1996.

8. Both sides agreed to cooperate fully with each other to ensure the efficient implementation of the study in order to achieve the objectives as described in the Inception Report.

Kota Kinabalu, April 10, 1996

....	....
Mr Tsutomu HANDA	**Mr. IDRUS BIN HJ ABDUL GHANI**
Team Leader	General Manager
Study Team, JICA	SAFODA

MEETING ON THE INCEPTION REPORT OF THE FEASIBILITY STUDY ON FORESTRY DEVELOPMENT PROJEKCT IN MARAK PARAK, NORTHERN SABAH IN MALAYSIA (APRIL 10, 1996)

In attendance:

The Malaysian Side

1. Mr. Idrus bin Hj. Abdul Ghani	-	General Manager, SAFODA
2. Ms. Monica Chia	-	State Development Department, Sabah
3. Mr. Linus Dani	-	State Development Department, Sabah
4. Mr. Awang Shamsi Hj. Jamih	-	District Officer, Kota Marudu
5. Mr. Jeflus S. Sinajin	-	Forestry Department, Sandakan
6. Mr. Freddie Kou	-	Lands & Surveys Department, Kota Kinabalu
7. Tuan Hj.Md. Yassin B. Hj.Ibrahim	-	Federal Department of Development Sabah
8. Mr. Ahmad Musli	-	SAFODA
9. Mr. Freddy Lee	-	SAFODA (Secretary)

The Japanese Side

1. Tsutomu HANDA	-	Study Team Leader, JOFCA
2. Kiyoshi FUJII	-	Study Team Sub-Leader, JOFCA
3. Yasuyo HIROUCHI	-	Study Team Member, Global Link Mgmt.Inc.
4. Takehiko HIRANO	-	Study Team Member, Kokusai Kogyo Co.Ltd.
5. Toshio SAITO	-	Study Team Member, JOFCA
6. Takaki TOYOTA	-	Study Team Member, JOFCA
7. Toshinori ISOGAI	-	JICA Malaysia Office

Modification to the Inception Report

No	Reference to the Inception Report	Modification to be made (as underlined)
1	Page 5, item 4	The study is to be conducted over a period of <u>eighteen (18) months</u> in ....
2	Page 5, item 4 - under the column "Year", instead of the First, Second and Third year in each row respectively :	<u>1996</u> <u>Apr - Dec</u> <u>1997</u> <u>Jan - Mar</u> <u>1997</u> <u>Apr - Aug</u>
3	Page 13, item c., para 2	Social groups, and to <u>assess</u> ....
4	Page 13, item e)	<u>Assess</u> the positive ....

MINUTES OF THE MEETING ON THE EXPLANATION AND DISCUSSION OF THE INTERIM REPORT ON THE FEASIBILITY STUDY ON THE FORESTRY DEVELOPMENT PROJECT IN MARAK PARAK, NORTHERN SABAH, MALAYSIA

In pursuance to the objectives of the scope of work for the Feasibility Study on the Forestry Development Project in Marak Parak in Northern Sabah, Malaysia (hereinafter referred to as "the Study"), signed on 15 December 1995, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Study Team headed by Mr.Tsutomu HANDA in April, August, September and October 1996 to carry out the first of a two-phase study.

The Study Team submitted 20 copies of the Interim Report based on the study done in the first phase to the Malaysian side on 17 January 1997 and held two meetings at Kota Kinabalu in Sabah, one on 24 January 1997 to explain the study and the other on 27 January 1997 to further discuss it with the Malaysian authorities and counterparts headed by Mr.Idrus Bin Haji Abdul Ghani, General Manager of the Sabah Forestry Development Authority (hereinafter referred to as "SAFODA"). The list of attendants in the meetings is shown in Appendix 1 and 2.

The results as well as the main comments from both meetings are as follows:-

1. The Malaysian side and the Study Team of JICA discussed the Interim Report and both sides generally agreed to the comprehensive contents of the report with some modifications as shown in Appendix 3.

2. The meeting was informed that the initial study area hectarage of 54,000 ha. was reduced to 50,523 ha. only due to the rectification on the map of part of the boundary of the Lingkabau Forest Reserve.

3. The meeting was informed that a hydrological study for the construction of a multi-purpose reservoir somewhere along the Kinarom River had been recently undertaken. The Study Team together with SAFODA will have to get in touch with the Water Department in Kota Kinabalu to obtain more details. The Study Team will thereafter have to take into consideration the existence of this study.

4. SAFODA had submitted a land application in January 1996 for an area of approximately 47,500 ha. more or less covering the study area. Based on the Kota Marudu ACLR's response, the application cannot be processed further for the time being as there are other land applications within the area which have not been processed completely. Manual compilation of all the land applications within the area may have to be done with the assistance of the Land Office in Kota Marudu.

5. The meeting was briefed that from the study done to date, approximately 8,000 ha. of shrublands were found to be suitable for forest plantation while about 3,000 ha. were identified as areas where enrichment planting could be done. These areas are not however, without encumberances as land claims and applications also exist in these areas.

X. ima

6. A workshop will be conducted in Kota Marudu on 30 January 1997 where village heads, community leaders as well as officers from relevant government departments and agencies will be invited. At the workshop, an explanation of the report and its approaches as well as gathering of feedback from the respondents will be conducted.

7. The issue of uncertainties regarding to the extent and processing status of land applications and claims (based on customary native rights) was discussed at length as this was thought to have implications on the forestry implementation program. The meeting finally agreed that for all intents and purposes, since the Study is basically for the forestry development of the area, the implementaton plan should be prepared not by disregarding the land issue but by providing for alternative plans depending on the different land status.

8. The meeting also agreed to the suggestion to provide an alternative plan to enhance forestry activities in private lots in the area which may be similar to the private tree farm extension program currently undertaken by SAFODA.

Kota Kinabalu
28 January 1997

....
Mr.Tsutomu HANDA
Team Leader
Study Team, JICA

....
Mr.Idrus Bin Hj.Abdul Ghani
General Manager
SAFODA

....
Witnessed by
Dr.Minoru KUMAZAKI
Team Leader
Advisory Team, JICA

Appendix 1

MEETING ON THE EXPLANATION OF THE INTERIM REPORT ON THE FEASIBILITY STUDY ON THE FORESTRY DEVELOPMENT PROJECT IN MARAK PARAK, NORTHERN SABAH, MALAYSIA
(24 JANUARY 1997)

In attendance:

The Malaysian Side

1. Mr.Francis G.Otigil - Deputy General Manager, SAFODA
2. Mr.Peter Chee Nyuk Foh - District Officer, Kota Marudu
3. Mr.Patrick Mojinun - Asst.District Officer, Kota Marudu
4. Mr.Ahmad Zaki Ansore - Federal Department of Development, Sabah
5. Ms.Shamsiah Hj.Jirat - State Development Department, Sabah
6. Mr.Jeflus Sinajin - Forestry Department HQ, Sandakan
7. Mr.Ahmad Hj.Musli - SAFODA
8. Mr.Freddy Lee - SAFODA (Secretary)

The Japanese Side

Study Team

1. Mr.Tsutomu HANDA - Study Team Leader, JOFCA
2. Mr.Kiyoshi FUJII - Study Team Sub-Leader, JOFCA
3. Ms.Yasuyo HIROUCHI - Study Team Member, JOFCA
4. Mr.Takaki TOYODA - Study Team Member, JOFCA
5. Mr.Toshio SAITO - Study Team Member, JOFCA
6. Mr.Hirotsugu NISHIZAWA - Study Team Member, JOFCA
7. Mr.Shinichi MORI - Study Team Member, JOFCA

Advisory Team

1. Dr.Minoru KUMAZAKI - Advisory Team Leader, University of Tsukuba
2. Mr.Masayuki IWASA - Advisory Team Member, Japan Agriculture, Forestry and Fisheries Credit Fund
3. Mr.Hiroyuki MATONO - Advisory Team Member, JICA

Appendix 2

MEETING ON THE DISCUSSION OF THE INTERIM REPORT ON THE FEASIBILITY STUDY ON THE FORESTRY DEVELOPMENT PROJECT IN MARAK PARAK, NORTHERN SABAH, MALAYSIA
(27 JANUARY 1997)

In attendance:

The Malaysian Side

1.	Mr.Francis G.Otigil	-	Deputy General Manager, SAFODA
2.	Ms Monica Chia	-	State Development Department, Sabah
3.	Mr.Patrick Mojinun	-	Asst.District Officer, Kota Marudu
4.	Mr.Ahmad Zaki Ansore	-	Federal Department of Development, Sabah
5.	Mr.Freddy Kou	-	Lands & Surveys Department, Kota Kinabalu
6.	Mr.Ahmad Hj.Musli	-	SAFODA
7.	Mr.Freddy Lee	-	SAFODA (Secretary)

The Japanese Side

Study Team

1.	Mr Tsutomu HANDA	-	Study Team Leader, JOFCA
2.	Mr.Kiyoshi FUJII	-	Study Team Sub-Leader, JOFCA
3.	Ms.Yasuyo HIROUCHI	-	Study Team Member, JOFCA
4.	Mr.Takaki TOYODA	-	Study Team Member, JOFCA
5.	Mr.Toshio SAITO	-	Study Team Member, JOFCA
6.	Mr.Hirotsugu NISHIZAWA	-	Study Team Member, JOFCA
7.	Mr.Shinichi MORI	-	Study Team Member, JOFCA

Advisory Team

1.	Dr.Minoru KUMAZAKI	-	Advisory Team Leader, University of Tsukuba
2.	Mr.Masayuki IWASA	-	Advisory Team Member, Japan Agriculture, Forestry and Fisheries Credit Fund
3.	Mr.Hiroyuki MATONO	-	Advisory Team Member, JICA

Appendix 3

Modification to the Interim Report

No.	*Reference to the Interim Report*	*Items to be modified (as underlined)*	*Modification to be made*
1	Title page	THE <u>FOREST</u>	THE FORESTRY
2	page 37	Section 2-3-3 (2) is missing	Section will be given as soon as possible
3	page 25 2nd para, line 1	... Dusun <u>native tribe</u> ...	... Dusun ethnic group ...
4	page 37 Table II-10	the first entry under the "females" column : <u>13</u>	should be 313 instead
5	throughout the report	the word <u>Kinaram River</u>	should be Kinarom River
6	page 7 1st para, line 3	... Kota Kinabalu <u>and</u> ...	... Kota Kinabalu, which
7	page 43 2nd para, line 5	...<u>The is</u> once crops ...	... Once crops ...
8	page 47 Figure II-14 to be moved to the Annex part		
9	page 48 footnote 6 may be incorrectly referred		
10	throughout the report, the Malaysian currency should be written as RM XXX		

Attachment 3

MEMBER LIST OF THE STUDY TEAM

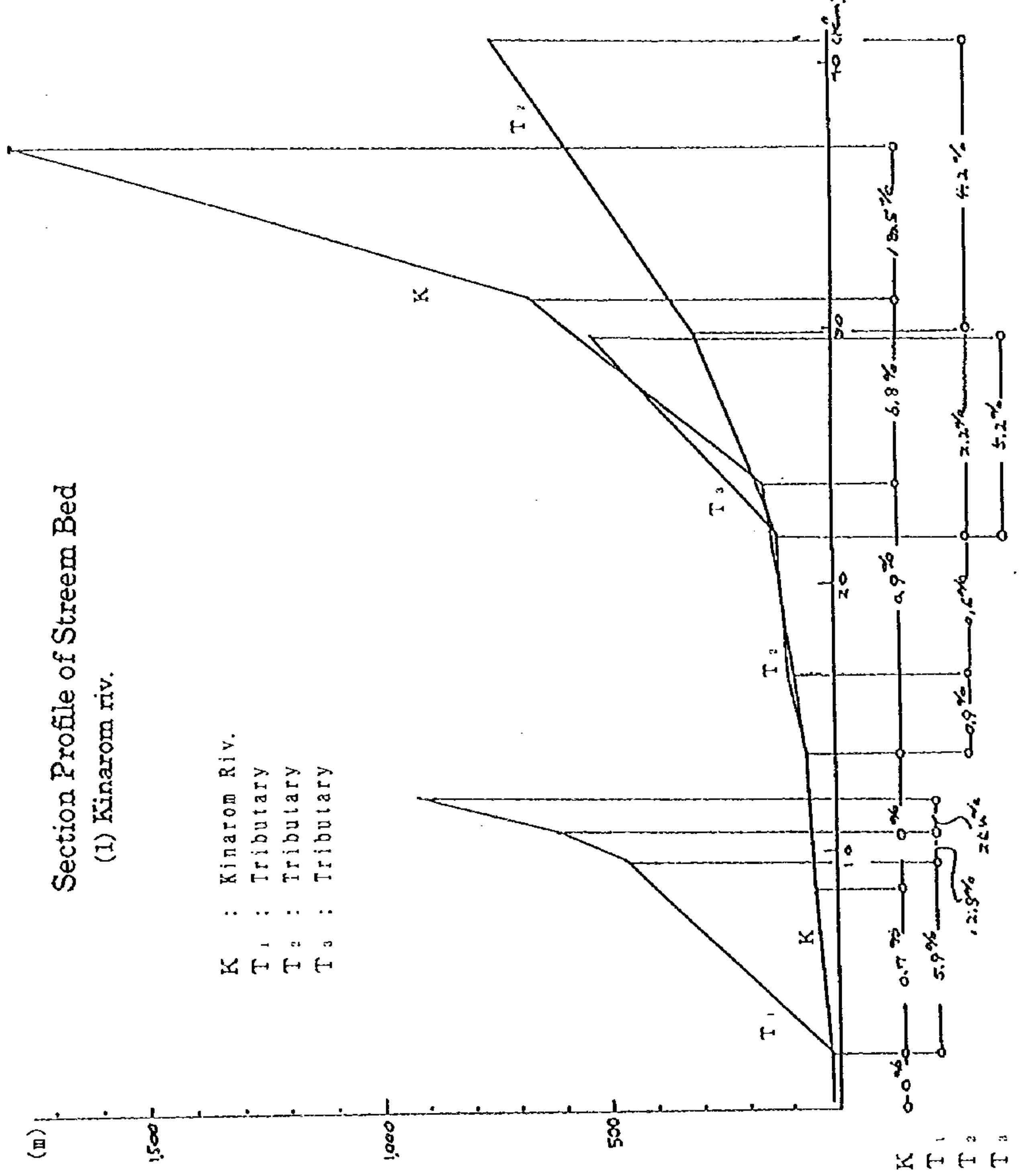
Tsutomu HANDA	Team leader/ Forest management plan	Japan Overseas Forestry Consultants Association (JOFCA)
Kiyoshi FUJII	Sub-leader/ re-afforestation	JOFCA
Hirotsugu NISHIZAWA	Forest survey/ Soil survey	JOFCA
Takaki TOYODA	Forest survey/ Soil survey	JOFCA
Yasuyo HIROUCHI	Socio-economics analysis	Global Link Management,Inc
Toshio SAITO	Forestry Infrastructure/ Environmental assessment	JOFCA
Takehiko HIRANO	Mapping	Kokusai Kogyo Co.,LTD.
Shin'ichi MORI	Financial and economic analysis	IMG
Kota SHIMOKAWA	Land-use and vegetation	Japan Forest Technical Association (JAFTA)

Attachment 4

ORGANIZATION VISITED

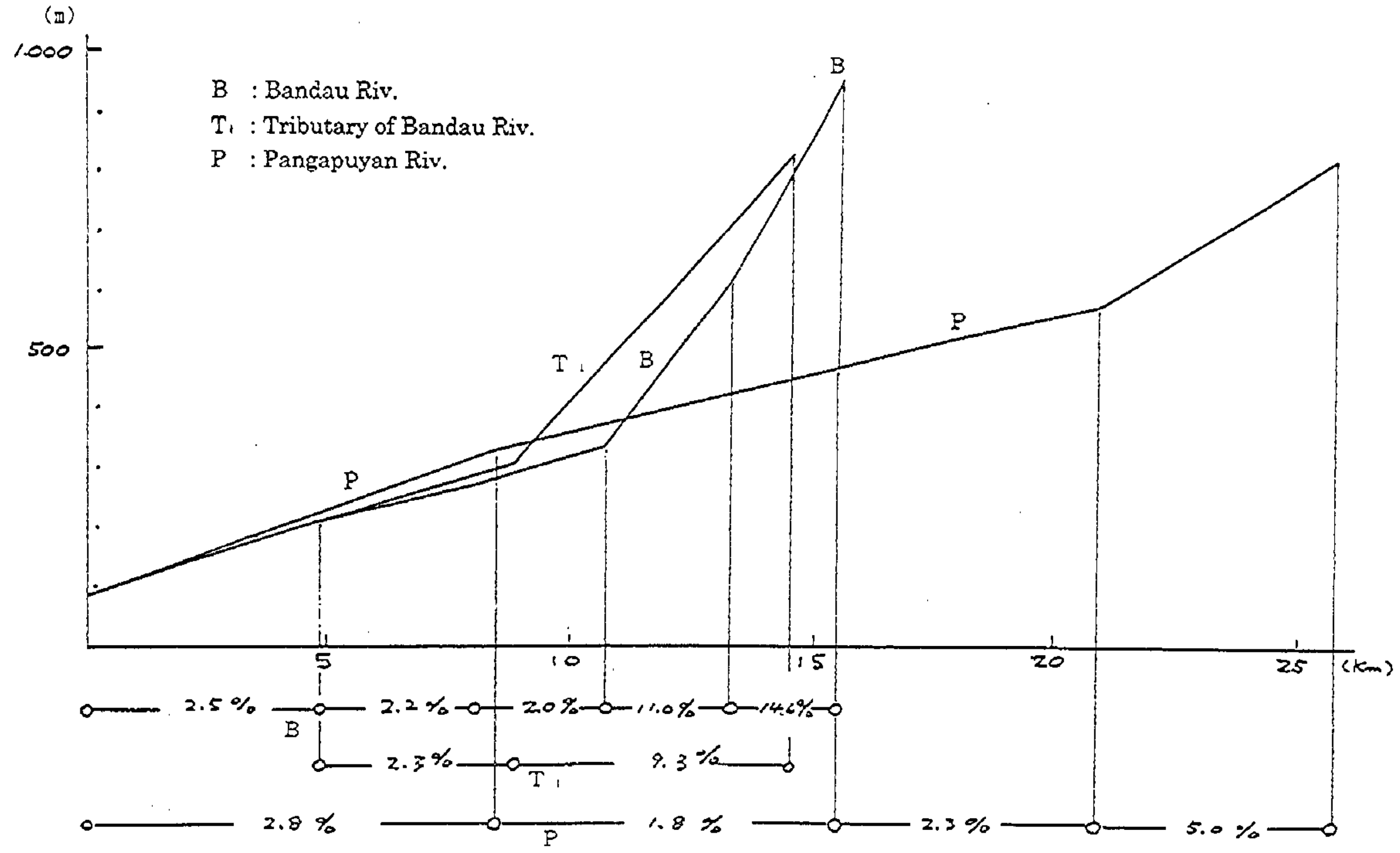
- Economic Planning Unit, Malaysian Government
- Ministry of Resources Development and Enterprise
- Public Works Department
    - -Kota Marudu District Office
- Weather Service Malaysia, Sabah Branch
- Cooperative of Rural Development, Northern Region Office
- Cooperative of Rural Development, Marak Parak Office
- Kota Marudu Sabah Rubber Fund Board Office
- Kota Marudu Sabah Foundation Office
- Forestry Department
    - -Headquarters
    - -Kudat Regional Forest Office
    - -Kota Marudu District Forest Office
- Agriculture Department
    - -Kota Marudu District Office
- Land and Survey Department
    - -Kota Marudu Land Office
- Kota Marudu District Office
- Kota Marudu District Community Development Office
- Kota Mardu District Native Chief Office
- Sabah Harbour Authority
- Kota Mardu District Irrigation Office
- Malaysian Timber Industry Board

- Forest Research Centre
- Sabah Softwoods Sdn.Bhd.
- Rakyat Berjawa Sdn.Bhd.(Innoprise Corporation Sdn.Bhd.)
- Yung Chen Wood Industry Sdn. Bhd.
- SINORA Sdn. Bhd.
- Sabah Forest Industries Sdn. Bhd.
- Kilang Papan Seribu Daya Berhad (KPSD)
- Seribu Daya Sdn. Bhd.
- Headquarters, Sabah Rubber Fund Board (SRFB)
- Daiken Sarawak Sdn. Bhd.
- Merbok Hilir Bhd.
- Hume Fibreboard Sdn. Bhd.
- Takeuchi MDF Sdn. Bhd.
- Tawau Plywood Manufacturing Sdn. Bhd.
- Malaysian Timber Council
- Sungai Silinponpon Block Board Sdn Bhd.

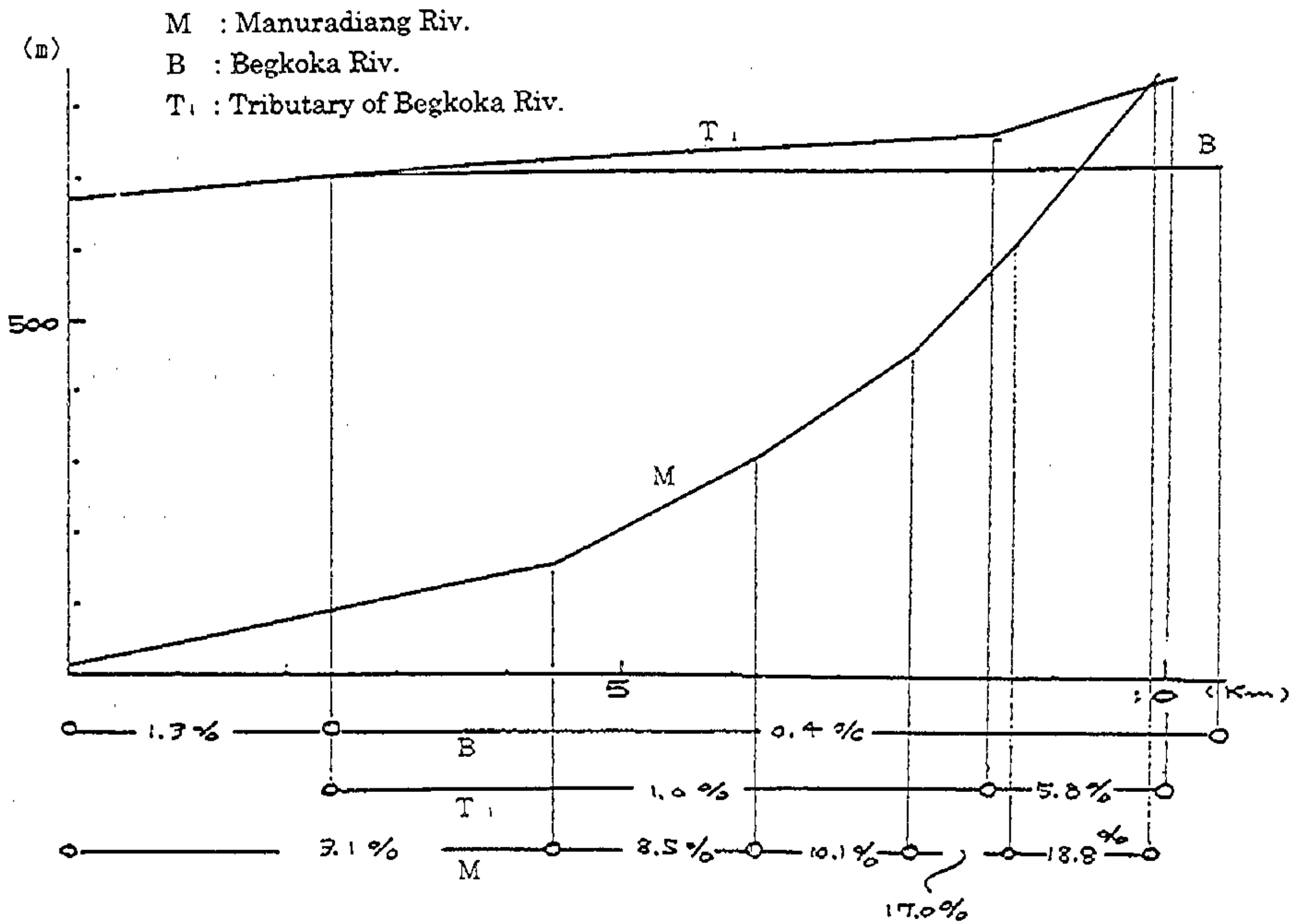


Section Profile of Streem Bed
(1) Kinarom riv.

(2) Bandau and Pangapuyan riv.

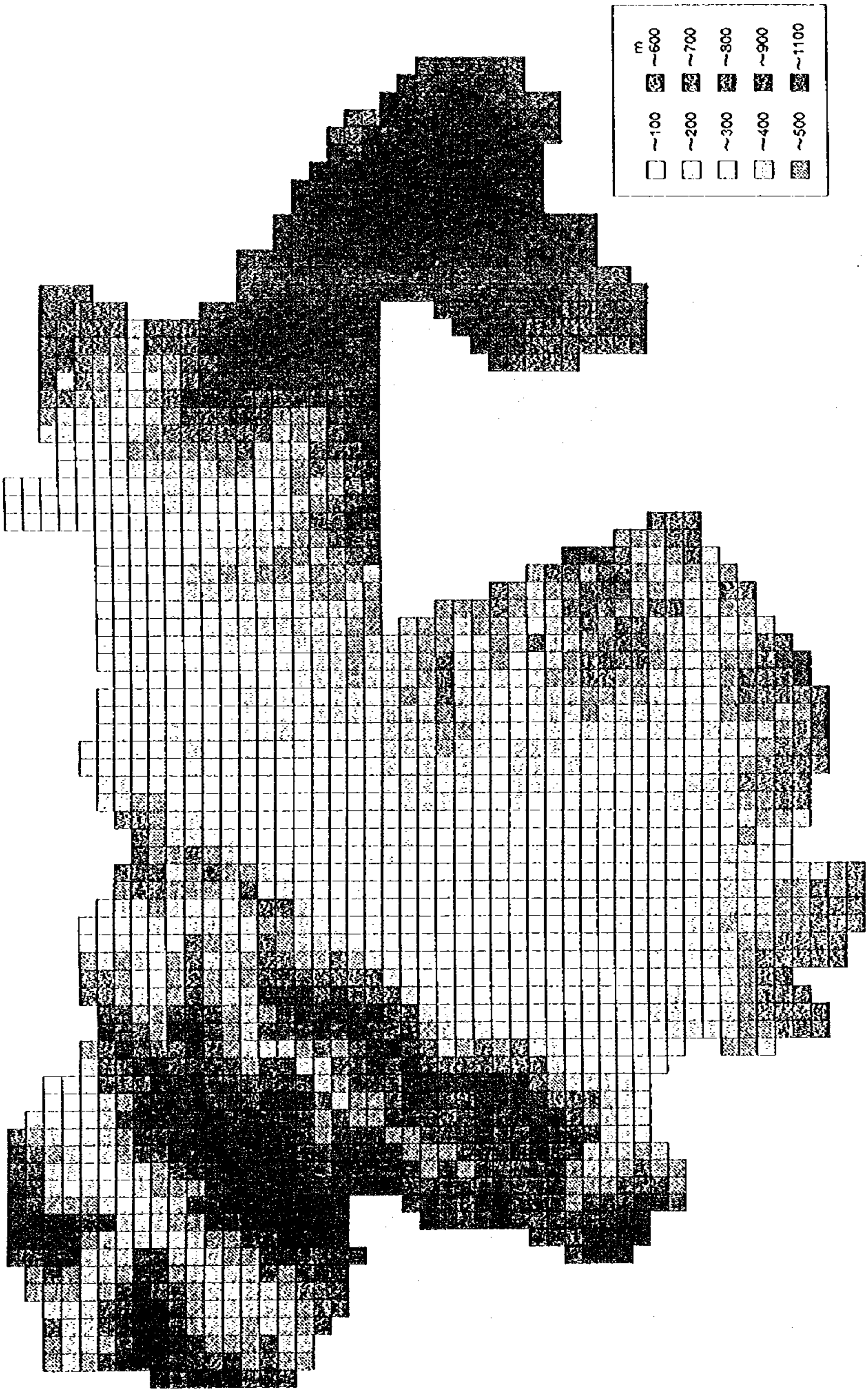


(3) Manuradiang and Bengkoka riv.

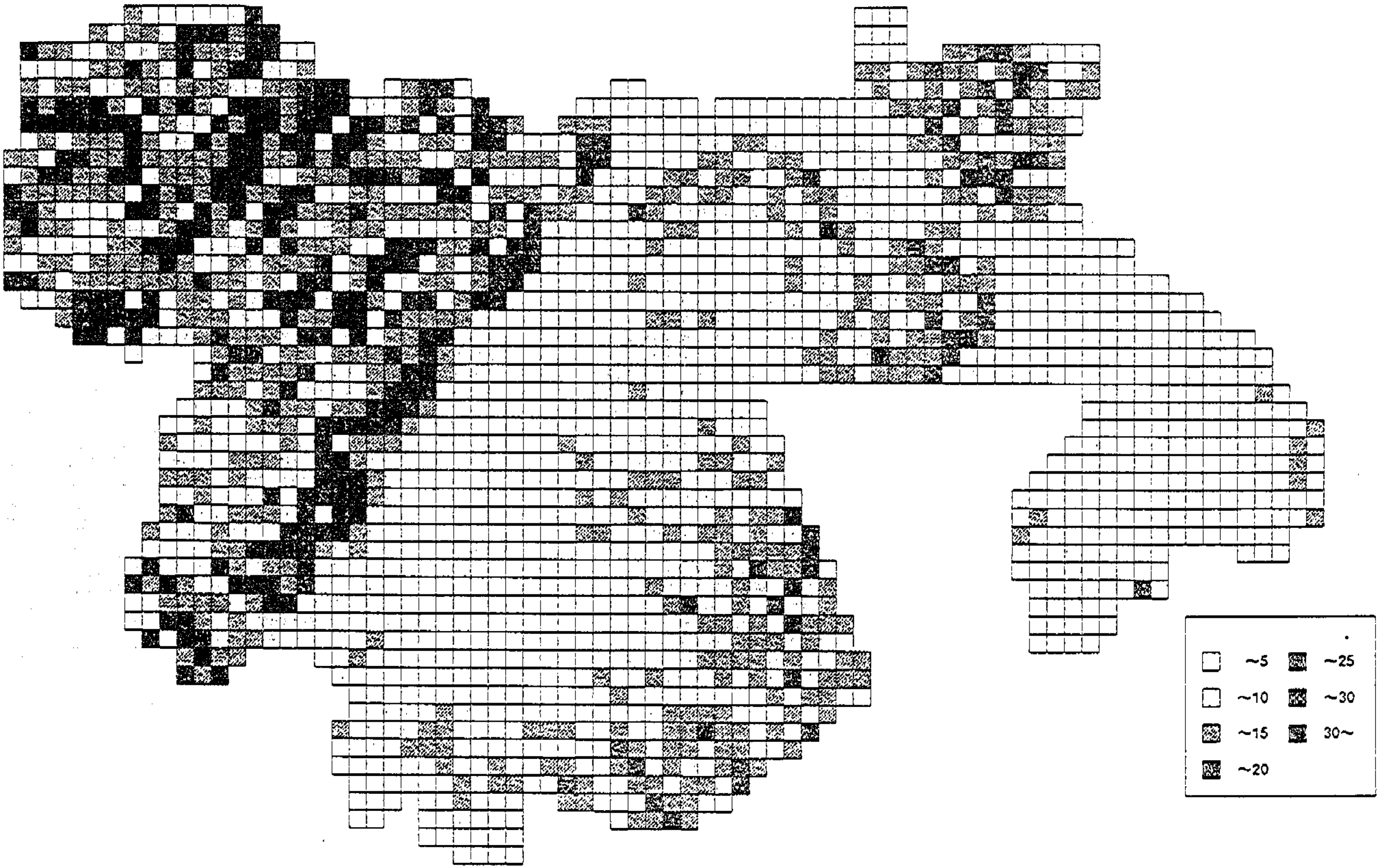


Mesh Analysis of Natural Conditions

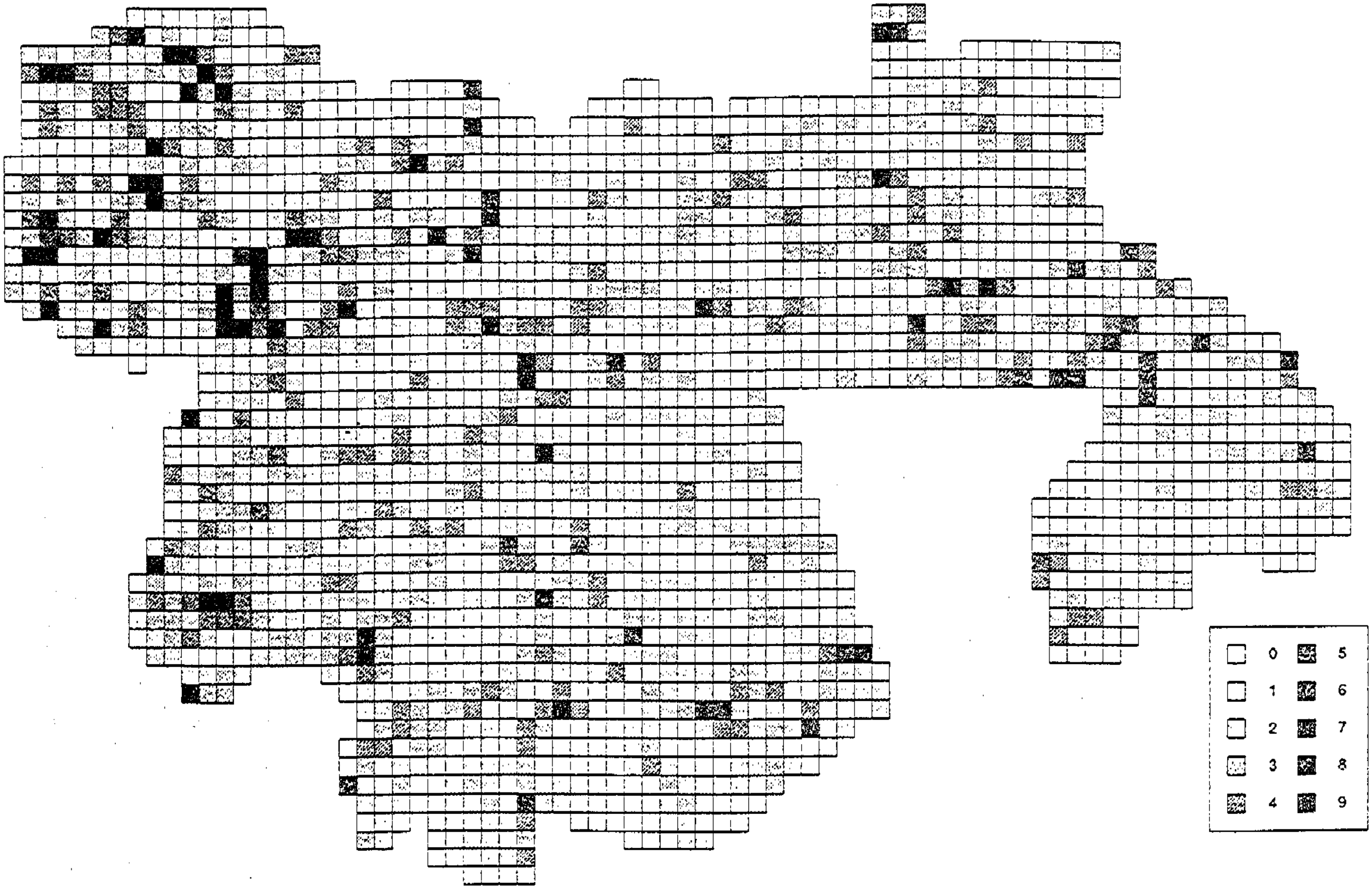
(1) Altitude



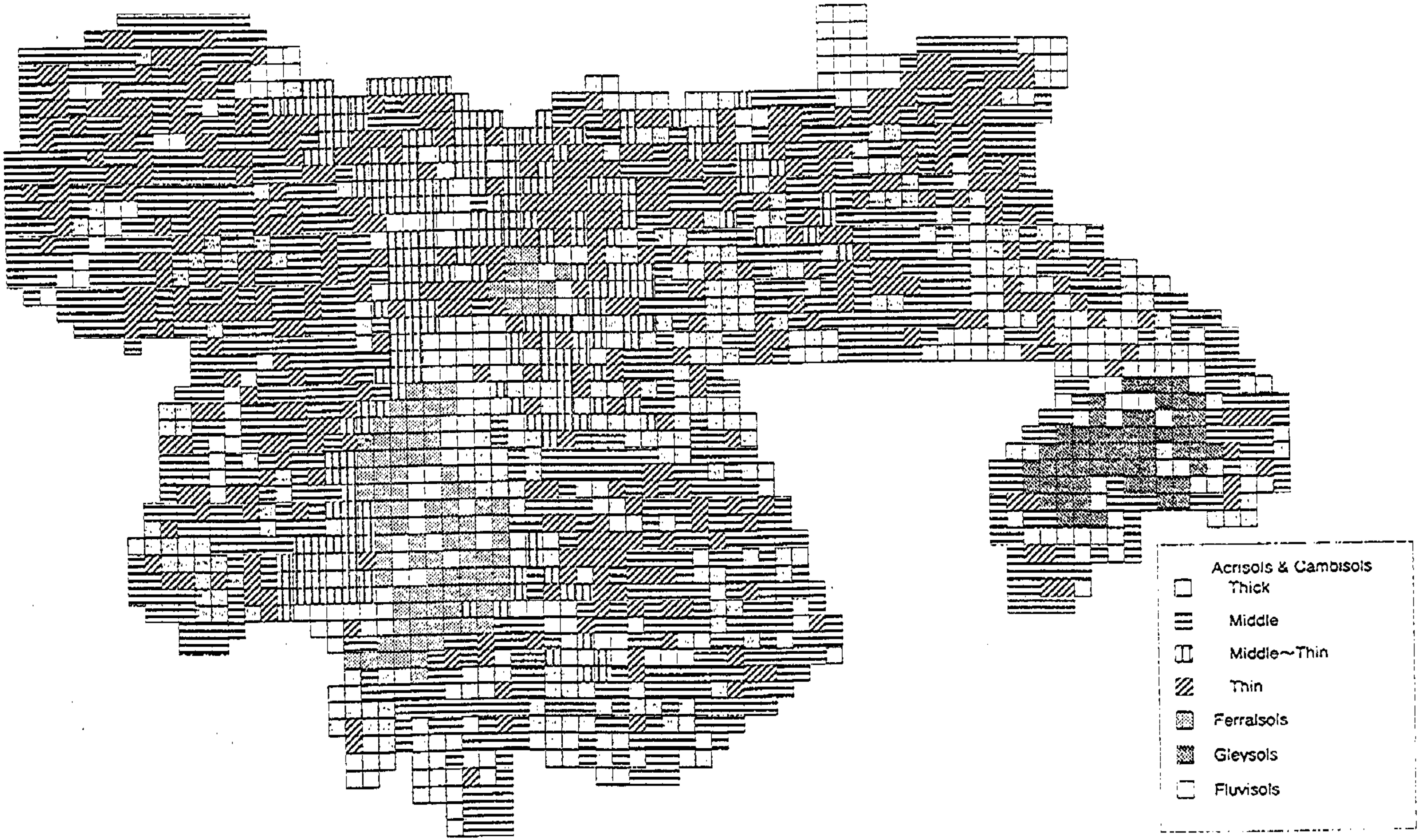
(2) Maximum angle of inclination



(3) Valley density

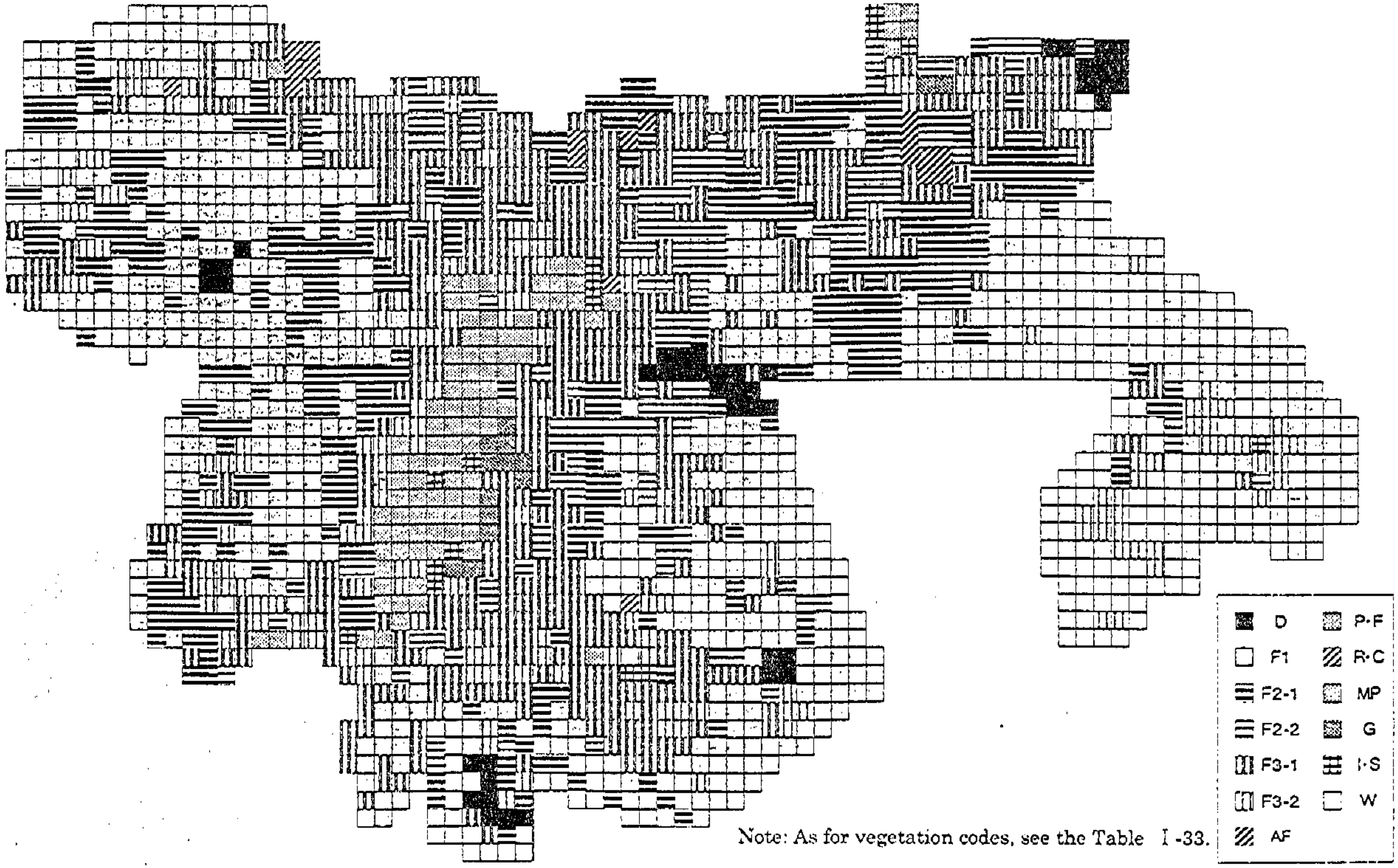


(4) Soil type



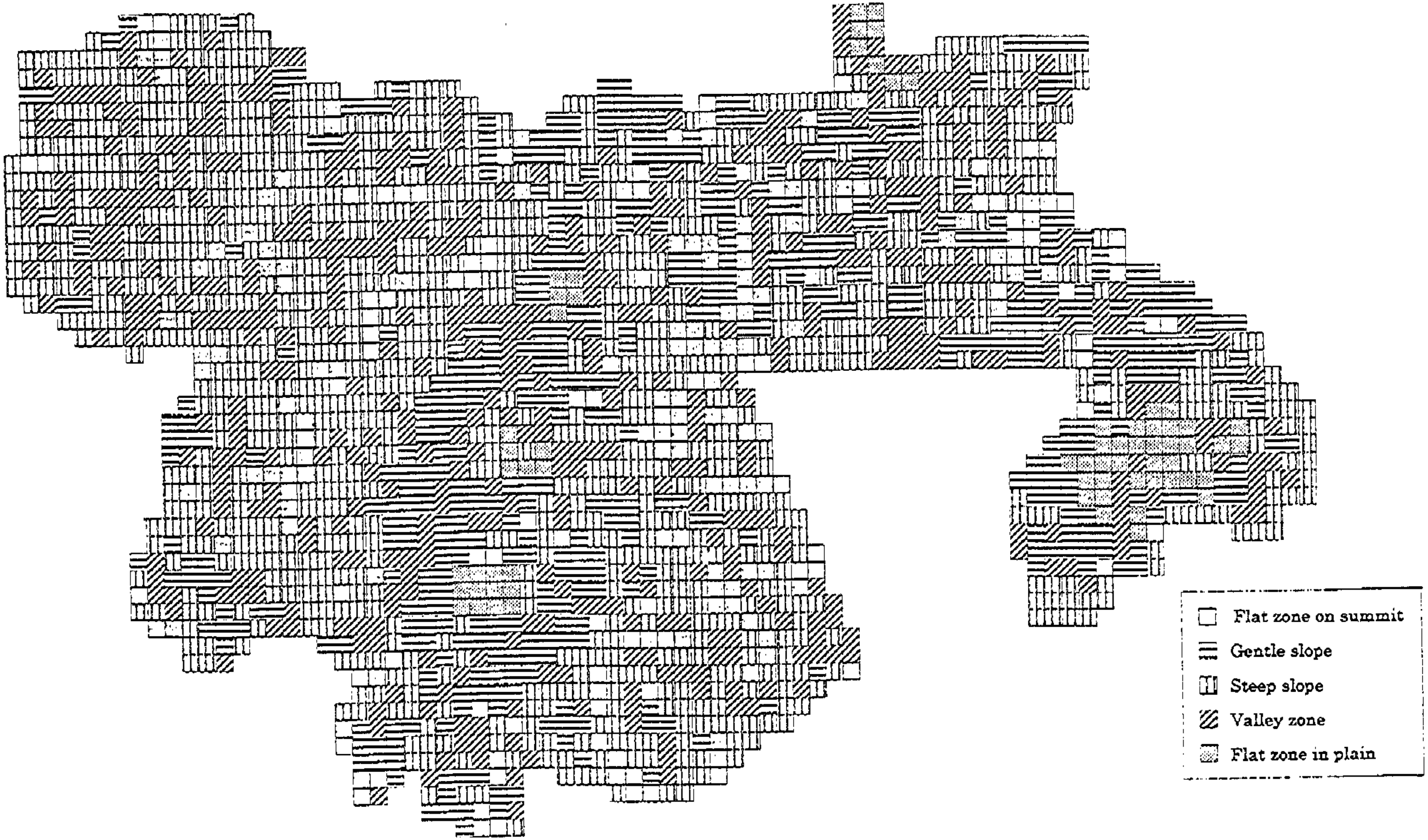
Acrisols & Cambisols
Thick
Middle
Middle~Thin
Thin
Ferralsols
Gleysols
Fluvisols

(5) Vegetation



Note: As for vegetation codes, see the Table I -33.

(6) Topographic classification

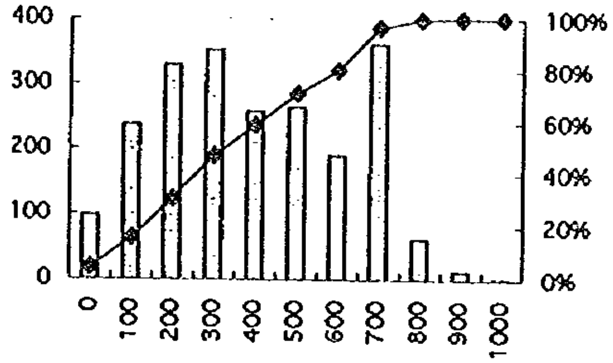


Frequency disrtribution of 6 factors

Atitude

(0~1097.3m)

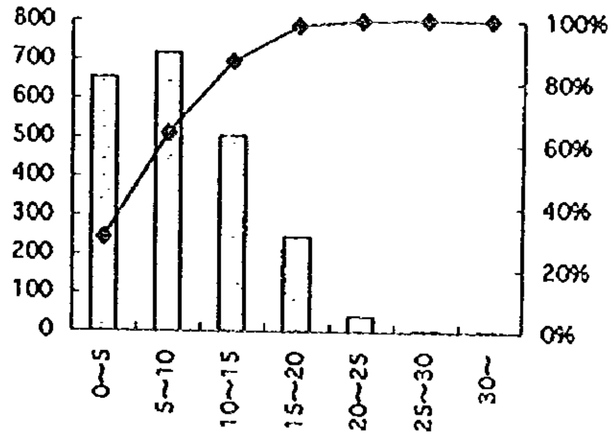
data	n	%
0 ~ 100	97	4.51%
100 ~ 200	237	15.51%
200 ~ 300	329	30.79%
300 ~ 400	351	47.10%
400 ~ 500	256	58.99%
500 ~ 600	262	71.16%
600 ~ 700	188	79.89%
700 ~ 800	360	96.61%
800 ~ 900	60	99.40%
900 ~ 1000	12	99.95%
1000 ~ 1100	1	100.00%



Maximum angle of Inclination (°)

(0~35°)

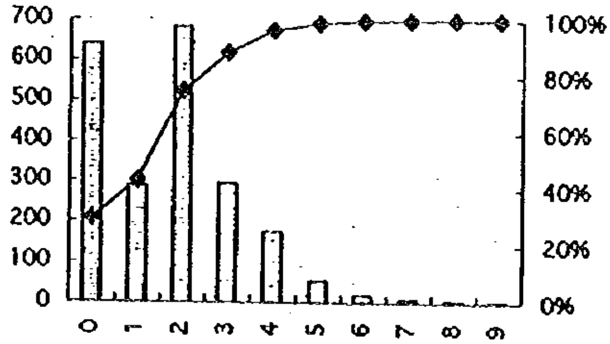
data	n	%
0~5	651	30.24%
5~10	715	63.45%
10~15	502	86.76%
15~20	243	98.05%
20~25	39	99.86%
25~30	2	99.95%
30~	1	100.00%



Valley density

(0~9)

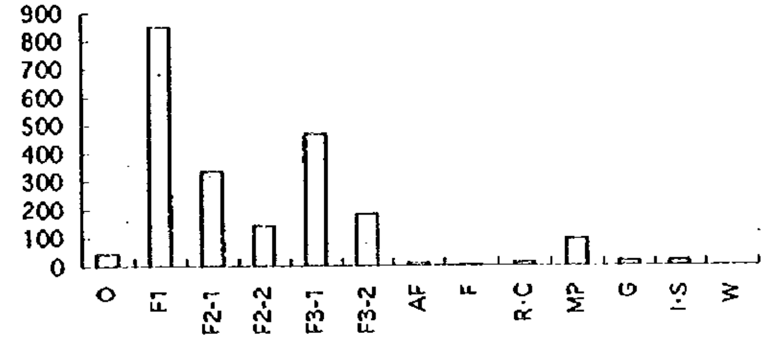
data	n	%
0	638	29.63%
1	287	42.96%
2	681	74.59%
3	293	88.20%
4	173	96.24%
5	53	98.70%
6	18	99.54%
7	6	99.81%
8	3	99.95%
9	1	100.00%



Vegetation

(12type)

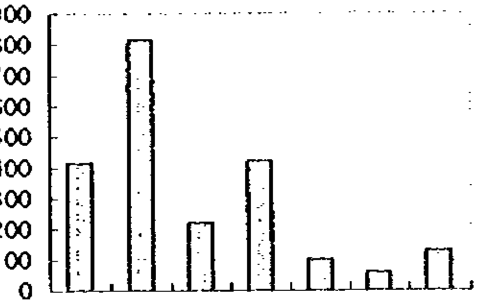
data		n
O	<1>	44
F1	<2>	847
F2-1	<3>	334
F2-2	<4>	141
F3-1	<5>	466
F3-2	<6>	182
AF	<7>	6
F	<8>	2
R·C	<9>	10
MP	<10>	93
G	<11>	13
I·S	<12>	15
W	<13>	0



Soil type

(7type)

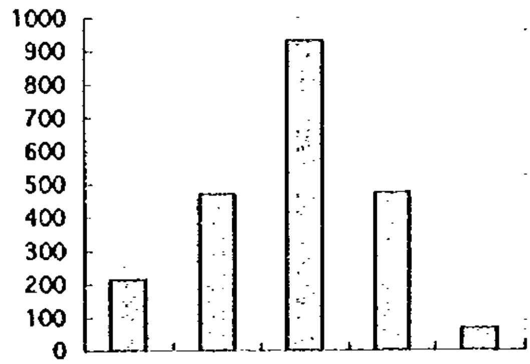
data		n
S	<1>	413
M	<2>	814
MT	<3>	220
T	<4>	421
Fe	<5>	99
G	<6>	57
F	<7>	129



Topographic classification

(5type)

data		n
T	<1>	214
JS	<2>	470
SS	<3>	931
V	<4>	473
F	<5>	65



INFORMATION GATHERING WORKSHOP

As part of preliminary socio-economic survey, the Study Team conducted an information gathering workshop on Monday, 15 April, 1996, from 930-1630 hours, at Community Hall, Kota Mardu. Objectives of the workshop are (1) to analyze people, groups and organizations which may be affected by the Forestry Development Project in Marak Parak (the Project) and (2) to analyze "cause and effect" relationships of the existing problems in the study area. Methods of Participation Analysis and Problem Analysis, which are part of a project planning tool called "Project Cycle Management (PCM) Participatory Planning", which were developed by Foundation of Advanced International Development, were applied in the workshop. As many as 10 persons, including representatives from the villages in the Study Area, relevant government agencies and SAFODA, participated in the workshop. In addition, the study team members attended the workshop as observers. Unfortunately no village women participated in the workshop despite invitation. A list of participants and observers is given below.

Chart1: List of participants and observers

	Name	Organization	Title
		Participants	
1	Kuntingai Bin Singaron	Mukim. Marak Parak	Wakil Ketua Anak Negri (WKAN)
2	KK. Bulagoi Boruid	Kg. Polipikan	Ketua Kampung
3	Gomudong Boruid	Village Development and Security Committee (JKKK) Kg. Polipikan	Chairman
4	Motis Budan	JKKK, Kg. Marak Parak	Chairman
5	Abd. Salam B. Akup	Department of Forestry	District Forestry Officer
6	James Iskandar Baudi	District Office, Kota Marudu	Assist. Development Officer
7	Chin Neyule Fui	Famer's Association (AKPP)	Asst. Accountant
8	Freddy Lee	SAFODA	Surveyor
9	Ahmad Hk. Musli	SAFODA	Regional Forestry Director
10	Cadoly Lagang	SAFODA	Asst. Planting Officer
		Observers	
1	Tsutomu HANDA	JICA Study Team	Team Leader
2	Kiyoshi FUJII	JICA Study Team	Sub-Leader
3	Toshio SAITO	JICA Study Team	Member
4	Takaki TOYOTA	JICA Study Team	Member
5	Yasuyo HIROUCHI	JICA Study Team	Member/Moderator

During the workshop, the participants were requested to express their ideas by writing them concisely on cards (both in English and Malay) and putting them on the board. Assistance was given to those who cannot write.

II. INTRODUCTION

The team leader gave a brief explanation on the objectives of the Study and the workshop to the participants.

III. PARTICIPATION ANALYSIS

Individuals, groups and organizations relevant to communities were listed on the board and discussed. The result of the discussion is summarized in Chart 2 below.

Chart 2: Individuals, groups, organizations relevant to communities

Beneficiaries	Supporting Groups	Potential Opponents
-Village men -Village women -Shifting cultivators -Small holders -Mini-bus drivers -Hunters	-District Office -Department of Forestry -Department of Agriculture -Department of Education -Department of Social Development -Native Chief Office -Ketua Kampung -JKKK -Koperasi Pembanguuan Desa (KPD) -Ahli Kumpulan Tani -Kumpulan Keluarga Tani -Ahli Kumpulan Persatuan Peladans -Sabah Rubber Fund Board -Sabah Foundation -Churches	-Shifting cultivators

Among those listed above, five social groups, which were regarded as key actors in the community, were selected for detailed analyses: (1)"village men", (2)"village women", (3)"shifting cultivators", (4)"Ketua Kampung (Village Head)" and (5) "Village Development and Security Committee (JKKK)" .

(1) Village Men

(a) Characteristics

They are diligent and hardworking. They get up early (around 5 o'clock). They are basically subsistence farmers. Many of them practice shifting cultivation. Some are small holders who cultivate farm land which they have titles to. They often go hunting in order to make up for food deficiency at home. They also suffer from lack of job opportunities to earn cash income. Average monthly income range from RM 100 to RM 200 . (Poverty line in Sabah is RM 150). Lack of cash income makes it impossible for them to invest in land development for more agricultural production. In sum, they are caught in a vicious cycle of low agricultural production and low income.

(b) Problems

Accessibility to Kota Marudu, where markets for their agricultural products exist, is a problem. Most of the villages in the Study Area are located in remote areas but transportation is very poor. Villagers have to take private mini-buses to Kota Marudu but roads and paths, most of which are not even graveled, are in bad shape and hardly maintained. Bridges are primitive and often flooded over during the rainy season, which are seldom repaired.

There is no electricity in the villages. (Some villages have been provided with generators by the government but they are broken and not in use). They use kerosene lamps for lighting and fuelwood for cooking. Most of the villages do not have access to safe drinking water, either: Water has to be obtained from wells, springs, rivers, etc., which have sometimes led to breakout of water-related diseases such as cholera. Lack of rural health care is also a problem. Only Marak Parak Village has a clinic. Health education is not enough. Social drinking could also be a problem. Quality of education in general is poor. There are only a few primary schools in the Study Area. There are not enough number of teachers, either.

(c) Needs

They need secure landownership i.e. native title. To increase agricultural production, they need training and technical advice. They also want job opportunities in their villages. Improvement of road condition as well as development of public transportation system is necessary. Gravity piped water should be available in every village. The village men are also interested in having their children better educated, for which more boarding schools in the area are needed.

(d) Implications for the Project

The Project could be a welcome as it could create job opportunities for especially young people (10-21 years old). Adult village men may find it difficult to participate in the Project as they are often too busy with their agricultural activities. The Project may slow down urban migration and may even bring some of those who have migrated to town back to the villages. In the meantime, the Project could possibly cause some conflicts with villagers. Boundaries of land without titles are not clear and some farm land is kept idle due to shortage of manpower. Both of them would make it difficult for the Project to zone the area for forestry activities. To avoid this, it is important that the village men are well informed and consulted regarding the Project in advance.

(2) Village Women

As mentioned earlier, there are no female participants so that analysis of village women was conducted from men's point of view only.

(a) Characteristics

They are "housewives" though they engage in farming activities such as planting vegetables, maize, padi, sweet potatoes, fruit trees, etc. and taking care of domestic animals (chicken, buffaloes and cows). Women cook, make local wine and raise children. Some women are widows.

(b) Problems

Women are busy with taking care of their children. There are many children per family (on average 4-5 children) due to lack of access to birth control and family planning. Lack of health care is a problem for women. Women also suffer from low income. Marketing their agricultural products is difficult because they have limited mobility due to lack of appropriate transportation and bad road condition. Low price of agricultural products is also a problem.

(c) Needs

Many women are illiterate and need adult education. (Female children are generally literate as they go to school). Not only men but also women need basic farming knowledge.

(d) Implications for the Project

The Project could involve village women in various ways. For industrial plantation, women could work at a nursery. If a camp is to be set up, women could sell vegetables there, work at a canteen and sundry shop. For social forestry type of activities, women could be involved in planting trees.

(3) Shifting Cultivators

(a) Characteristics

They cultivate hill padi, maize and some vegetables in area of 2-5 acres respectively. Average distance to field is 1-2 km (approximately 20 minutes' walk). They practice slash and burn. They used to conduct shifting cultivation in groups (Gotong Royong). Nowadays, they are more interested in concentrating their effort on their own land and shifting cultivation by Gotong Royong is decreasing. They also grow vegetables and fruit trees around their houses (home garden).

(b) Problems

Sometimes dry season is too long. It is difficult to control fire. Agricultural yield is low partly because they do not have enough money to purchase fertilizers. Crops are frequently damaged by wild animals such as monkeys and wild boars. Some family members are not able to work because they fall sick. They often cannot complete necessary work due to shortage of manpower in time and lack of funds.

(c) **Needs**

Technical advice on agriculture is necessary for them to increase productivity. They should also learn methods for pest control. Water for crops should be available. Transportation to reach markets for products as well as improvement of road condition is necessary.

(d) **Implications for the Project**

The Project could create jobs for them. It could also encourage optimal land use. Implementation of scheme by govemment.

(4) **Village Head (Ketua Kampung)**

(a) **Characteristics**

They are responsible, patient, impartial, firm and concise. They are appointed by the local government from their respective villages and are in charge of matters related to native customs. For example, they facilitate land application for native title and settle land conflicts. They also settle marriage and divorce cases.

(b) **Problems**

They find it difficult to settle some cases as villages have various attitudes (from bad to good) towards them. When there are court cases in Kota Marudu, the village heads must attend to but communication is a problem. Delay in processing land application on the government side is also a problem for them. Furthermore, they are often ill informed of government projects in their villages, which make difficult for them to convince villagers of its importance.

(c) **Needs**

They need training in "human resource management". More development assistance from the govemment would facilitate their work. It is important that they have detailed information on development projects.

(d) **Implications for the Project**

They could explain objectives of the Project to the villagers clearly and convince them of its benefits. The Project could solve underemployment situation in their villages. The Project could also reduce land conflict problems as it would provide sources of non-agricultural income.

(5) Village Development and Security Committee (JKKK)

(a) Characteristics

A JKKK exists in every village. It is under jurisdiction of State Ministry of Rural Development and its members (15 members in Kg. Marak Parak, of which 3 are women) are appointed by the local government from the respective villages. They are full-time government employees and receive monthly allowance of RM 100. They are responsible for planning development activities. They are also responsible for security of their respective villages. They play intermediary role between villages and the local government.

(b) Problems

JKKKs do not have enough budget. Some JKKK members lack of experience and are not active. They suffer from lack of cooperation from some villagers mostly due to personal reasons. JKKK members do not know boundaries of villages exactly though they are in charge of security of village.

(c) Needs

They need training in Leadership and study tour. Communication facility such as telephone should be available to them. They also need additional allowance for their work

(d) Implications for the Project

The Project could involve a plan for village development. JKKK could cooperate in developing the Project. JKKK could encourage the youth to participate in the Project. They could also assist in solving land conflicts which could be involved in the Project.

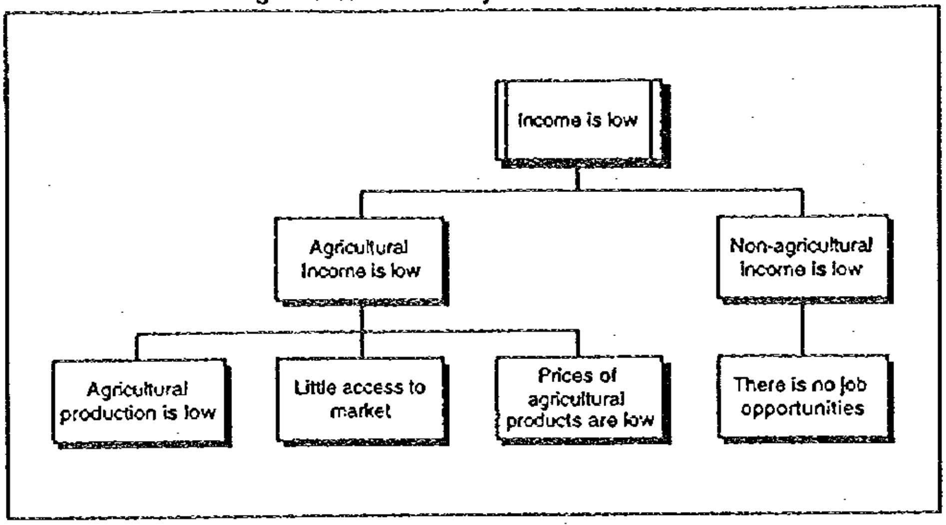
III. PROBLEM ANALYSIS

After analyzing the key social groups, the workshop participants selected villagers (men and women) as the target group of the Project. "**Income is low**" was identified as the core problem for the villagers. Income was classified into two categories: agricultural as well as non-agricultural sources. The workshop participants analyzed the causes of these problems through developing a problem tree. The problem tree developed by the participants was summarized in Diagram 1.

(1) Agricultural income is low.

Four direct causes are identified : (1) "Agricultural production is low", (2) " Little access to market"and (3) "Prices of agricultural products are low"".

Diagram 1: Summary of Problem Tree



(a) Agricultural production is low

Causes:

- There is shortage of manpower to cultivate farm land. Some villagers have migrated to Kota Marudu and other places. Young people are not interested in farming. Incentives to work in agricultural sector are few. In addition, some farmers are not fully committed to their work.
- Land productivity is low. First of all, soil condition in the area is not quite suitable for agriculture. Many farmers practice traditional agriculture (slash and bum), which is not very productive as they do not have knowledge and information regarding modern agriculture. Land preparation such as ploughing is not completed as modern machinery is not available. Seed quality is not very good as seeds are collected by themselves.
- Existing plots are too small for large-scale farming. Villagers do not have enough capital to plant larger area as they do not know how to get agricultural credits. Furthermore, many villagers do not yet acquired land titles (Native Titles), which are required to apply for credits, due to slowness of processing of land applications.
- Crops are frequently damaged by pests before harvested. Villagers do not practice pest control because they do not have appropriate knowledge. Also, pesticides and equipment/tools are too expensive for them.
- Weather information is not available so that farmers cannot make appropriate decisions in time.
- There is often water shortage in the area.

(b) Little access to market

Causes:

- Villages are located in remote areas
- Road condition is poor.

* There is no public transportation available.

(c) Prices of agricultural products are low

Its causes were not analyzed.

(2) Non-agricultural income is low

One of the major causes was identified as "there are few job opportunities". Due to shortage of time, further analysis was not conducted.

MINUTES OF MEETING OF CDO, PEMAJU MUKIM, JKKK, KK, SAFODA AND JOFCA

Date : 3 September 1996
Time : 8.30 AM
Venue : Conference Room, Kota Marudu District Office

Attendance

1. OKK Mohd. Ali Yassin Hasffim	KD Kota Marudu	50+ yrs
2. Mr. John Charles Mikat	CDO N.6 Langkon	40 yrs
3. Mr. Kuntingai Sigaron	WKAN Mukim Marak Parak	42 yrs
4. Mr. Almalek Utoh	Penyelia N.5 Tandek	37 yrs
5. Mr. Kalik Pandarasa	PM Mukim Marak Parak	-
6. Mr. Presly Gambu	PM Mukim Luba Pelumpung	47 yrs
7. Mr. Jikal Tamingan	PM Mukim Gana	39 yrs
8. Mr. Botong Anjok	PM Mukim Talantang	57 yrs
9. Mr. Jusika Tiaras	KK Kg. ~~Marak Parak~~ M. Baral	41 yrs
10. Mr. Kungkim Sarail	KK Kg. Marak Parak	39 yrs
11. Mr. Lakasan Sawanti	KK Kg. Tangkol	52 yrs
12. Mr. Bandawa Sondigan	KK Kg. Melangkap Tengah	45 yrs
13. Mr. Bulagai Beruid	KK Kg. Polipikan	54 yrs
14. Mr. Maruda	KK	-
15. Mr. Keritek	KK	-
16. Mr. Kudoh	KK Kg. Sunsui	-
17. Mr. Gondi Kuim	P/JKKK Kg. Melangkap Darat	34 yrs
18. Mr. Niol Lompitou	P/JKKK Kg. Melangkap Tengah	-
19 Mr. Kiyoshi Fuii	JOFCA	
20. Ms Hirouchi Yasuyo	Global Link Management Inc.	
21. Mr. Petrus F. Guriting	INDEP	
22. Mr. Maipol Spait	INDEP	
23. SAFODA Representatives (3 persons)	SAFODA	

1. Introduction

Mr. John C. Mikat, the CDO of N.6 Langkon, welcome everyone who have attended the meeting especially to the Pemaju Mukim and Pengerusi JKKK.

2. Purpose of Meeting

John Mikat, CDO N.6 Langkon, explained to the participants regarding the purpose of the meeting. He requested them to give their full cooperation to the team who would be conducting a research on behalf of JOFCA and SAFODA in the four mukims; namely Mukim Marak Parak, Mukim Talantang, Mukim Gana and Mukim Luba Pelumpung. Subsequently, he requested Mr. Kiyoshi Fuji as the group's team leader and Ms. Hirouchi Yasuyo to elaborate on their respective research work.

sub

3. Purpose of Study

3.1. Tree Planting Project

Mr. K. Fuji explained the study outline of the tree planting project in Marak Parak Consolidation. The study is funded by JICA on request by the Malaysian Government through SAFODA. The main target area would be Mukims Marak Parak, Talantang, Gana and Luba Pelumpung. The project is partially intended to uplift the socio-economic status of the local communities in the affected area. Therefore, he requested a full understanding and cooperation from the local people to enable his team to carry out their research work.

3.2. Socio-economic Research Work

JOFCA

Ms. H. Yasuyo indicated the various villages involved in the tree planting project based on an aerial map taken by ~~SAFODA~~ recently. A socio-economic survey to be done in the area would consider all aspects of interest to the local communities in the aforementioned mukims. She stressed that the lands owned by the local people would not be touched by this project, hence the need to identify the exact locations of the potential project area. Anyhow, upon concluding the preliminary socio-economic research she said that whether the project would actually be implemented or not would depend on the final decision of the Malaysian Government.

At the same time, she pointed out two pertinent quesions to the local leaders for Mr. K. Fuji: (a) Whether there are still land in the targetted project area available for the tree planting project and how to identify them; and (b) Whether the surrounding mukims would be able to provide the required labour to manage the nursery and the tree planting should the project materialise.

Finally, she told the participants the list of villagers in the various mukim which are located in the project area.

4. Questions and Answers

4.1. Q. from Mr. Presley, PM Mukim Luba Pehumpung

(a) Regarding the lands with title and LA in the respective villagers, will these be included in the tree planting project? Will Safoda takes away their land?

(b) How do the land owners get their land developed for tree planting?

Answers from Safoda

(a) Safoda will not take away any land already owned by the people including those with LA. Only state land will be eyed for the tree planting project.

(b) Individual land owners can request Safoda relating to planting commercial trees in their own land.

4.2. Q. from Tandek Representative

(a) When this project is implemented, will the land be distributed on a 15-acre per person later?

Answer from Safoda

(a) The allotment of 15 acres per person does not arise as this is not a scheme project.

4.3. Q. from KK Kg. Melangkap Tengah

(a) Before the research team enters my village, I request that the map indicating the actual boundaries of the project be given to us so that we are prepared to discuss further matters?

Answer from CDO (John)

(a) The actual map will be shown to the people when the research team comes to their village. Further, it is the responsibility of the Pengerusi JKKK aisded by the KK to explain the matter to the people in each village. Anyhow, Kg. Melangkap Tengah is not involved in the sampled detail study, therefore the communities there should not be unduly worried in meeting the research team.

4.4. Q. from KK Kg. Melangkap Darat

(a) Regarding the scheme undertaken by Safoda in Bengkoka area, we regret do not understand why Safoda has not fulfilled their promise of giving back the land to the local people? We do not want to hear anymore false promises?

(b) The implementation of this project should consider the views of the people whether they want this project or not based on the negative impacts gathered from the socio-economic survey. Can you elaborate on this issue?

Answers from Safoda (a) & CDO (b)

(a) There is a misunderstanding on this matter by the people. Actually, the division of the said land will be done in September this year.

(b) The purpose of this socio-economic survey is to collect all relevant data including views from the local people. That is why you should give your full cooperation to the researchers so that all your views are incorporated in the study and recommendation to the relevant authority in implementing the project in future.

4.5. Q. from PM Mukim Talantang

(a) The general interest of the people in my mukim prefer planting rubber to tree on their land. Are you going to force us into committing ourselves to the treeplanting project? small-scale

Answer from Safoda

(a) Reallistically, we can only recommend to the people what is suitable to be planted on their land. Eventually, it is themselves to determine what they want to use with their land. We cannot force them to do tree planting at all.

5. Concluding Remarks

5.1. Ms. H.Yasuyo

Yasuyo expressed her gratitude for securing the cooperation from the community leaders. She reiterated that JICA's intention is to respect the rights of the local communities over the possession of their land. This activity in fact is just a preliminary study on the socio-econmic aspects of the potentially affected areas. The second phase of the study on incorporating the community participation in the project development would be carried out in 1997.

5.2. John (CDO)

The CDO reemphasized the importance of cooperation from the various community leaders to explained the genuine intention of the research by the team. Finally, he thanked them for their attendance and support for the project.

6. Adjournment of Meeting

The meeting was adjourned at 10.30 am.

Report taken by:

MAIPOL SPAIT

COMMENTS ON THE PROJECT DURING THE INITIAL MEETINGS WITH VILLAGERS AT COMMUNITY HALLS

1. INTRODUCTION

There are five villages involved in the sampled survey for the socio-economic survey report carried out in the Marak Parak Consolidation. The villages are Marak Parak, Pompodon, Natu-Polipikan, Dalamason and Lombiding. In each village or kampung (Kg.), the people and the survey team held initial meetings at their respective community halls or balai raya. It was at these meetings that explanation on the project was given to the people by the survey team members. Likewise, comments from the villages were heard and noted. The pertinent remarks from the people are given below.

2. KG. MARAK PARAK

The people in Kg. Marak Parak forwarded the following comments and questions regarding the project:

a) The people are interested in seeing the project implemented in Mukim Marak Parak, provided that the areas they have claimed under LA and NGR are excluded from the project area. However, the following questions were raised by them at the meeting are as follows:

i) The commercial tree plantation project may not be feasible to be implemented in our village, but we would like to participate in the private tree farming. In this respect, how shall we get the seedlings from Safoda? Will they be given to us free of charge?

ii) If we decide to participate in the private tree faming, how long will it take for us to wait for the harvest?

iii) How big will be the tree be when it is suitable for harvesting?

iv) What is the price of the tree at the time of harvesting?

3. KG. POMPODON

In Kg. Pompodon, the JKKK chairman and the KK were the chief spokesmen for the people in the village. Their views were agreed upon by the other villagers at the meeting. Their comments on the project are as follows:

i) The people support the implementation of the project. Since most of the land areas in the village have been subdivided for LA processing, they request these plots to be excluded from the project area.

ii) Alternatively, the people are willing to include their land as part of the project area provided that they maintain the individual ownership of their land.

iii) The people cited the example of the rubber smallholders scheme currently conducted by the Sabah Rubber Fund Board (SRFB). Can Safoda provide the same service as given by SRFB with regards to forestry development?

(Note: Regarding the rubber Smallholders scheme provided by SRFB, the board offers to develop a designated area for rubber planting. Firstly, the board agrees with several villages who offer their adjoining land to be cleared and planted with rubber trees at its expense. It also provide a subsidy of RM100.00 per acre to workers in the scheme. The workers can be the owner of the land or other people. After planting, the board will maintain the scheme until the fifth or sixth year; that is, until the rubber trees are ready for tapping. At this time, the board hand over the full scheme to the individual land owners who will the become the owners of the rubber trees accordingly. The farmers will tap their rubber trees from then onwards. The board will continue to provide supporting services to the respective land owners by in the form of transportation and marketing the rubber produce. In this arrangement, the farmer does not have to spend anything or lose anything in the process.)

3. KG. DALAMASON

The KK of Kg. Dalamason became the spokesman for the people in his village. He had the following comments on the project:

i) Since Kg. Dalamason has been included in the project area, the people want to know the possible advantages and disadvantages of the of it onto them?

ii) At the moment, the SRFB is in the process of identifying the boundary of the areas they want to include in the rubbaer smallholders scheme for this village. Knowing the detail of the arrangement normally practised by the board in such a scheme, the people want to know if Safoda would provide the similar services to those villagers who may be interested to participate in the private tree farming. Anyhow, they prefer planting teak wood compared to acacia mangium for reason that the former fetches a better price upon harvesting.

iii) If the projected is implemented through Safoda, cann the people claim back the land after harvesting the trees in future?

iv) The people fear that the project may cause the drying up of their water sources especially in the water catchment area in the village. If this is true, then the tree farming will not be good for their village.

4. KG. NATU

Kg. Natu and Kg. Polipikan are administered by the same village headman. Likewise, the KK became the spokesman for the two villages. He fully supports the project for the following reasons:

i) To avail the construction and maintenance of good roads through both villagesfor easier tranportation in marketing the villagers' agricultural produce. Besides, such infrastructural development will improve the accessibility his villages for the benefit of the people. The road is the key to any other form of development in the two villages and the upliftment of their livelihood.

ii) There are large areas of empty land available in Kg. Natu-Polipikan which can be utilised for the project. It is estimated to be about 5,000 acres. The KK is willing to give the area for commercial forestry development.

5. KG. LOMBIDING

In Kg. Lombiding, the JKKK chairman and the KK took the lead in giving comments on the project. Their remarks are as follows:

i) Indeed, there are large areas of empty land available in the village, but they are in the process of subdividing and applying for them under individual ownership. The villagers have made up their mind as to the landuse plan in their village; that is, the planting of rubber trees and oil palm. According to them, they have approached the SRFB and Sabah Land Development Board (SLDB) for the purpose.

ii) Tree farming is their last priority. However, after the explanation on the possibility of having private tree farming, they raised the following questions:

a) What is the benefit the people will get if their plots of land are used by the project?

b) If the villagers would prefer the private tree farming, will they be provided with the seedlings free of charge by Safoda?

c) Eventually, their order of preference in terms of their land use plan is as follows:

First: SRFB ——— Rubber trees (smallholders scheme).

Second: SLDB -------- Oil palm)smallholders scheme)
Third: Planting of Fruit trees
Fourth: Hill padi cultivation
Fifth: Safoda -------- Private tree farming (if there are still areas available).

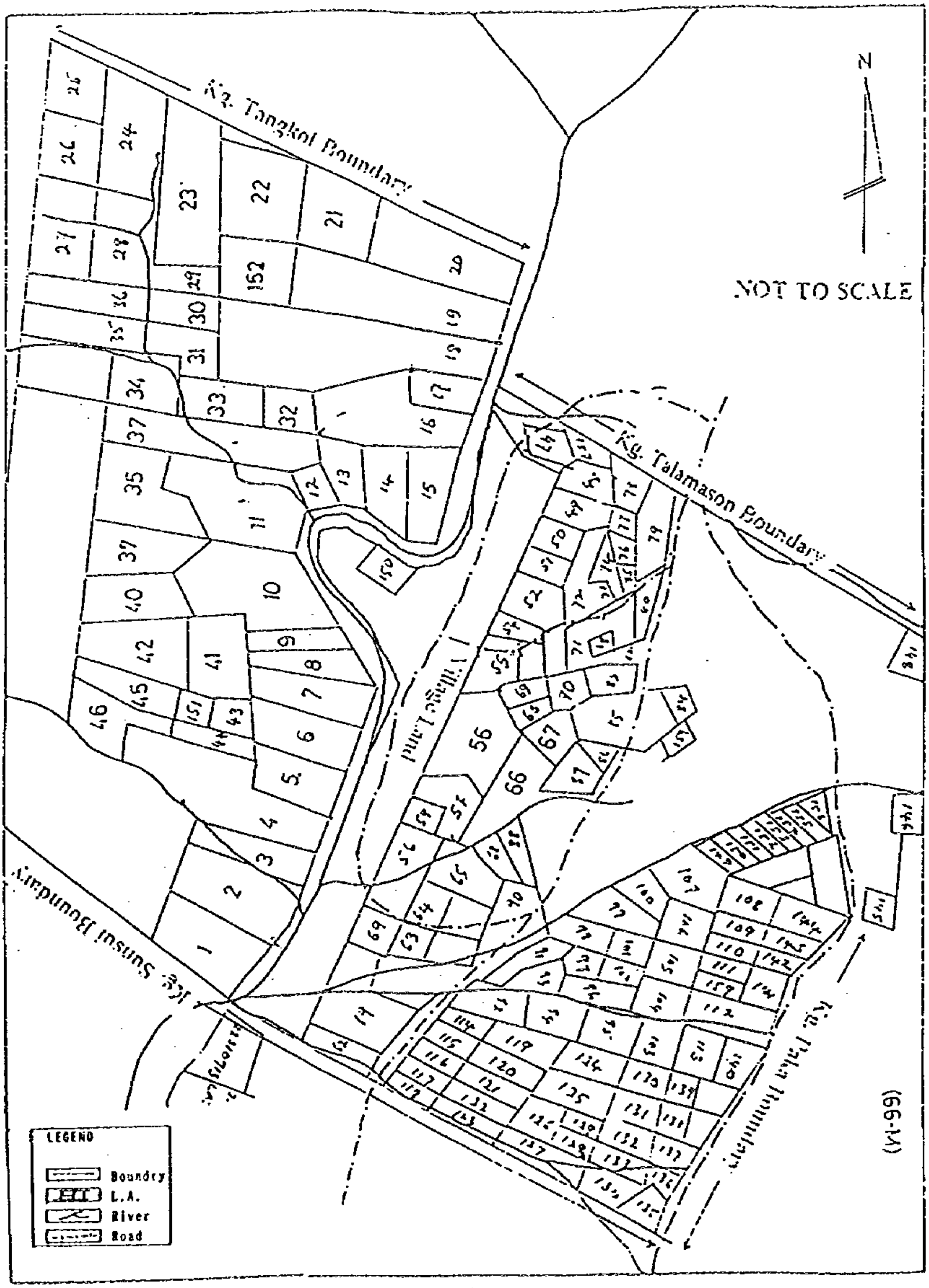
List of village for social survey

L=Langkon / T=Tandek

			Mukim	#	Village	Vegeta-tion	Population (1996)	Ethnic Group
	1	L	Luba Pelumpung	1	Gontoi	F2	180	Pongopuyan
	2	L		2	Luba Pelumpung	F2	116	Pongopuyan
	3	L		3	Pampang Poring	F2	96	Pongopuyan
X	4	L		4	Torintidon	F3	173	Pongopuyan
	5	L	Marak Parak	1	Bambangan	F2	116	Pongopuyan
X	6	L		2	Klas	F3	89	Pongopuyan
X	7	L		3	Marak Parak/Mogis	S/MP/G	627	Pongopuyan
X	8	L		4	Melangkap Darat	F3/S	650	Tombonuo
X	9	L		5	Melangkap Tengah	F3/S	350	Pongopuyan/Tombonuo
X	10	L		6	Natu	F3	140	Tinagas
X	11	L		7	Paka	F3	169	Pongopuyan
X	12	L		8	Paliu Sumbuh	F3	163	Tombonuo
X	13	L		9	Pangapuyan Baru	MP	212	Pangapuyan
X	14	L		10	Polipikan	F3	214	Tinagas
X	15	L		11	Pompodon	MP	156	Pongopuyan
X	16	L		12	Sorinsin	F3	175	Pongopuyan
X	17	L		13	Sunsui	F3	215	Pongopuyan
X	18	L		14	Talamason	MP	287	Pongopuyan
X	19	L		15	Tandahawan	F3	280	Tombonuo
X	20	L		16	Tangkol	MP	235	Pongopuyan
	21	L		17	Tungab	F1	60	Pongopuyan
X	22	L	Simpangan	1	Kotud	F3	250	Pongopuyan
X	23	L		2	Talas	F3	207	Pongopuyan
X	24	T	Gana	1	Dalamason	F3/G	265	Kimaragang, Sonsogon
	25	T		2	Langkaan Gana	F1	256	Tinagas, Liagkalau, Kimaragang
	26	T		3	Kipopogong	F1	176	-do-
	27	T		4	Nasapu Gana	F1	200	-do-
	28	T		5	Taguhu	F2	148	Kimaragang
X	29	T	Talantang	1	Lombiding	F3/F2	136	Kimaragang, Sonsogon
X	30	T		2	Penusukan	F3/G	176	Kimaragang
X	31	T		3	Piso	F3/F2	221	Kimaragang
X	32	T		5	Talantang 2	P/G	252	Kimaragang

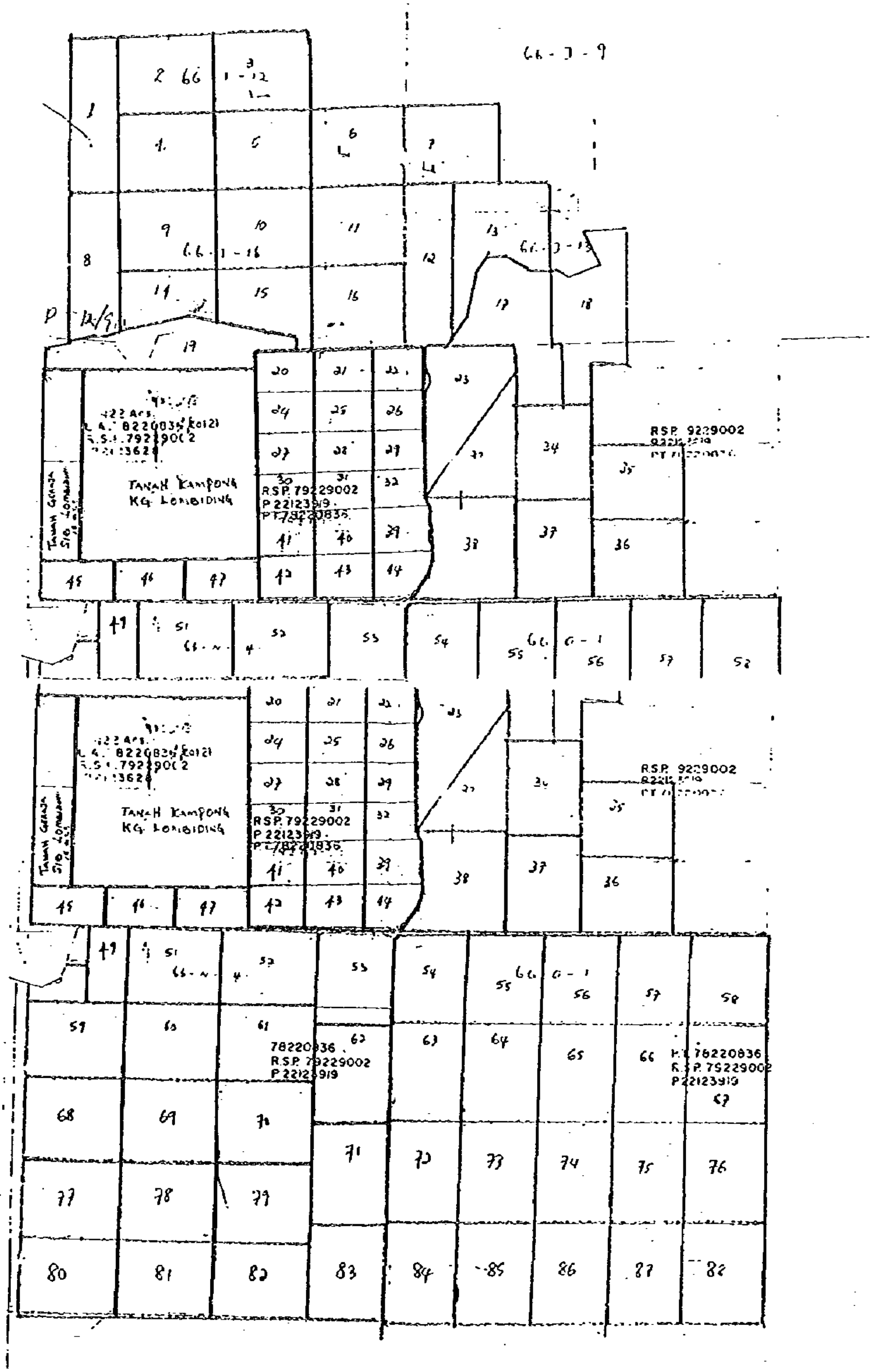
	Total	F3/G/MP
Population	6990	5553
Number of villages	32	23

Land Application Map of Kg.Pompadon

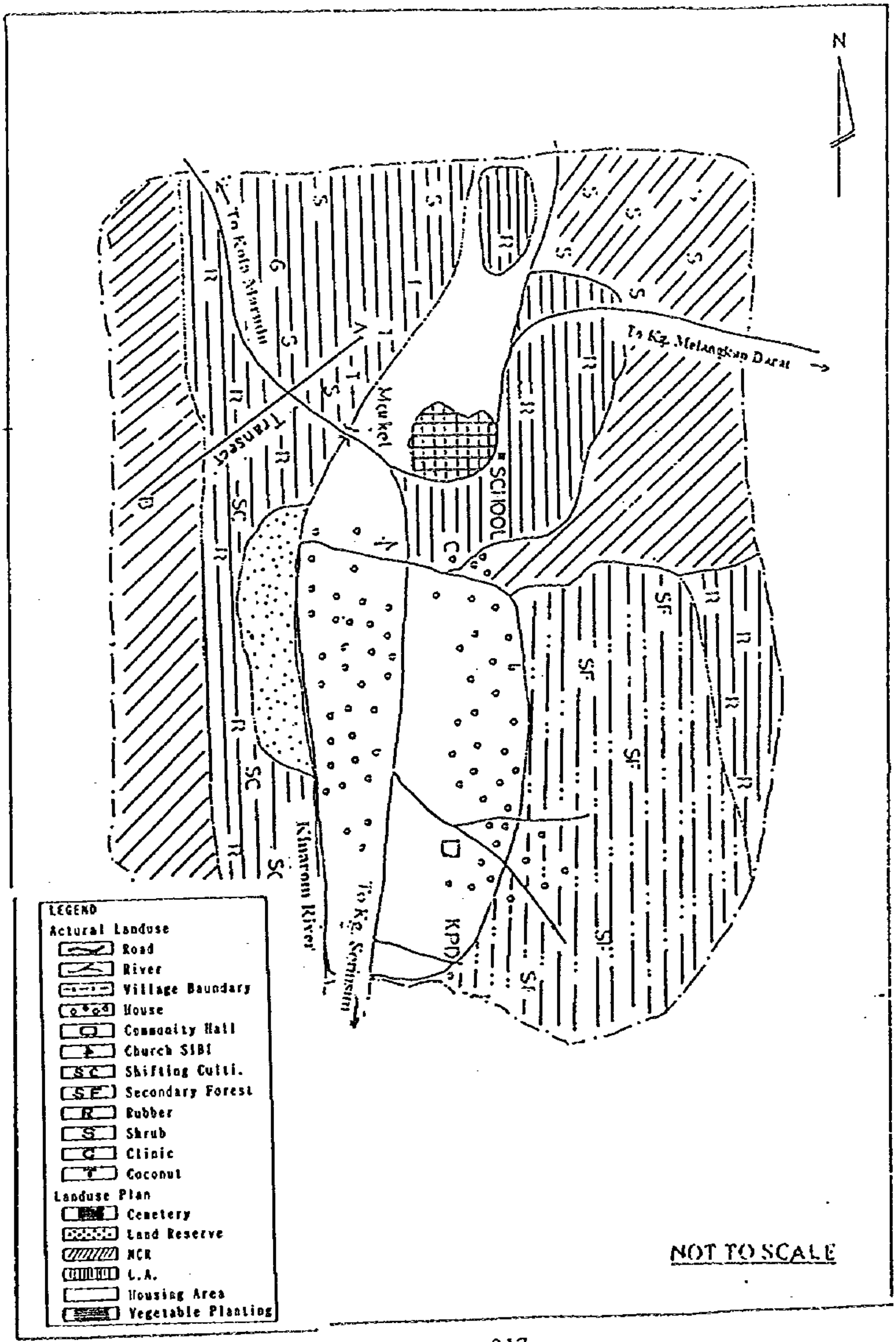


Attachment 12

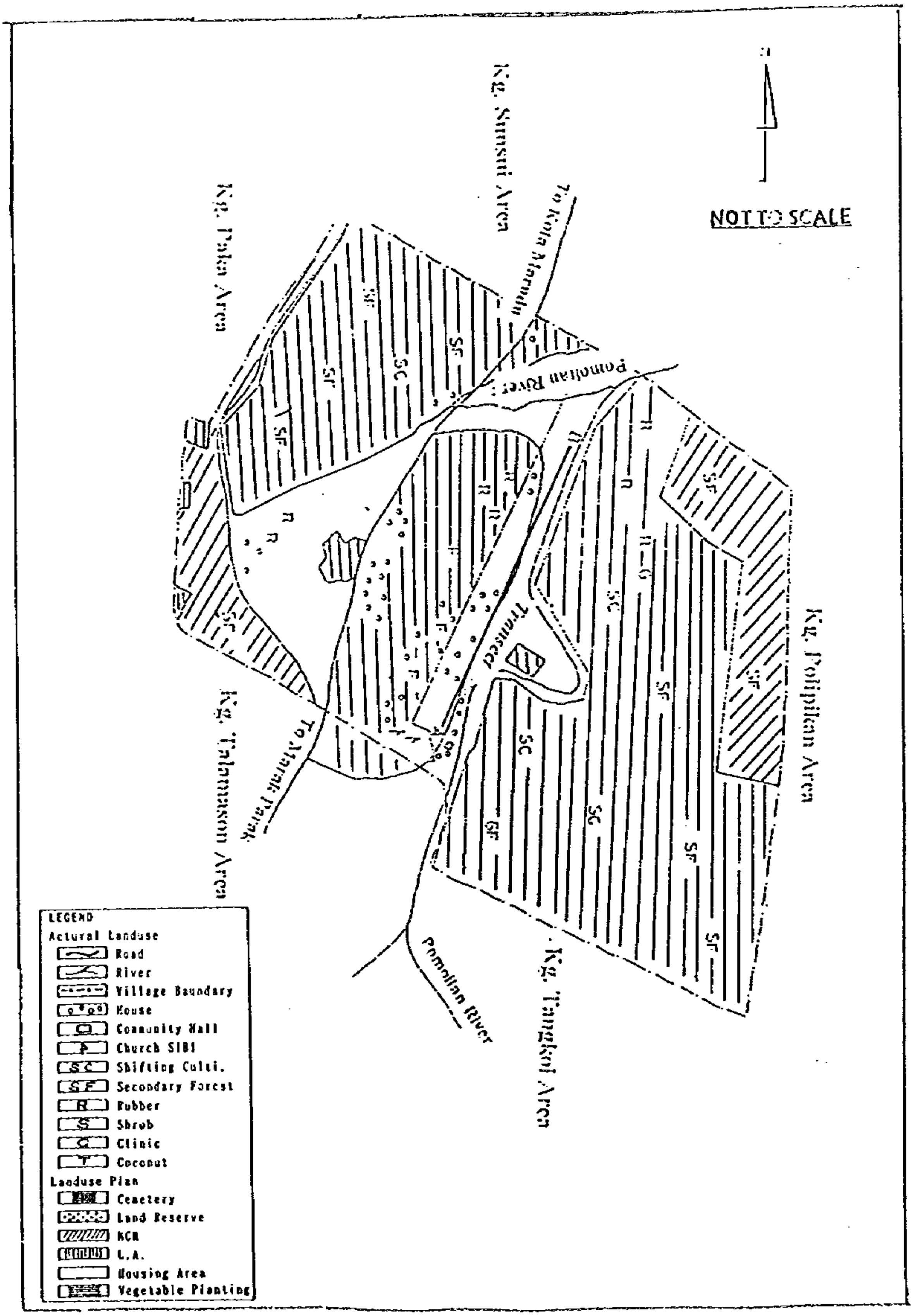
Land Application Map of Kg.Lombiding



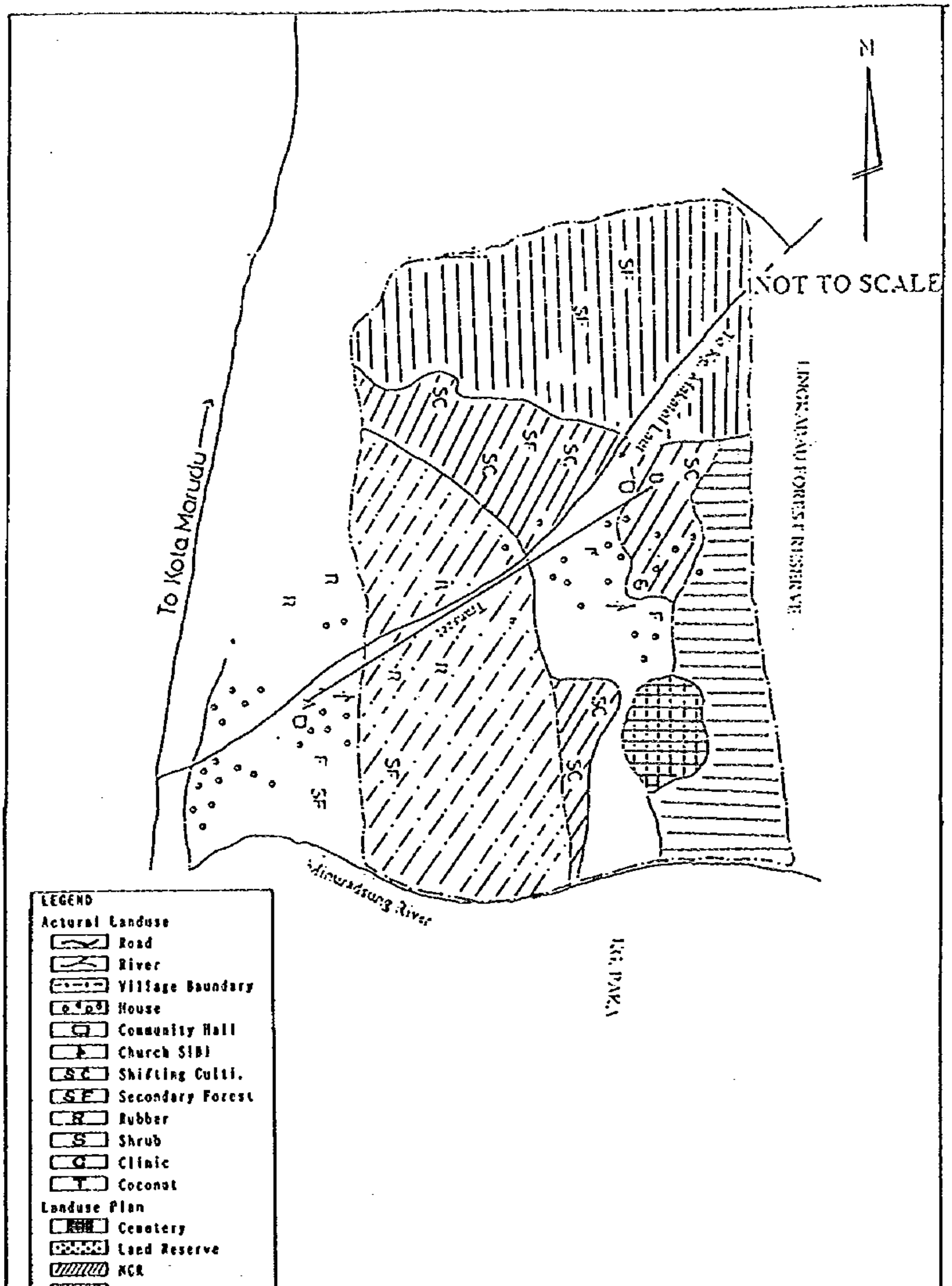
Settlement and Land Use Map of Kg. Marak Parak



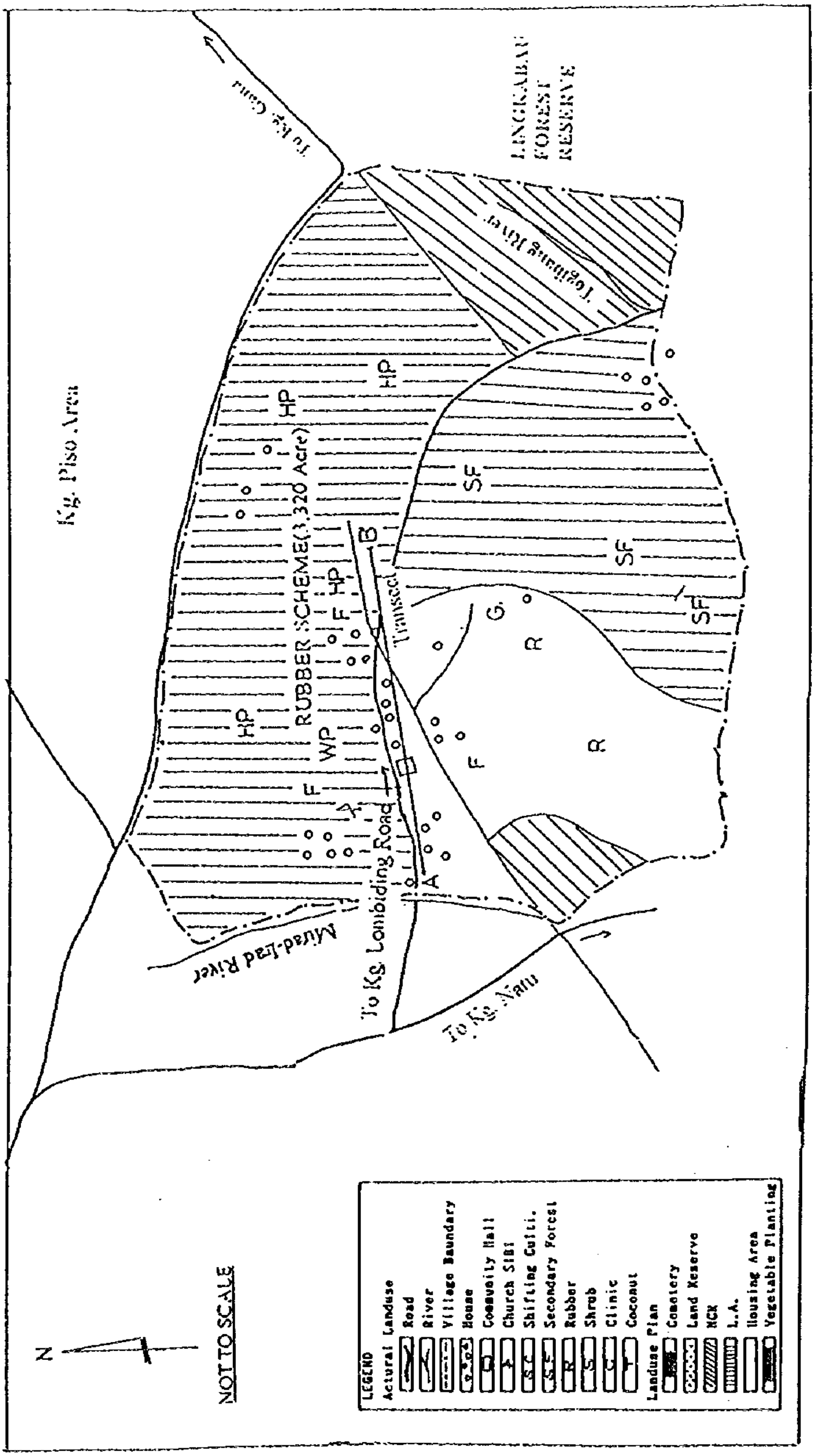
Settlement and Land Use Map of Kg. Pompadon



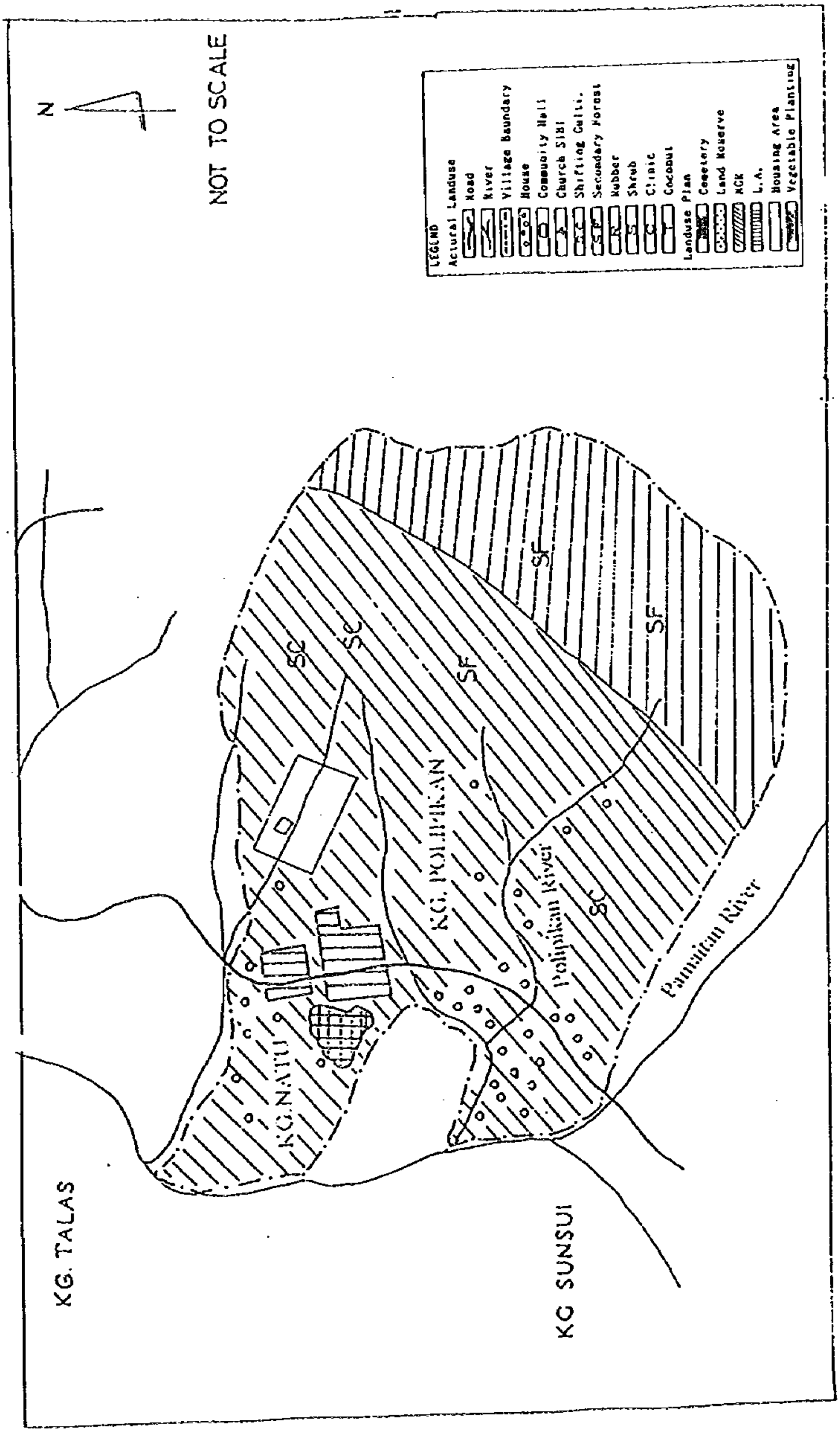
Settlement and Land Use Map of Kg. Dalamason



Settlement and Land Use Map of Kg. Lombiding



Settlement and Land Use Map of Kg. Natu-Polipikan



Procedures to obtain Native Title

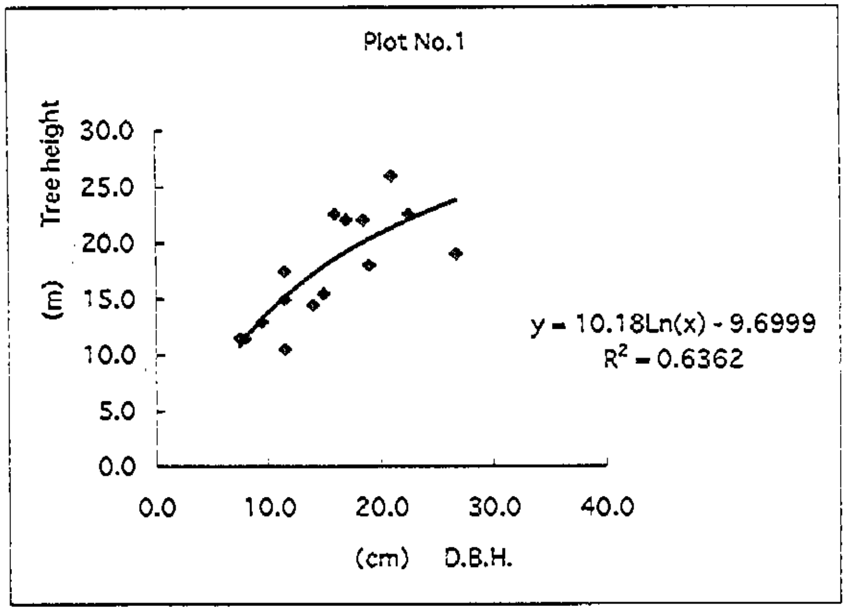
1. Registration of Application
   1) An Applicant for Native Title obtains an application form at the District Land and Survey Office and fills out the form (including purpose of use, location of the applied plot and its size, etc.)
   2) The applicant is required to submit the application to the ACLR through the District Land and Survey Office.
   3) The District Land and Survey Office receives and registers the application.

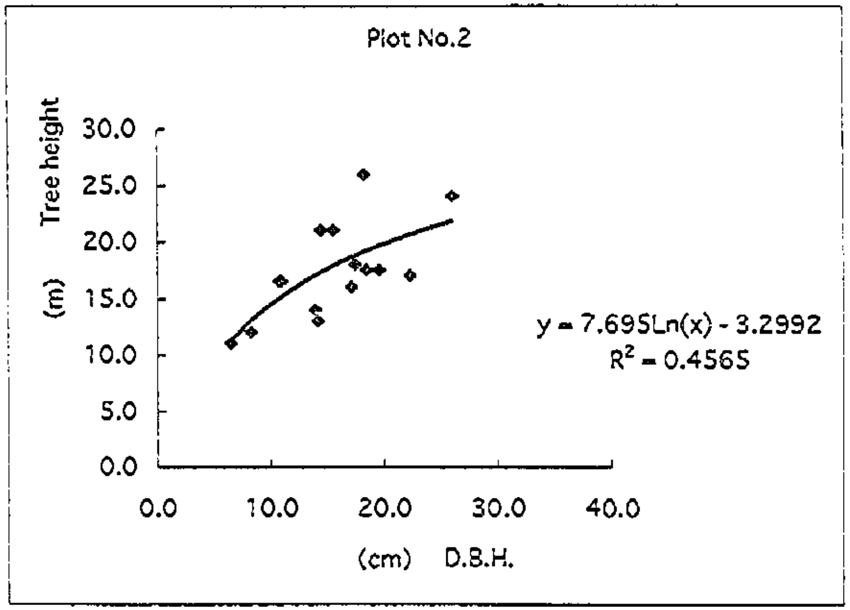
2. Review of Application
   4) The ACLR sends the application to the District Surveyor of the State Department of Land and Survey to check if the applied plot is located in the area classified as the State Land, which is alienable.
   5) The application is sent to the District Agriculture Office to verify that the applied land is suitable for the type of farming specified in the application form.
   6) The application is sent to the District Forest Office to find out whether or not timber trees exist in the applied land.
   7) The Land Utilization Committee determines whether it should recommend the approval for the said application to the Director of the State Department of Land and Survey.
   8) The Director reviews the recommended application and finally approves or refuses it.
   9) The approval or refusal of the application is notified to the applicant.

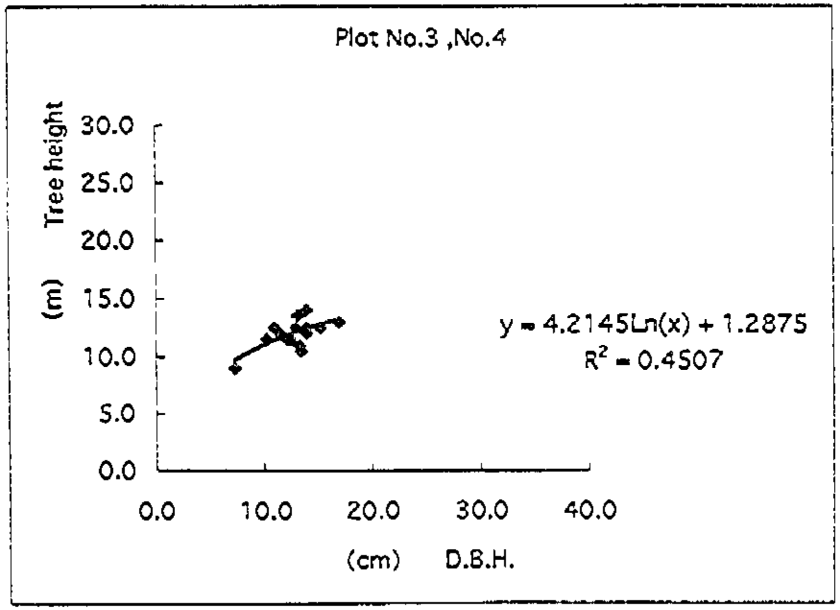
3. Survey of the Land
   10) The Director of the State Department of Land and Survey sends the approved application to the District Surveyor of the Department.
   11) The District Surveyor sends survey documents to the surveyor in charge.
   12) The surveyor directs the District Land and Survey Office to prepare a draft survey map.
   13) The Office conducts a survey and prepare a draft survey map.
   14) The draft survey map is sent to the State Department of Land and Survey for approval.

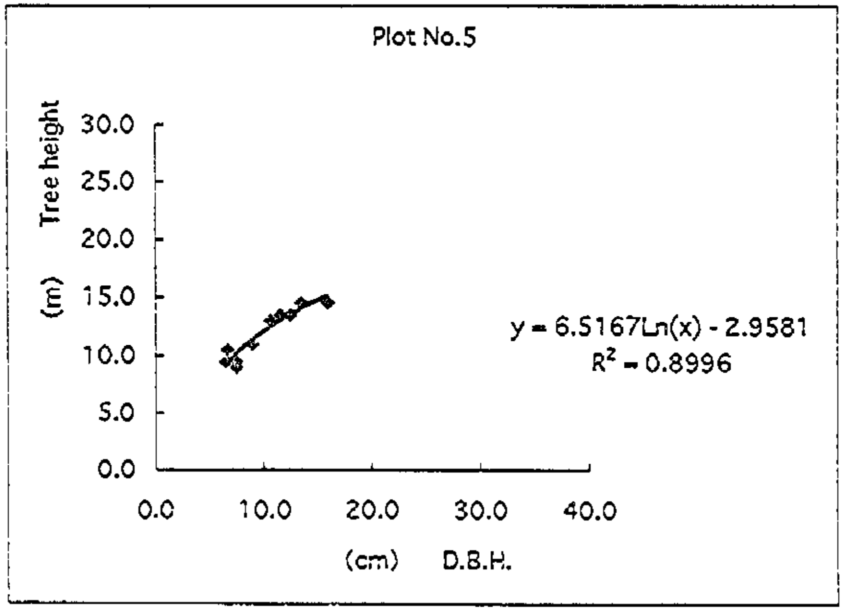
4. Registration on Land
   15) The State Department of Land and Survey performs necessary work for issuance of a Native Title.
   16) Relevant documents are sent to the ACLR in the District.
   17) The District Land and Survey Office prepares a Native Title.
   18) The Native Title is issued to the applicant.

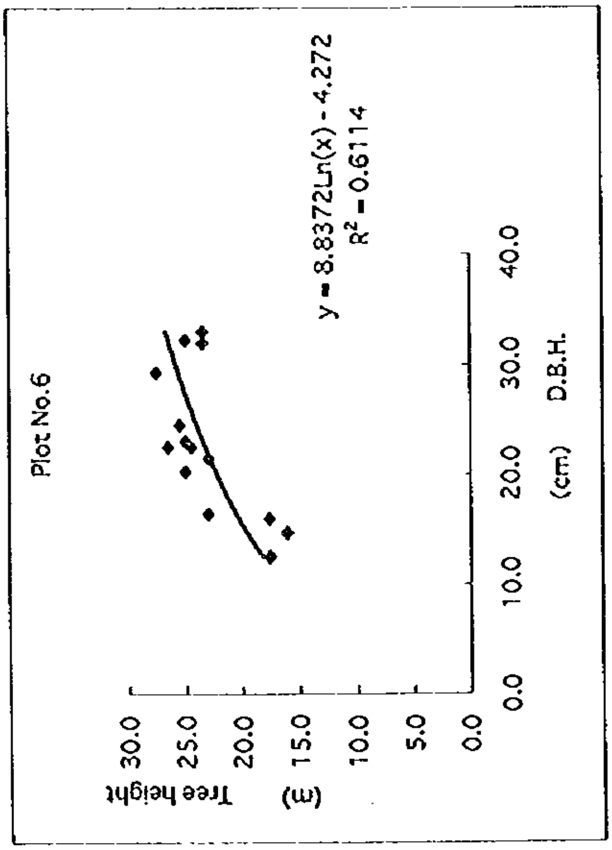
Correlation between D.B.H. and Tree Height



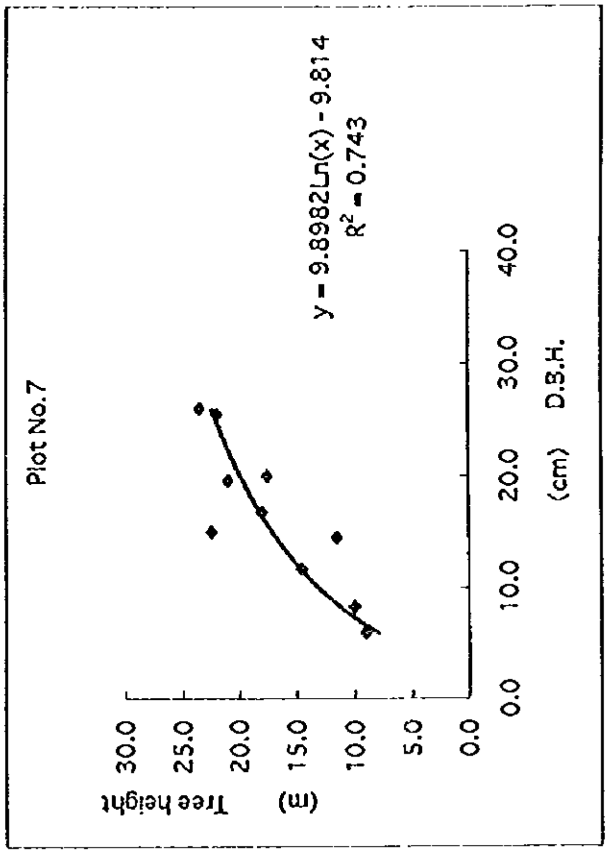




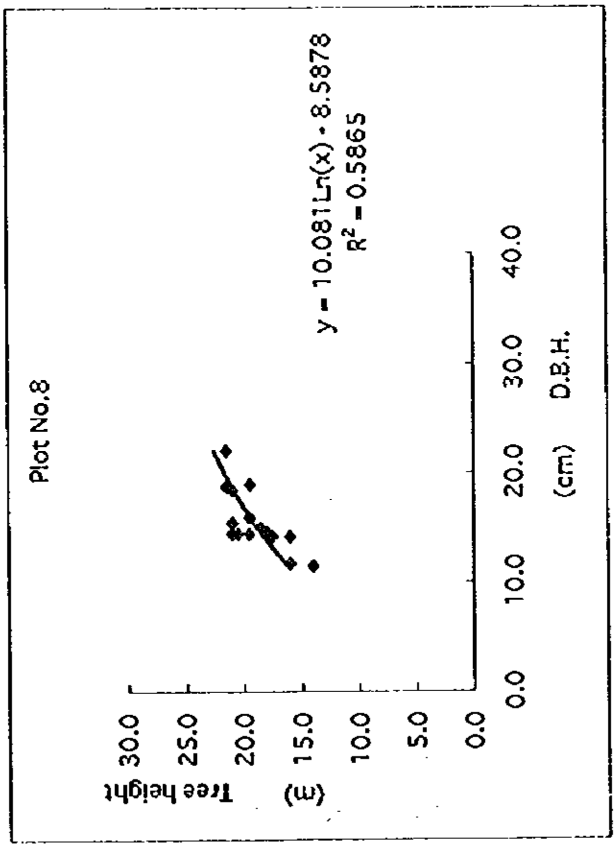




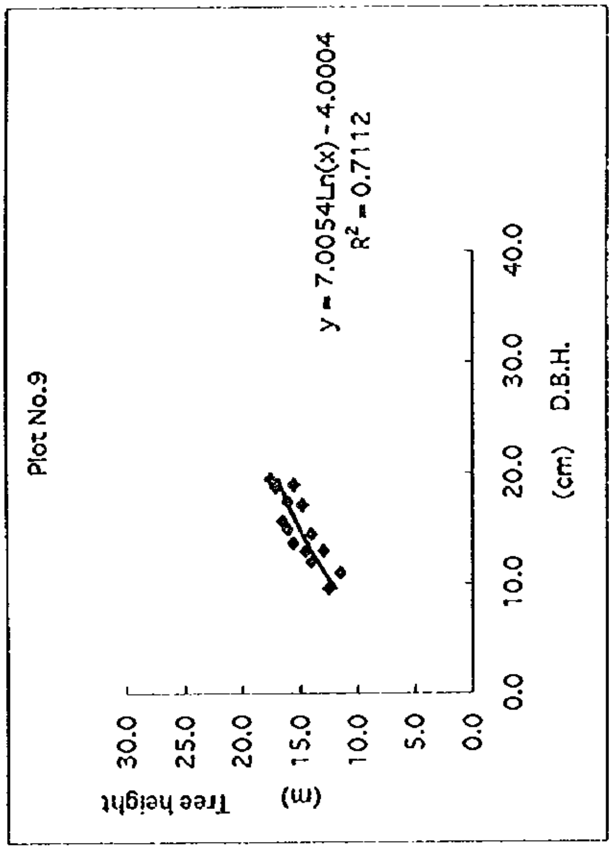
Plot No.6
Tree height (m)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
10.0
20.0
30.0
40.0
(cm) D.B.H.
y = 8.8372Ln(x) - 4.272
R² = 0.6114



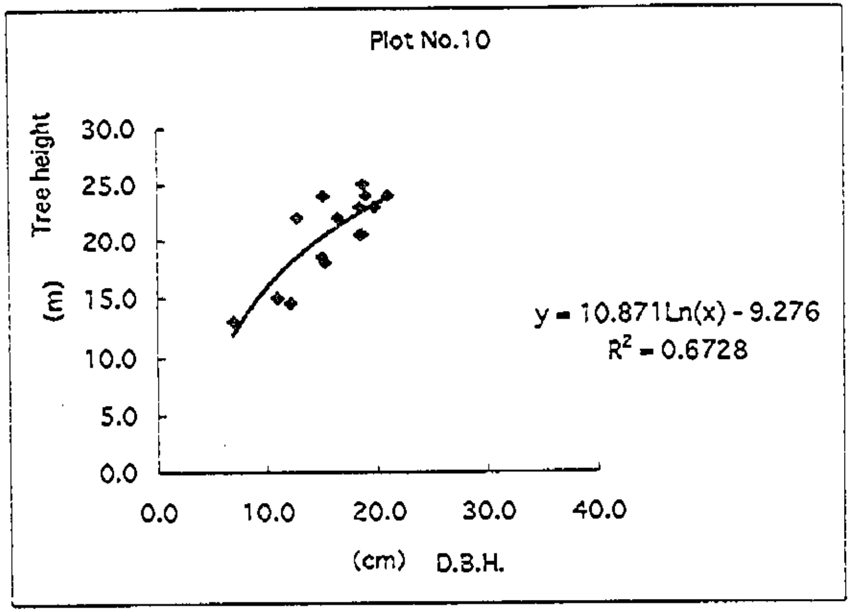
Plot No.7
Tree height (m)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
10.0
20.0
30.0
40.0
(cm) D.B.H.
y = 9.8982Ln(x) - 9.814
R² = 0.743

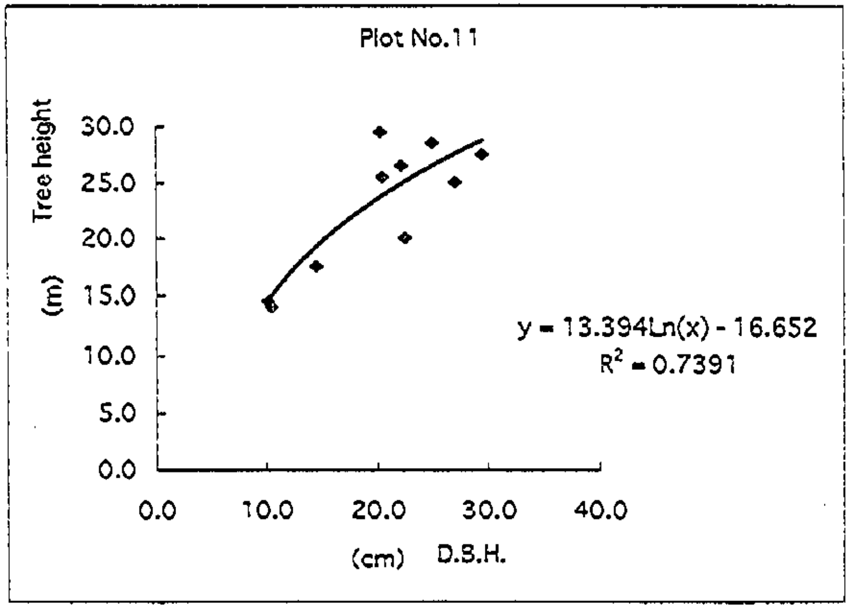


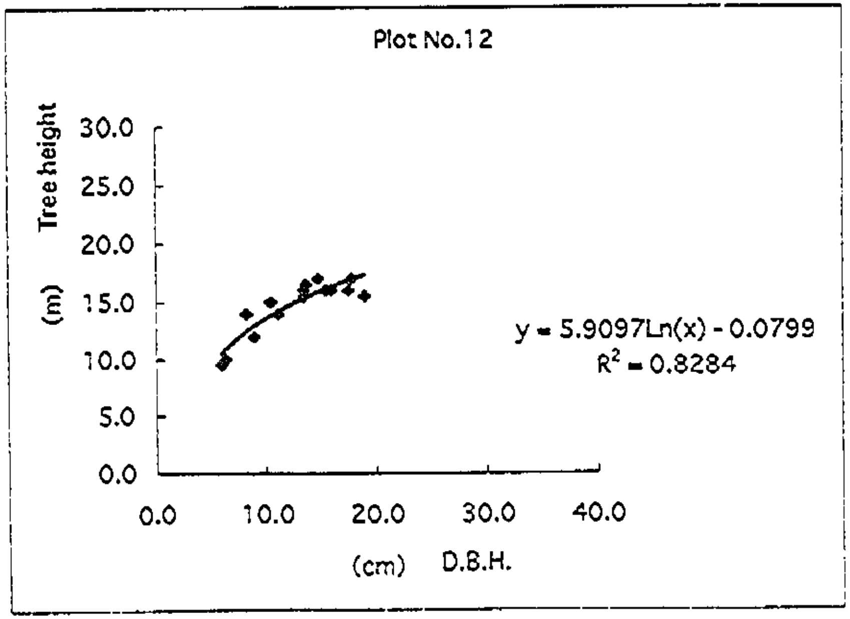
Plot No.8
Tree height (m)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
10.0
20.0
30.0
40.0
(cm) D.B.H.
y = 10.081Ln(x) - 8.5878
R² = 0.5865

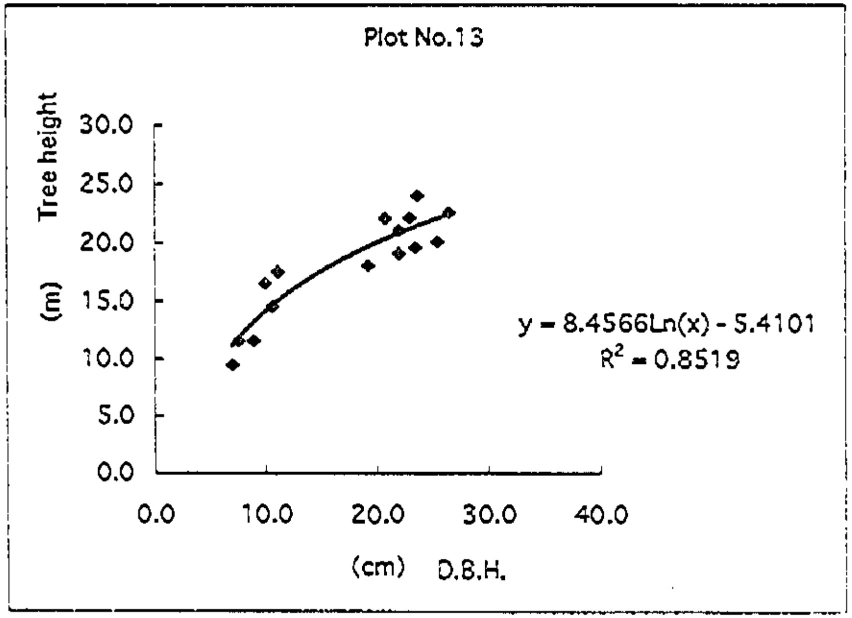


Plot No.9
Tree height (m)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
10.0
20.0
30.0
40.0
(cm) D.B.H.
y = 7.0054Ln(x) - 4.0004
R² = 0.7112

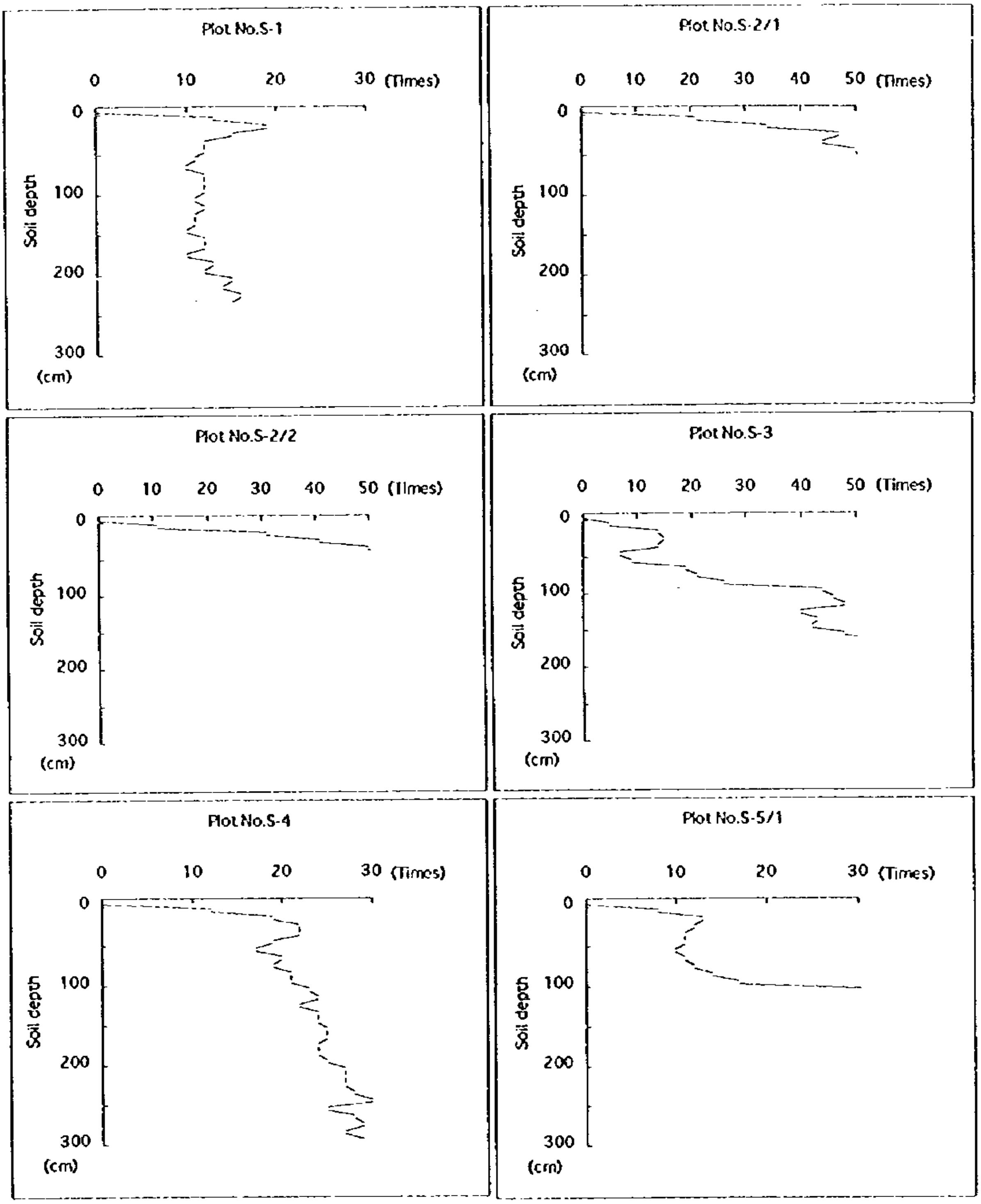

Plot No.10
Tree height
(m)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
10.0
20.0
30.0
40.0
(cm) D.B.H.
y = 10.871Ln(x) - 9.276
R² = 0.6728

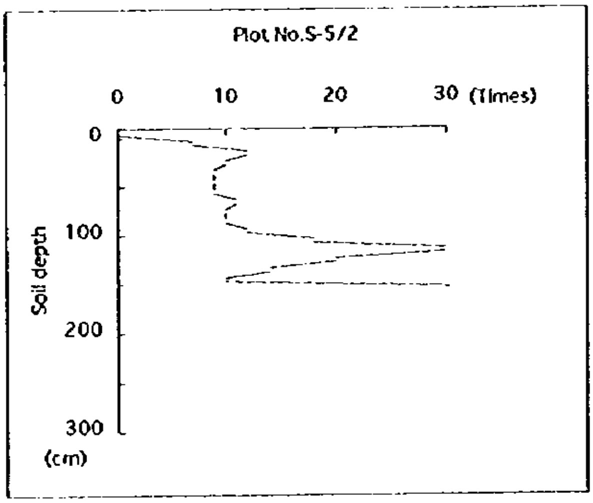

Plot No.11
Tree height
(m)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
10.0
20.0
30.0
40.0
(cm) D.B.H.
y = 13.394Ln(x) - 16.652
R² = 0.7391

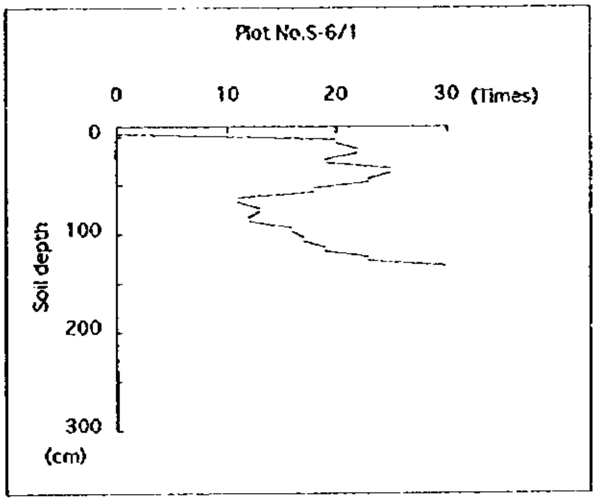

Plot No.12
Tree height
(m)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
10.0
20.0
30.0
40.0
(cm) D.B.H.
y = 5.9097Ln(x) - 0.0799
R² = 0.8284

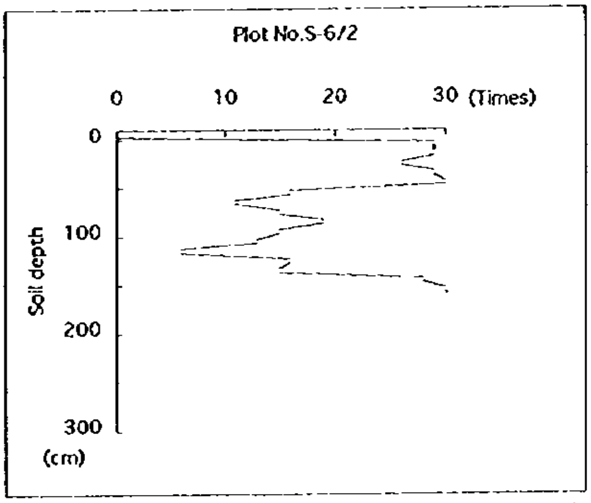

Plot No.13
Tree height
(m)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0.0
10.0
20.0
30.0
40.0
(cm) D.B.H.
y = 8.4566Ln(x) - 5.4101
R² = 0.8519

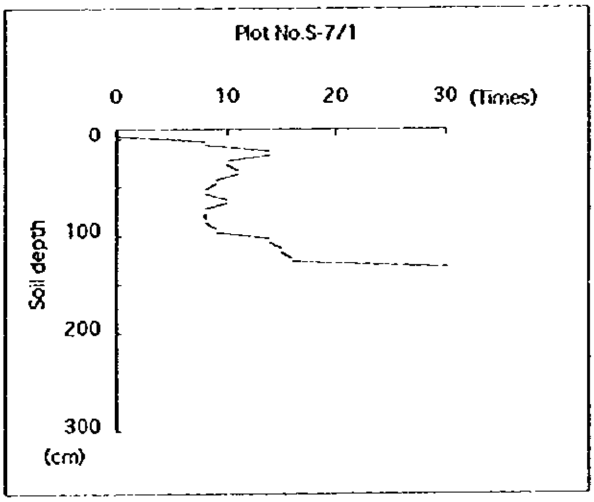
Soil Hardness in Each Plot

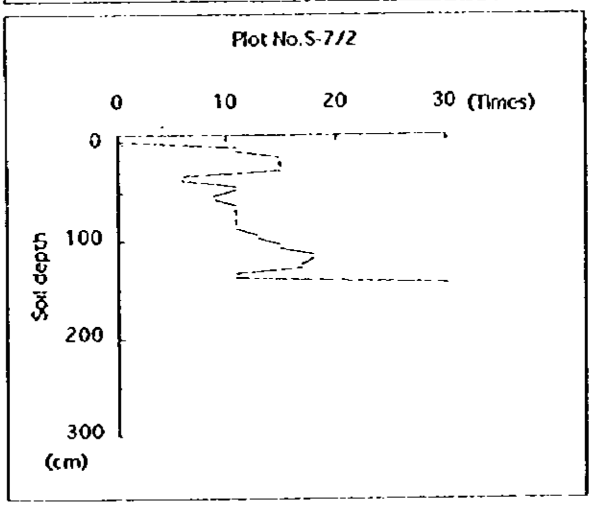


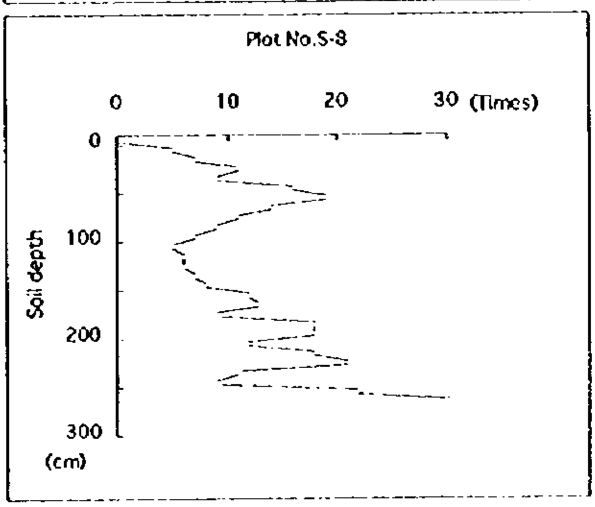

Plot No.S-5/2
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

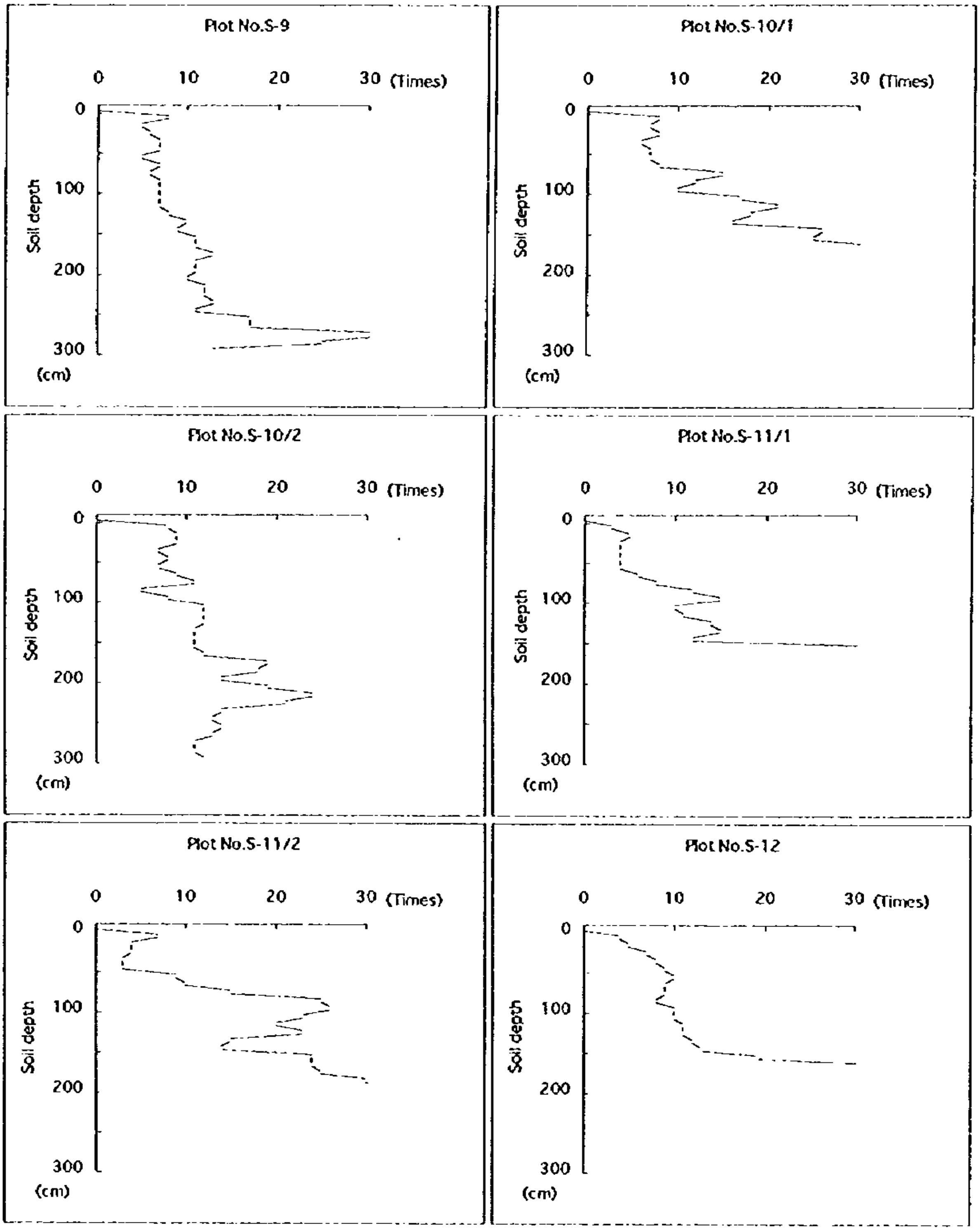

Plot No.S-6/1
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

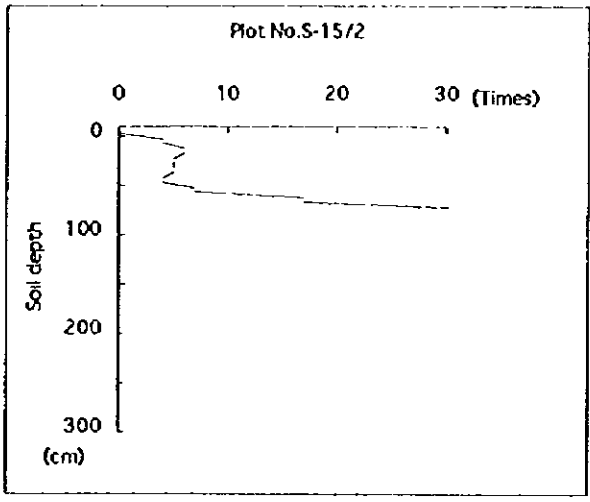

Plot No.S-6/2
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

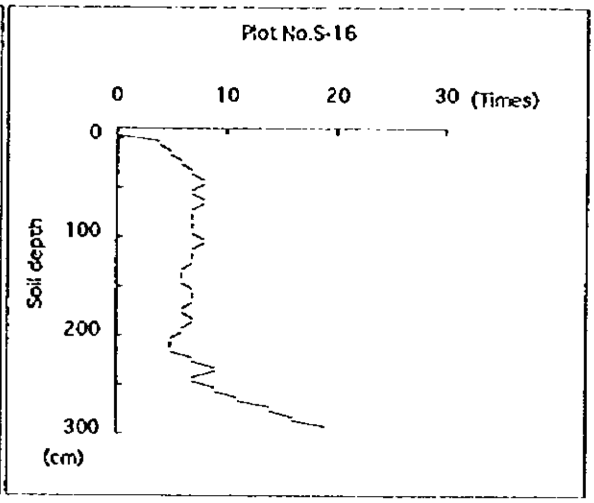

Plot No.S-7/1
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

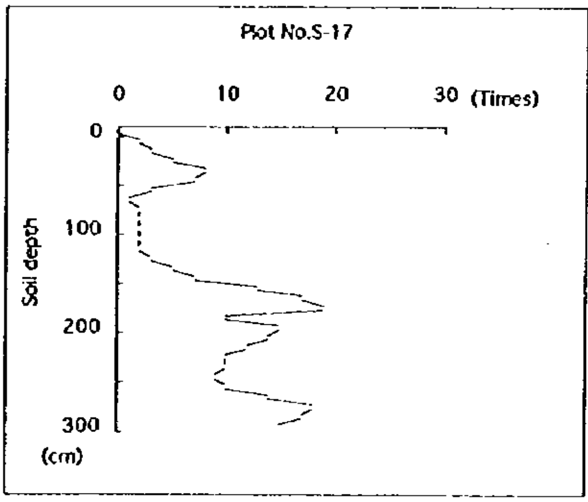

Plot No.S-7/2
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

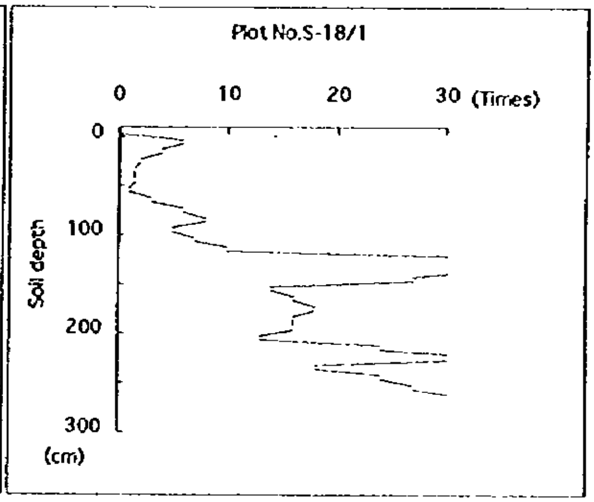

Plot No.S-8
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

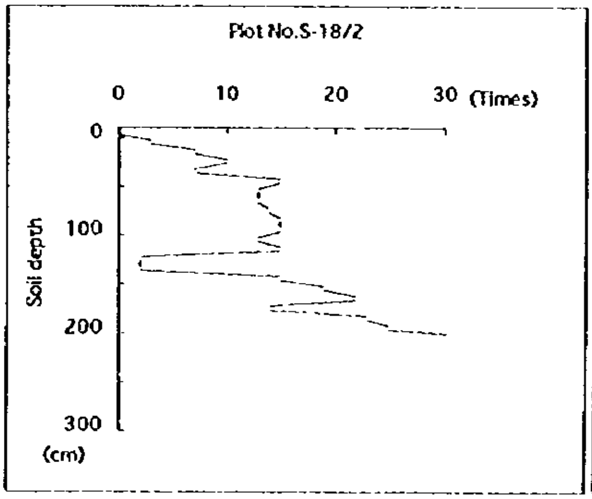

Plot No.S-9
Plot No.S-10/1
Plot No.S-10/2
Plot No.S-11/1
Plot No.S-11/2
Plot No.S-12
0 10 20 30 (Times)
Soil depth
0 100 200 300 (cm)

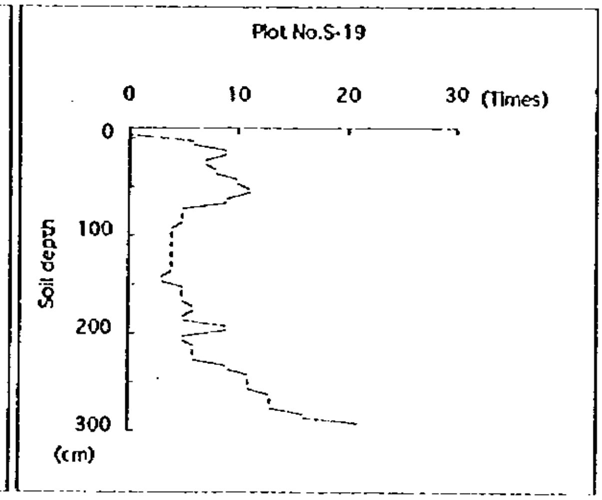

Plot No.S-15/2
0
10
20
30 (Times)
Soil depth
0
100
200
300
(cm)

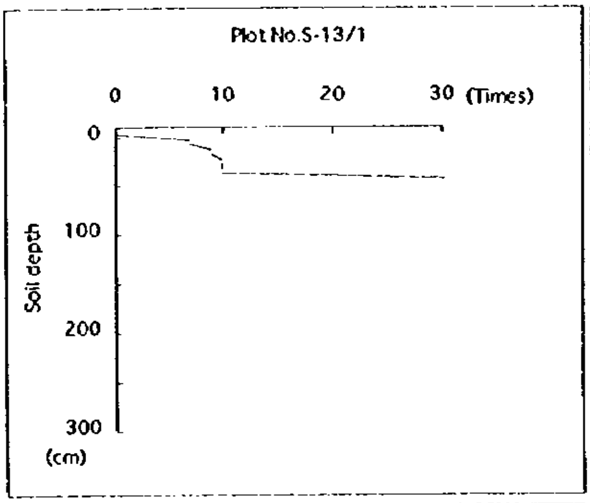

Plot No.S-16
0
10
20
30 (Times)
Soil depth
0
100
200
300
(cm)

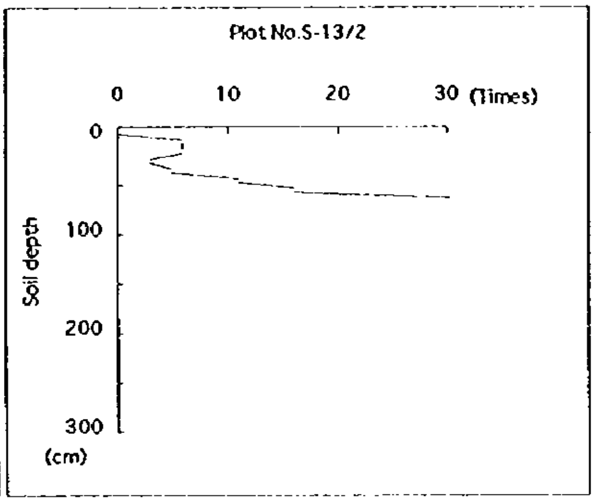

Plot No.S-17
0
10
20
30 (Times)
Soil depth
0
100
200
300
(cm)

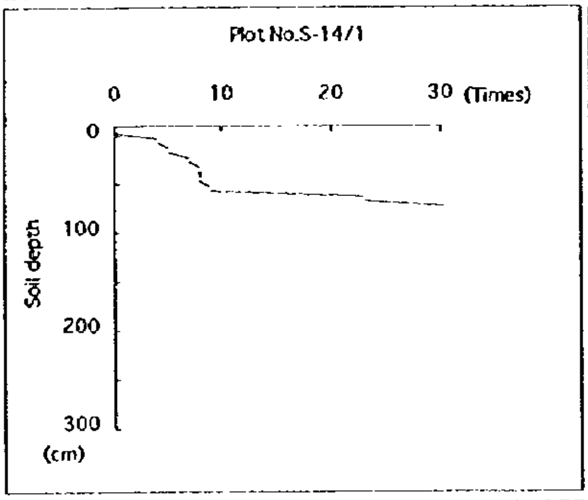

Plot No.S-18/1
0
10
20
30 (Times)
Soil depth
0
100
200
300
(cm)

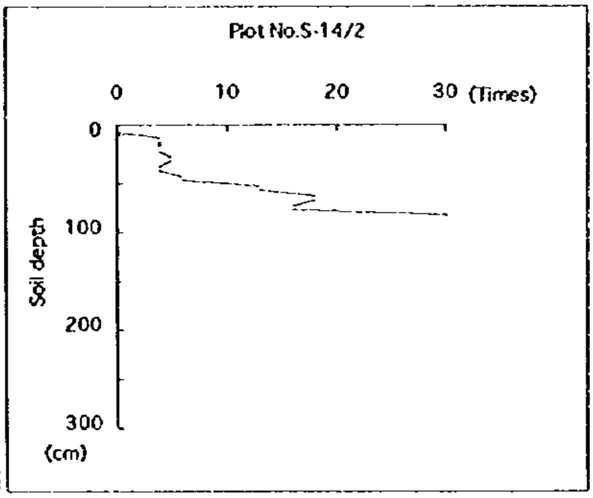

Plot No.S-18/2
0
10
20
30 (Times)
Soil depth
0
100
200
300
(cm)

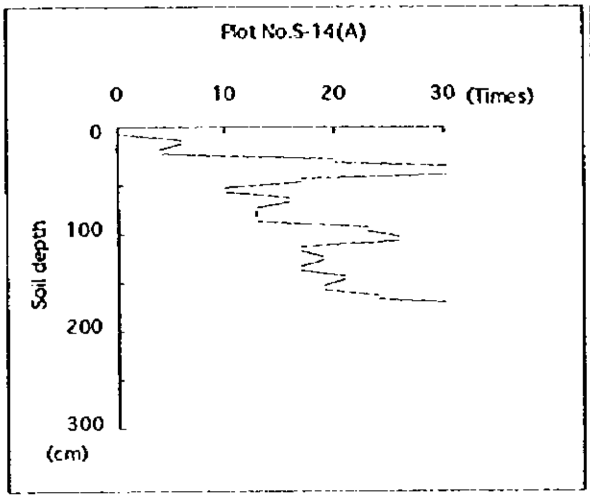

Plot No.S-19
0
10
20
30 (Times)
Soil depth
0
100
200
300
(cm)

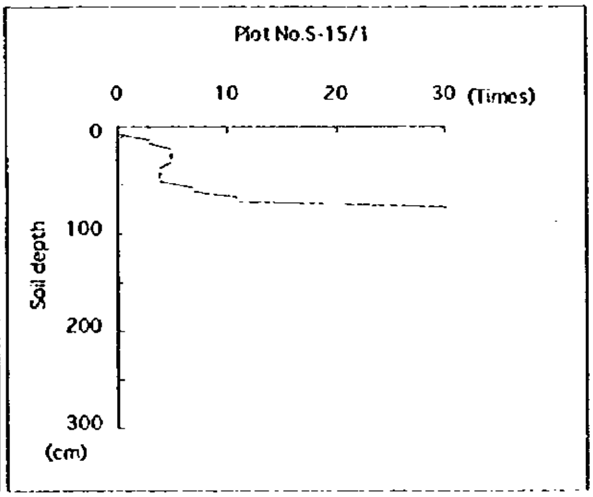

Plot No.S-13/1
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

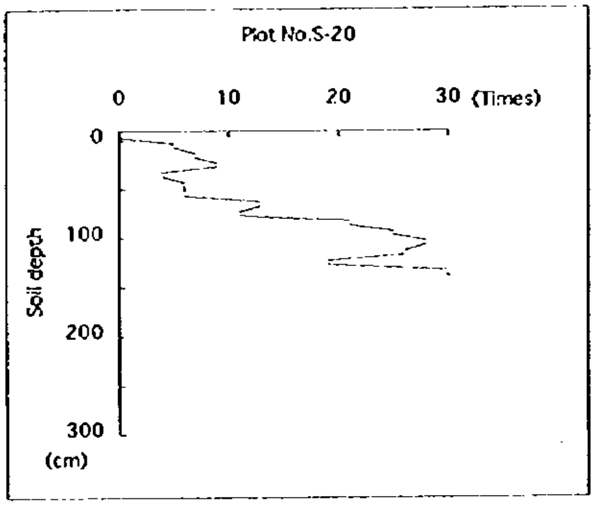

Plot No.S-13/2
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

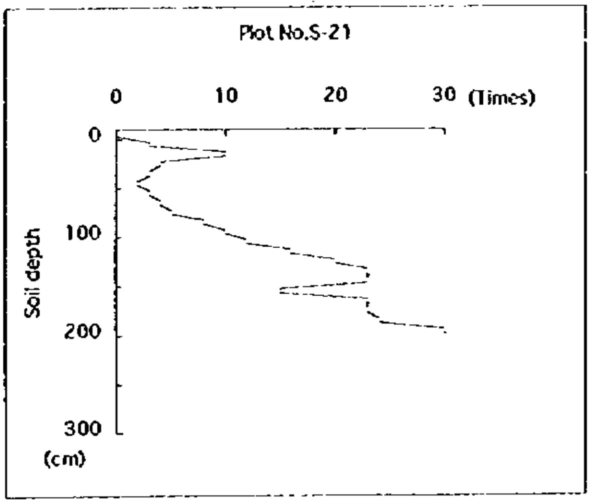

Plot No.S-14/1
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

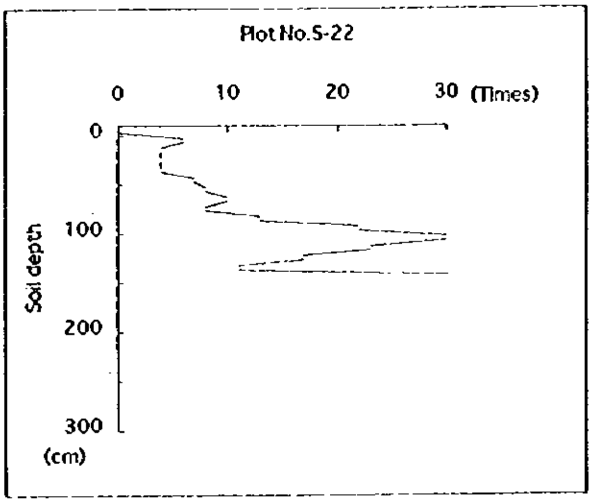

Plot No.S-14/2
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

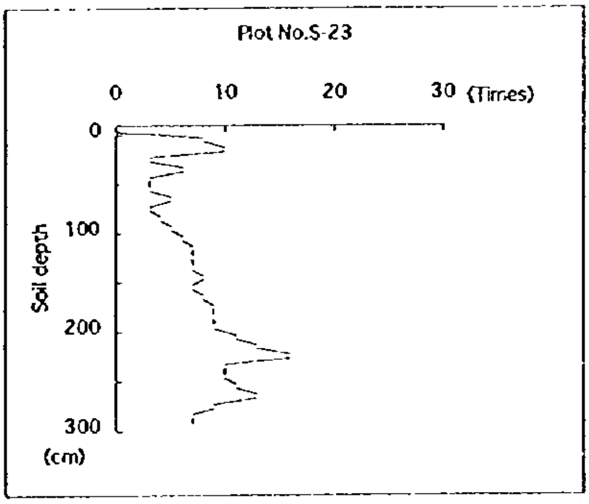

Plot No.S-14(A)
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

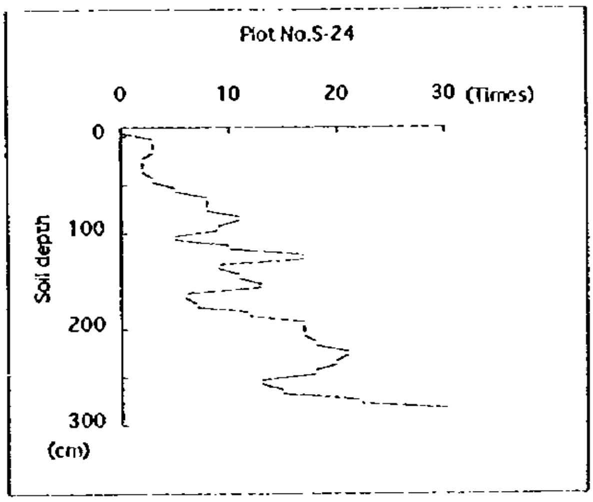

Plot No.S-15/1
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

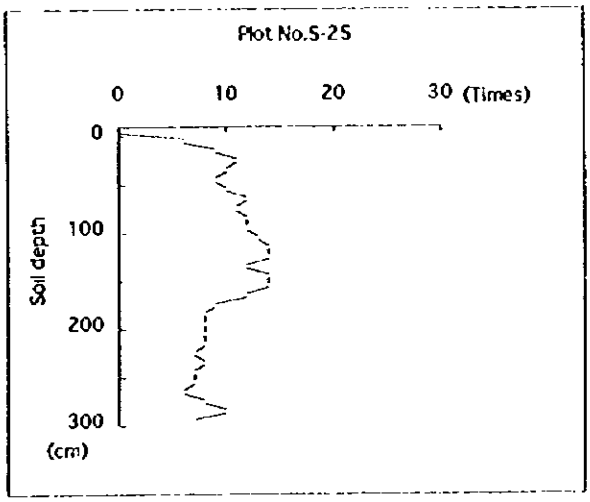

Plot No.S-20
0 10 20 30 (Times)
0 100 200 300 (cm)
Soil depth

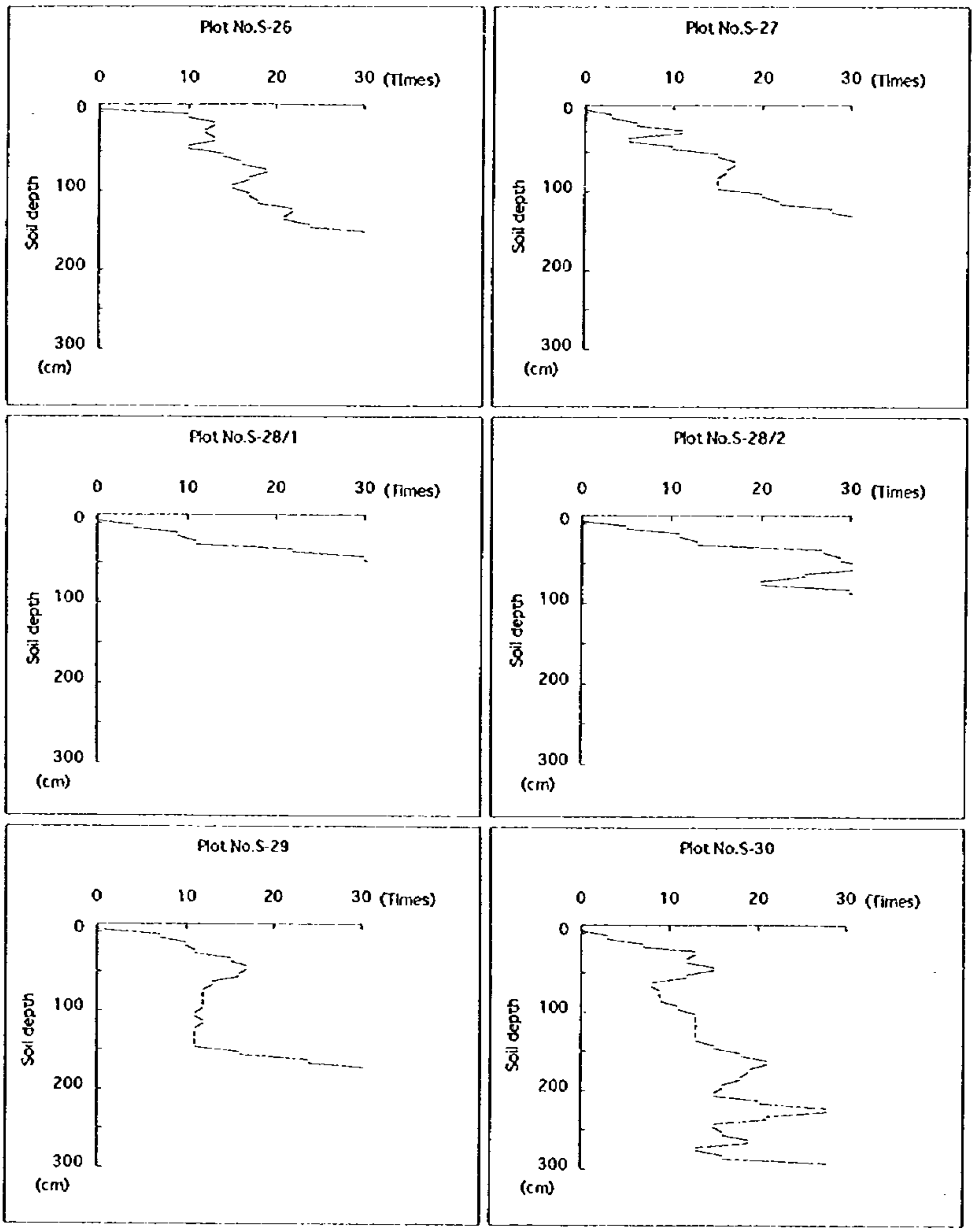

Plot No.S-21
0 10 20 30 (Times)
0 100 200 300 (cm)
Soil depth

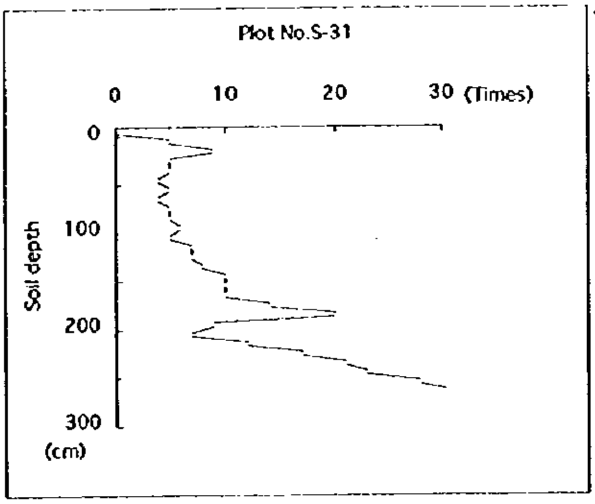

Plot No.S-22
0 10 20 30 (Times)
0 100 200 300 (cm)
Soil depth

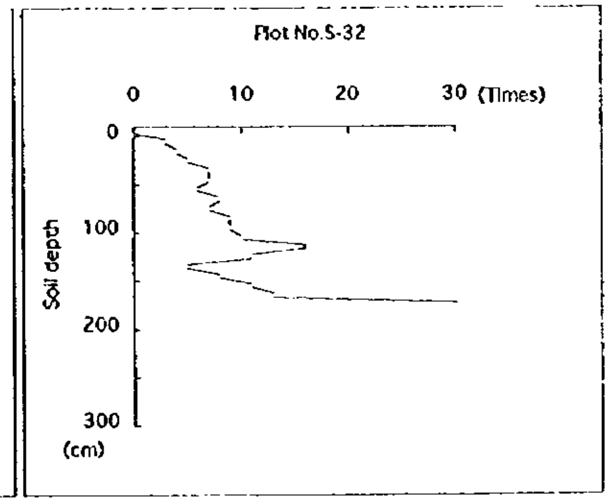

Plot No.S-23
0 10 20 30 (Times)
0 100 200 300 (cm)
Soil depth

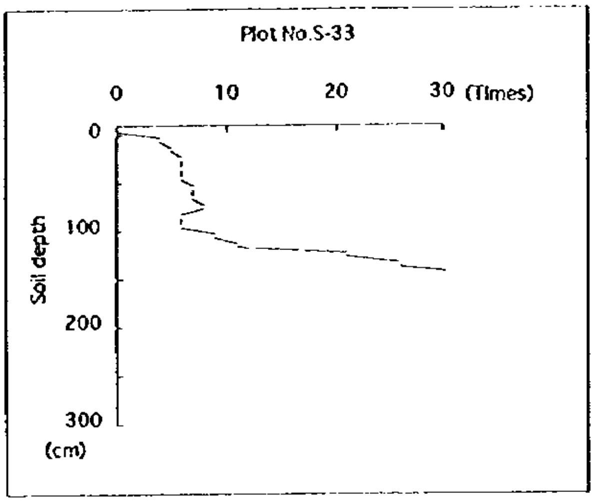

Plot No.S-24
0 10 20 30 (Times)
0 100 200 300 (cm)
Soil depth

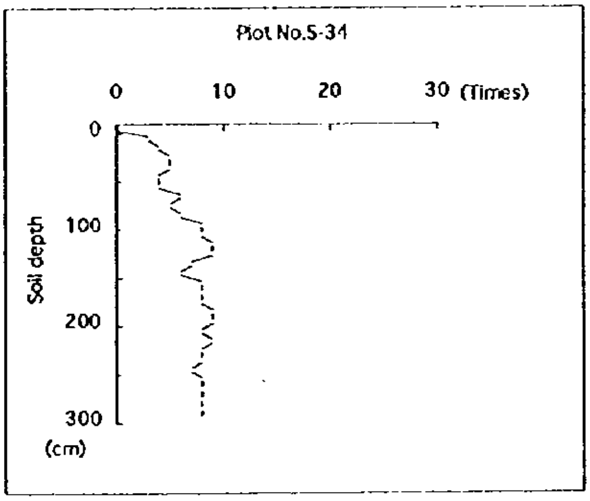

Plot No.S-25
0 10 20 30 (Times)
0 100 200 300 (cm)
Soil depth

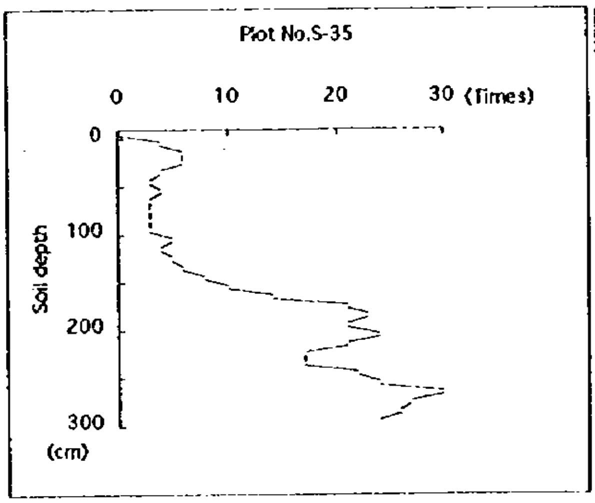

Plot No.S-26
0 10 20 30 (Times)
0 100 200 300 (cm)
Soil depth
Plot No.S-27
0 10 20 30 (Times)
0 100 200 300 (cm)
Soil depth
Plot No.S-28/1
0 10 20 30 (Times)
0 100 200 300 (cm)
Soil depth
Plot No.S-28/2
0 10 20 30 (Times)
0 100 200 300 (cm)
Soil depth
Plot No.S-29
0 10 20 30 (Times)
0 100 200 300 (cm)
Soil depth
Plot No.S-30
0 10 20 30 (Times)
0 100 200 300 (cm)
Soil depth

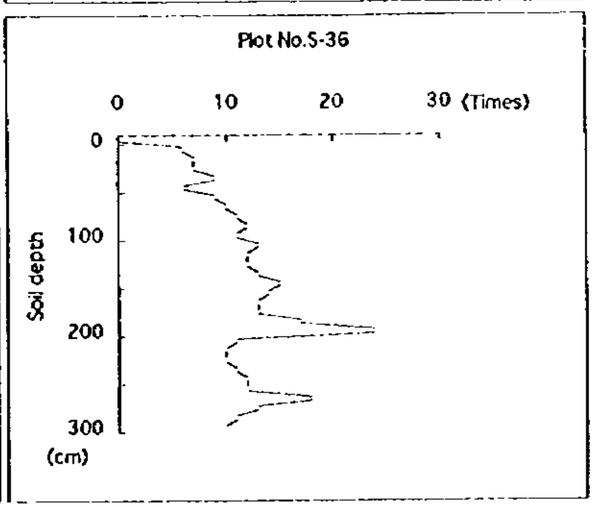

Plot No.S-31
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

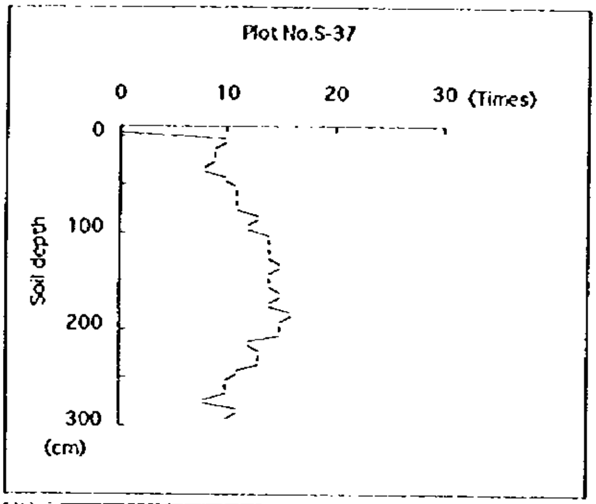

Plot No.S-32
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

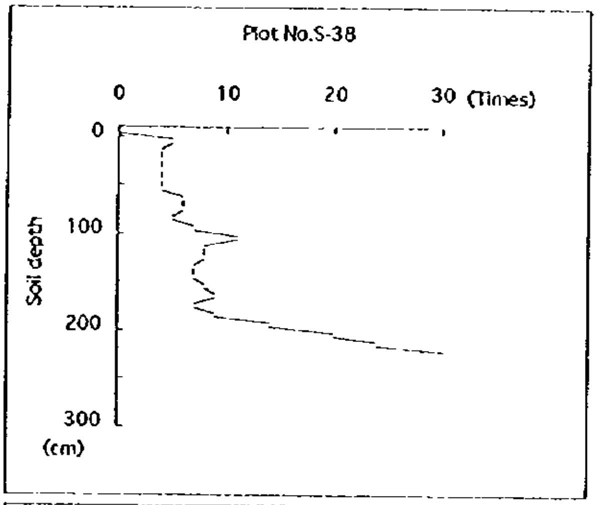

Plot No.S-33
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

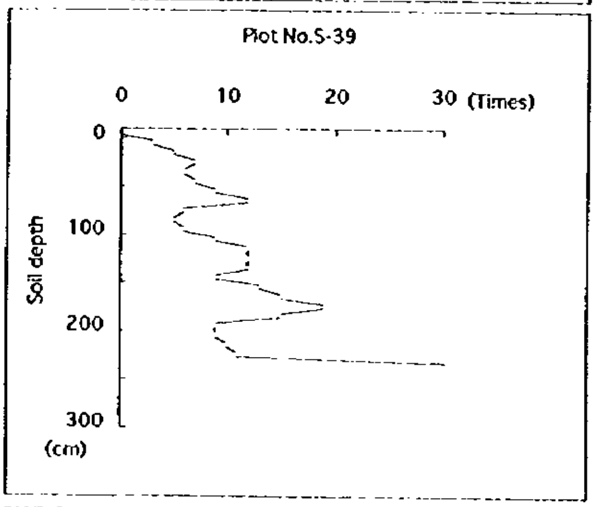

Plot No.S-34
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

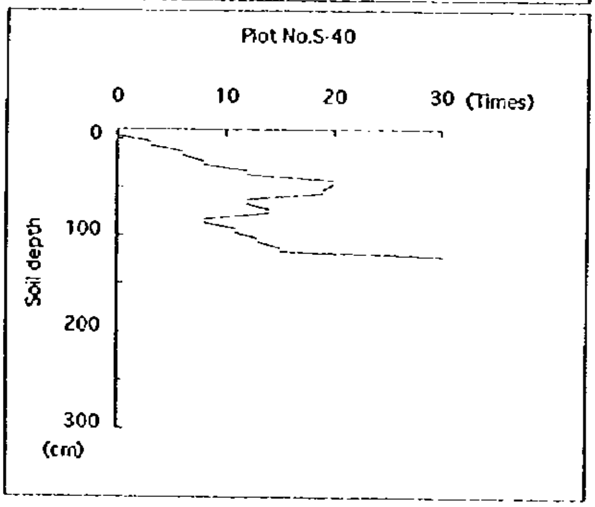

Plot No.S-35
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

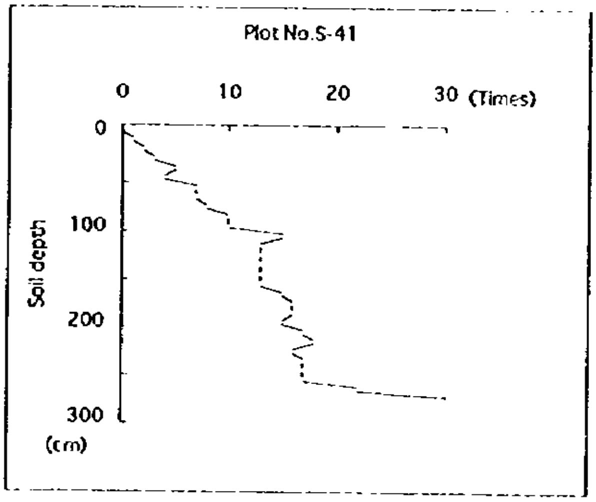

Plot No.S-36
0 10 20 30 (Times)
0
100
200
300
(cm)
Soil depth

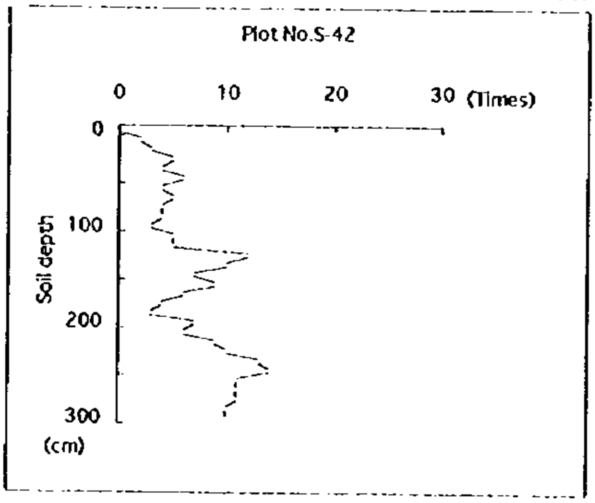

Plot No.S-37
0 10 20 30 (Times)
Soil depth
0
100
200
300
(cm)

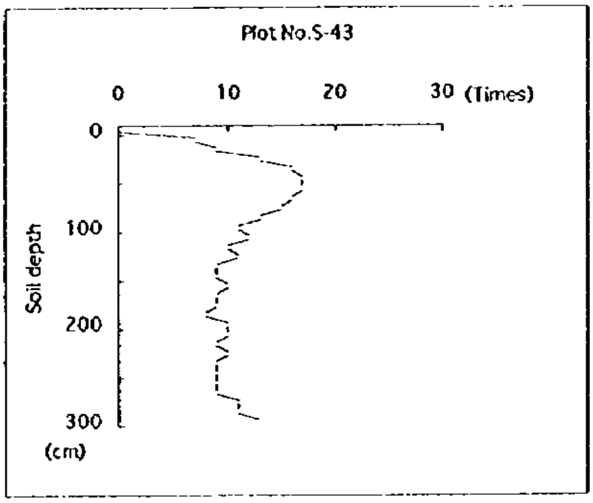

Plot No.S-38
0 10 20 30 (Times)
Soil depth
0
100
200
300
(cm)

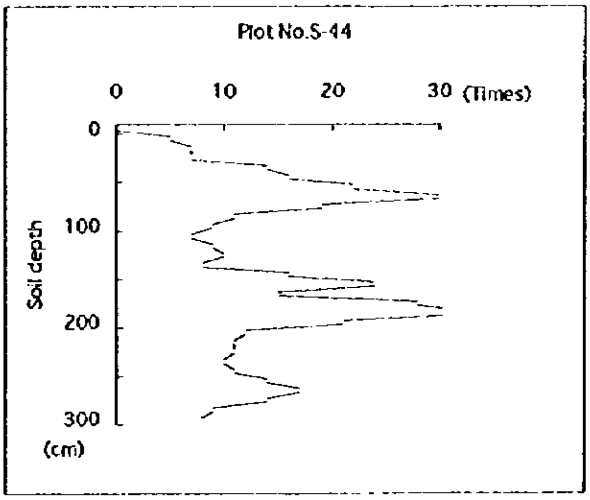

Plot No.S-39
0 10 20 30 (Times)
Soil depth
0
100
200
300
(cm)

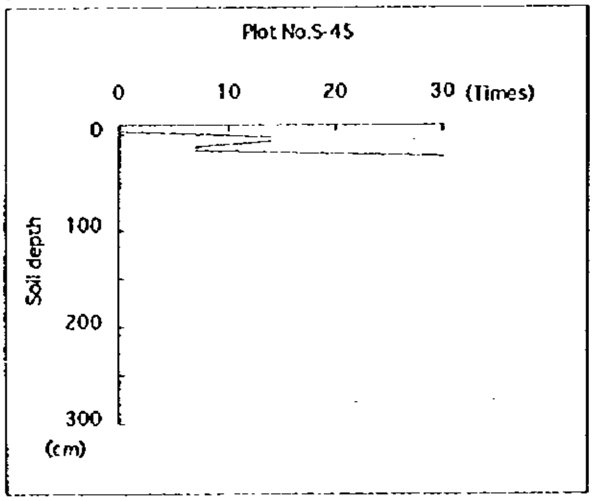

Plot No.S-40
0 10 20 30 (Times)
Soil depth
0
100
200
300
(cm)

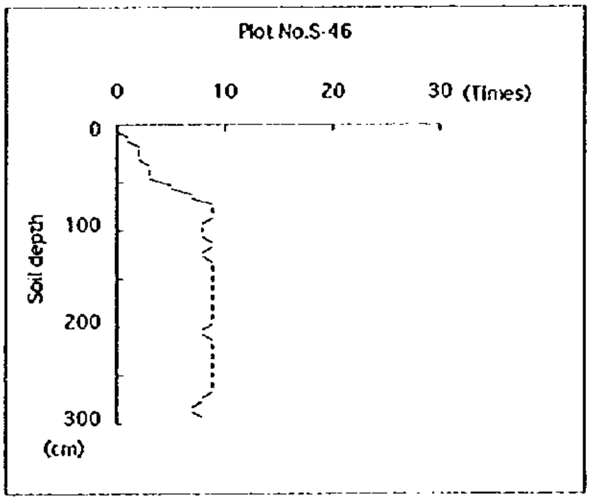

Plot No.S-41
0 10 20 30 (Times)
Soil depth
0
100
200
300
(cm)

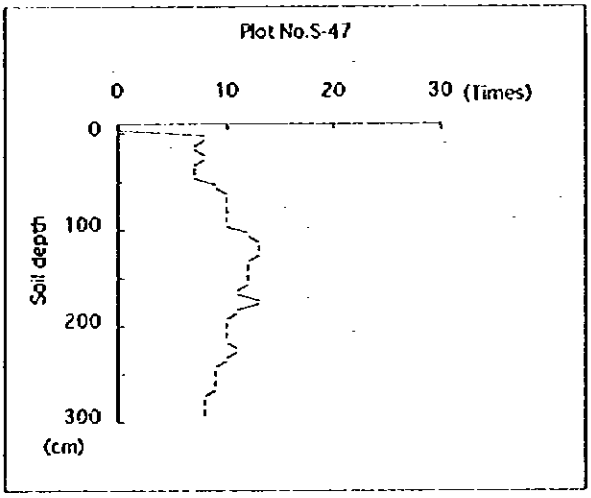

Plot No.S-42
0 10 20 30 (Times)
Soil depth
0
100
200
300
(cm)

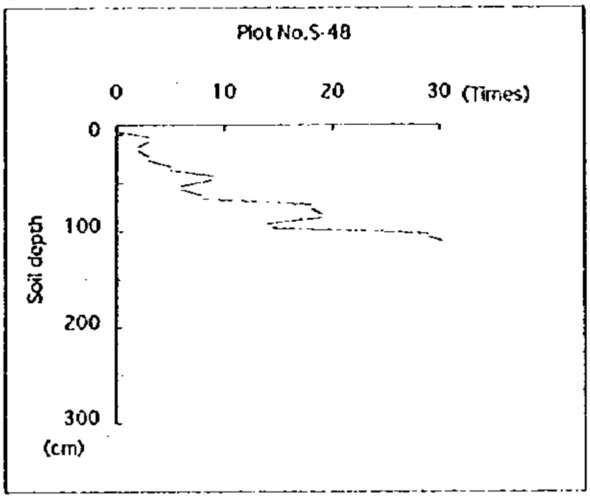

Plot No.S-43
0 10 20 30 (Times)
Soil depth
0
100
200
300
(cm)


Plot No.S-44
0 10 20 30 (Times)
Soil depth
0
100
200
300
(cm)


Plot No.S-45
0 10 20 30 (Times)
Soil depth
0
100
200
300
(cm)

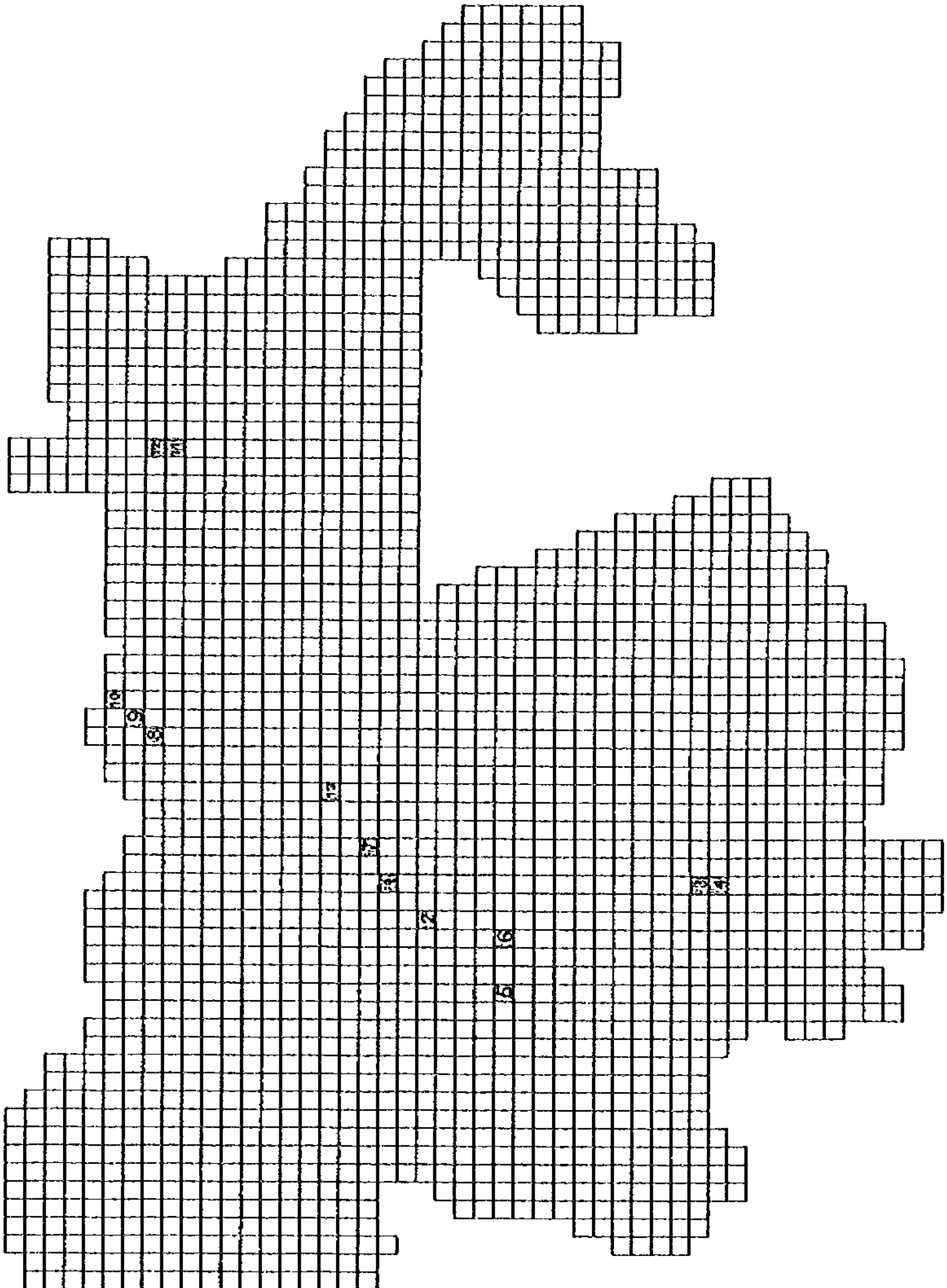

Plot No.S-46
0 10 20 30 (Times)
Soil depth
0
100
200
300
(cm)


Plot No.S-47
0 10 20 30 (Times)
Soil depth
0
100
200
300
(cm)


Plot No.S-48
0 10 20 30 (Times)
Soil depth
0
100
200
300
(cm)

Forestland Productivity

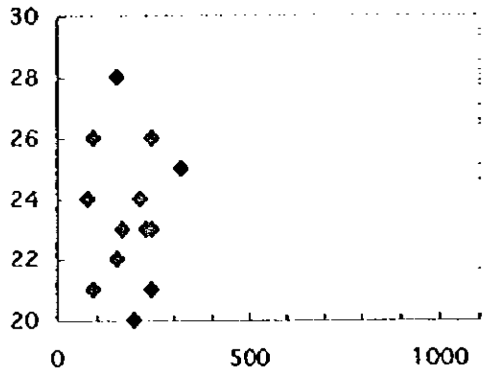
(1) Location of survey plots of plantation



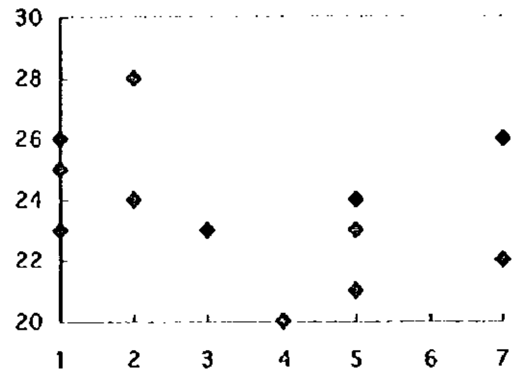
(2) Environmental factors of each plot

Plot No.	Atitude(m)	Max. angle of Inc.(°)	Valley density	Vegetation	Soil type	Topo.class	Site index
1	167.6	6.2	2	9	1	4	23
2	152.4	8.6	2	9	7	2	22
3	228.6	2.5	0	4	3	2	23
4	243.8	4.4	2	5	5	2	23
5	243.8	8.9	2	5	5	3	21
6	76.2	2.8	2	9	5	4	24
7	91.4	3.1	3	9	7	4	26
8	152.4	2.6	2	6	2	2	28
9	198.1	3.7	2	2	4	2	20
10	243.8	2.6	0	2	1	2	26
11	320.0	6.3	1	6	1	2	25
12	213.4	4.7	2	6	2	4	24
13	91.4	0.9	4	9	5	5	21

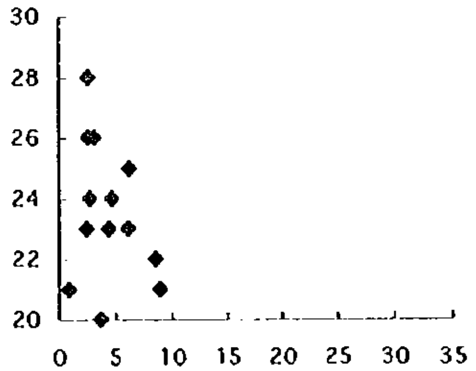
Atitude



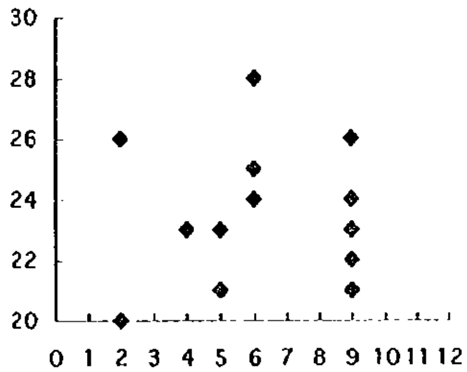
Soil type



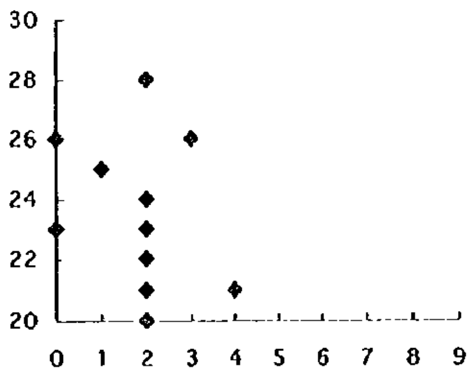
Maximum angle of Inclination (°)



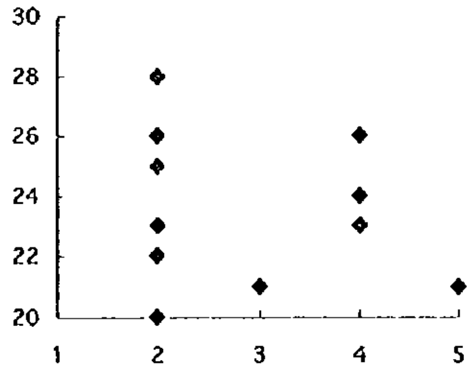
Vegetation



Valley density



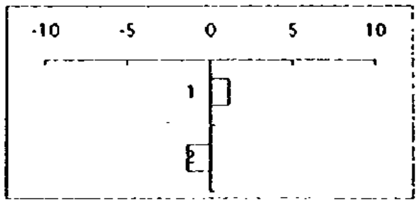
Topographic classification



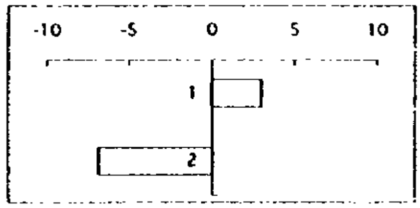
(3) Result of quantification

Score and renge

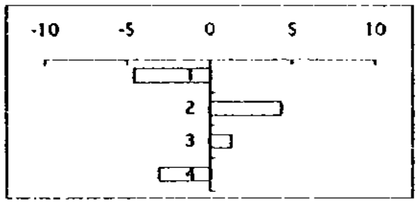
Altitude		n	score	range
1	0~200	7	1.154	
2	200~	6	-1.346	2.500



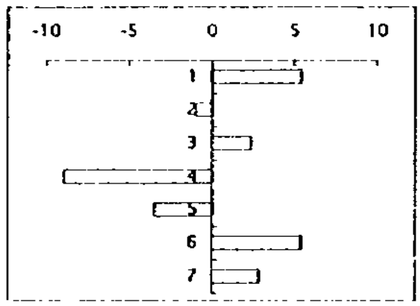
Max.angle of Inclination		n	score	range
1	0~5	9	3.035	
2	5~	4	-6.828	9.863



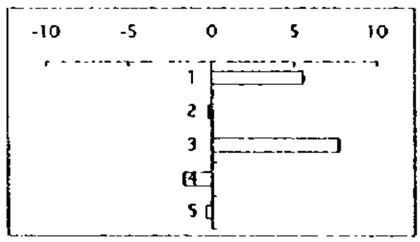
Valley density		n	score	range
1	0	2	-4.520	
2	1	1	4.342	8.863
3	2	8	1.342	
4	3~9	2	-3.020	



Soil type		n	score	range
1	S	3	5.426	
2	M	2	-0.937	
3	MT	1	2.426	
4	T	1	-8.937	14.363
5	Fe	4	-3.437	
6	G	0	5.426	
7	F	2	2.926	



Topographic classification		n	score	range
1	T	0	5.562	
2	JS	7	-0.133	
3	SS	1	7.730	9.363
4	V	4	-1.633	
5	F	1	-0.270	



Partial corretion coefficient of each item

Altitude	1.000
Max. angle of Inc.	1.000
Valley density	1.000
Soil type	1.000
Topographic class	1.000

Multiple corretion coefficient

R = 1.0000 R-square = 1.0000

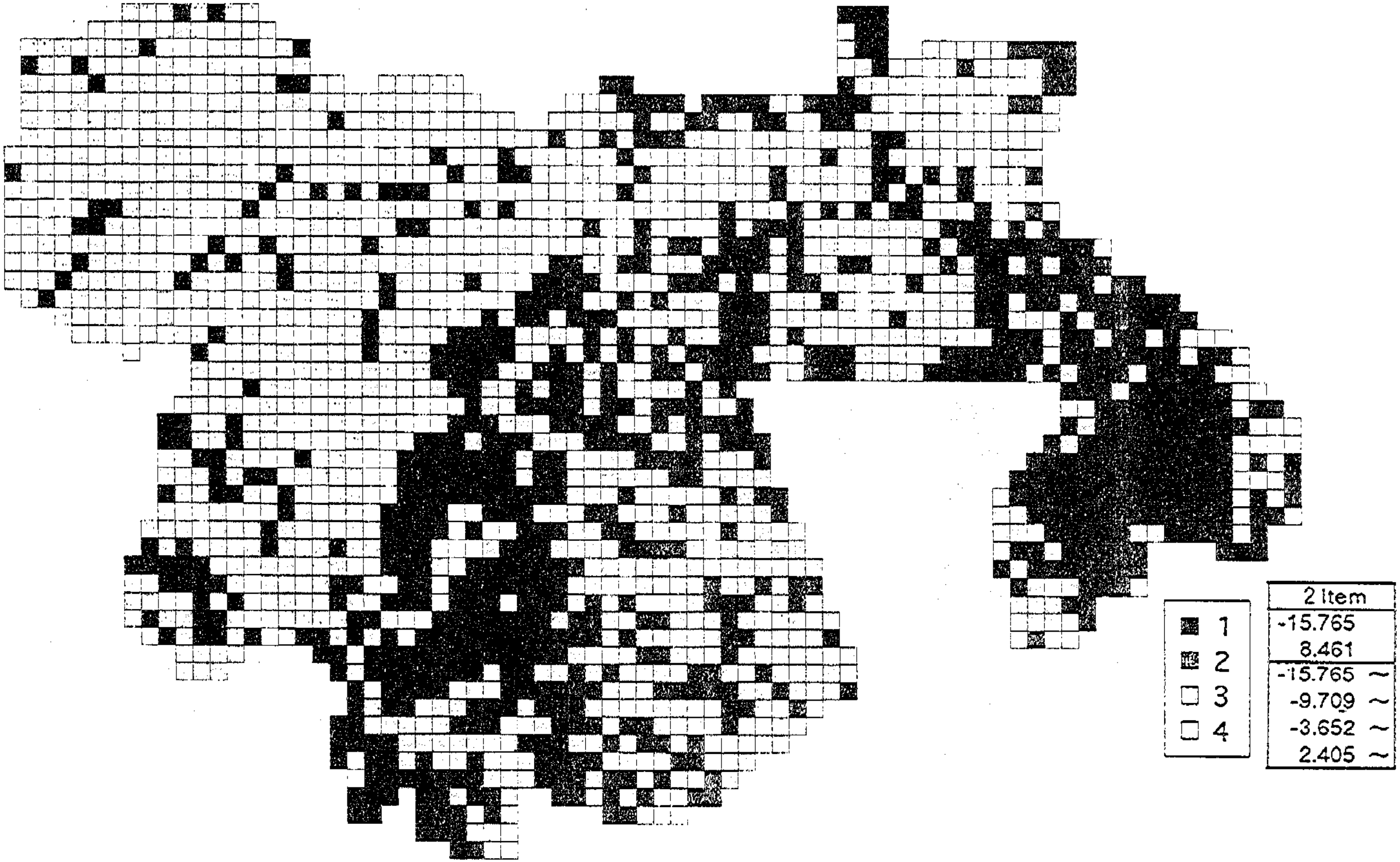
Constant

23.538

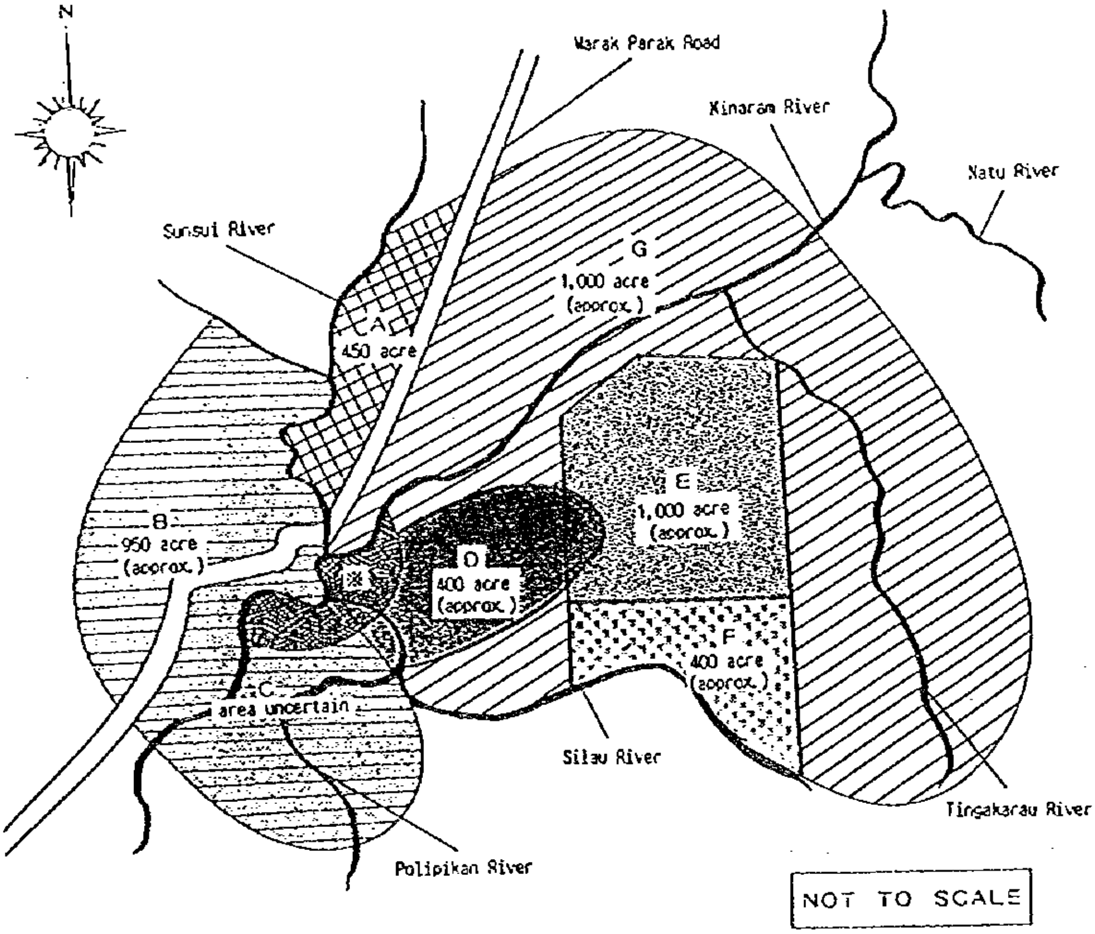
Single corretion coefficient matrix of quantificated item and objective vatiable

	Y	Altitude	Max. angle of Inc.	Valley density	Soil type	Topographic class
Y	1.000					
Altitude	-0.054	1.000				
Max. angle of Inc.	0.238	0.051	1.000			
Valley density	0.164	-0.039	-0.212	1.000		
Soil type	0.670	-0.288	-0.270	0.206	1.000	
Topographic class	0.115	-0.443	-0.334	-0.315	-0.033	1.000

(4) Forestland productivity by quantification

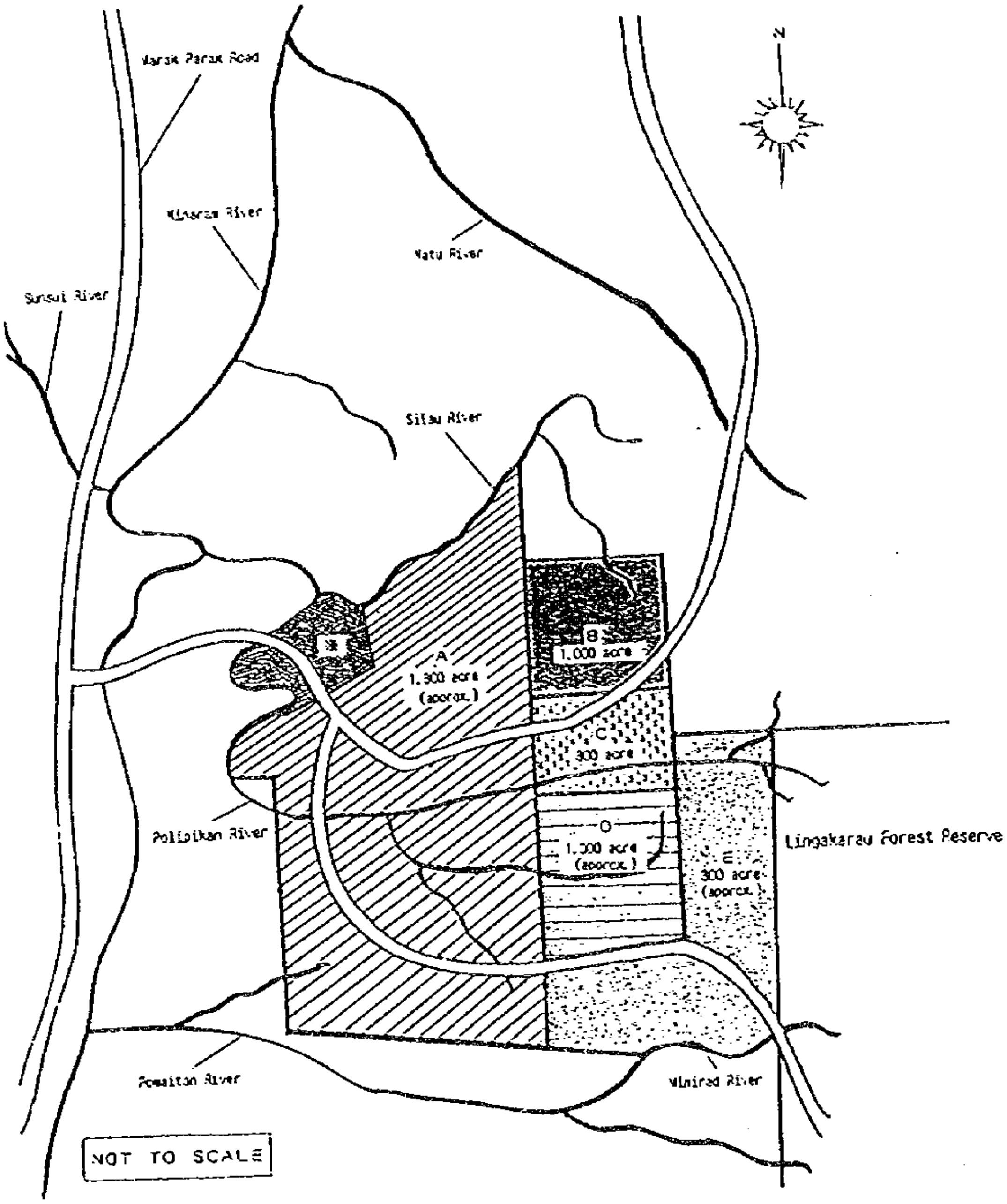


Land use pattern in the Survey Villages (1) Kg.Sunsui



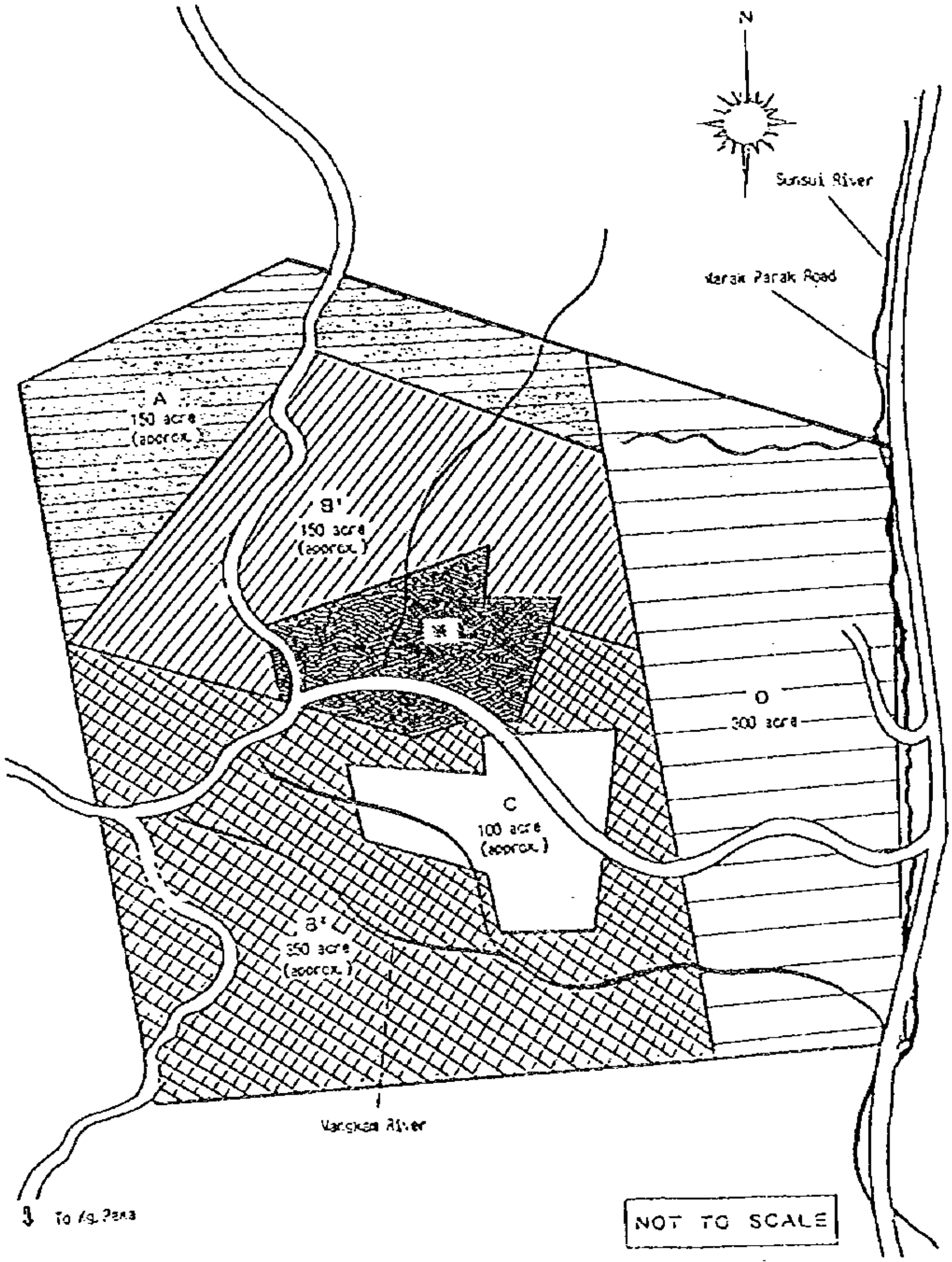
Block	Land Use	Land Status
A	Owned by 30 people. To be developed into SRFB rubber plantation	Surveyed LA.
B	Individually owned and no community plan. Used for self-planted rubber, slash&burn, orchard, A. mangium, etc.	Approx. 50% registered &50% approved/surveyd LA.
C	Same as Block B. No plan to change current land use pattern	Mostly approved LA. Some surveyed LA
D	Formely applied for FELCRA but rejected. Waiting for gov't assistance.	Approved LA.
E	Originally applied for communal grazing land but 30-35% has been redistrubited to individuals. Proposed land use for the rest is grazing except 200-300acres which will be set aside as village forest reserve.	Approved LA.
F	Owned by former KK. To be used by his children.	Approved LA.
G	Individually owned but mostly un/under-utilized (some part is used for houses, self-planted rubber, A. mangium, cemetery, etc). Has contacted SRFB for rubber splantation development but was told that it would be costly tobuild access roads (esp. on the east bank of Kinaram River).	Mostly approved LA. Some surveyed LA.
H	Settlement and cemetry.	-

Land use pattern in the Survey Villages (2) Kg.Polipikan



Block	Land Use	Legal Land Status
A	Indivudually owned. Formerlly SRFB plantation but 70% has been destroyed by fires. Currently used for rubber, slash&burn, orchard, A. mangium, etc.. Plan to develop into SRFB plantation again.	Approved LA.
B	Communally owned. Plan to develop into FELCRA oil palm plantation. "Middle forest".	Surveyd LA.
C	Collectily owned by people residing outside the village.	Surveyd LA.
D	Individually owned for self-planted rubber, oil palm, slash&burn, etc.. No community plan for development. Applied for titles in 1996.	Registered LA.
E	Good forest. No plan for development.	No claim.
*	Settlement	-

Land use pattern in the Survey Villages (3) Kg.Kotud



Block	Land Use	Legal Land Status
A	Indivudually owned for slash&burn, orchard, self-planted rubber, etc.. No community plan.	Registered LA. Some approved/surveyed LA.
B	Individually owned maily for self-planted rubber. Will be developed into SRFB plantation.SRFB rubber plantation.	B1:Registered LA. Some approved/surveyed LA. B2:Approved/Surveyd LA.
C	SRFB rubber plantation	Approved/Surveyd LA.
D	Land owned by 20 families from Kg. Goshen. Mainly used for self-planted rubber, fruits and slash&burn.	Registered LA. Some approved/surveyd LA.
*	Settlement and cemetry	-

Valuable Tree Species in the Model Area

(1) Kg.Sunsui

Important Trees in Surrounding Natural Forest								
	Local name	Academic name	For build mtl	For house hold	For food	For medi-cine	For fuel-wood	Other information (use, etc.)
1	Selangan batu	Shorea	x	x			x	for house, pole, bridge, electiric post,furniture
2	Kayu kapur	Dryobalanops	x	x			x	for floor, walls, stairs, 2x4, furnitures
3	Seraya	Shorea curtisii	x	x			x	-do-
4	Keruing	Dipterocarpus	x	x			x	-do-
5	Merabau		x	x			x	-do-
6	Sipatir		x				x	for house
7	Benuang	Octomeles sumatran	x				x	for house
8	Mangis(Mengaris?)	Koompassia excella?	x				x	for house
9	Rotan	Calamus		x			x	for strings, baskets
10	Kupang	Peltogyne javanica	x				x	for house
11	Tombaklik		x				x	for house
12	Jelutung	Dyera costulata	x				x	for house
13	Liposu				x		x	fruits
14	Togop		x				x	
15	Pahu (Paho?)	Magifera altissima?			x		x	fruits
16	Oumpiring				x		x	fruits
17	Durian hutan				x		x	fruits
18	Mata kuching	Nephelium malaiense			x		x	fruits
19	Rambutan hutan	Nephlium eriopetalum			x		x	fruits
20	Tutan				x		x	young leaves
21	Polod				x		x	young leaves
22	Bambu		x	x			x	for house, basket and traps
23	Tungkat Ali					x	x	
24	Tiviwang					x	x	
25	Tensisilou					x	x	
26	Tapak bowong					x	x	
27	Pokak senduduk					x	x	
28	Pokok bamban (Lias)					x	x	
29	Tombuasa					x	x	
30	Tawawo					x	x	
31	Morugion					x	x	
32	Begil		x			x	x	
33	Madahasi					x	x	
34	Lalang	Mitragyna Elliptica				x	x	
35	Rendogung					x	x	
36	Baduk					x	x	
37	Natu		x				x	
38	Ot vicak		x				x	
39	Ot keras		x				x	
40	Meng kernag		x				x	
41	Tolufu		x				x	

Valuable Tree Species in the Model Area

(2) Kg.Polipikan

	Important Trees in Surrounding Natural Forest								
	#	Local name	English Name or academic name	For build mtl	For house hold	For food	For medi-cine	For fuel-wood	Other information (use, etc.)
	1	Selangan batu	Shorea	X	X			X	for pole and 2x4
	2	Kayu kapur	Dryobalanops	X	X			X	for floor, walls, board, 2x4/table and chairs
	3	Seraya	Shorea curtisii	X	X			X	for board/wardrobe , cupboard
	4	Jelutung	Dyera costulata	X				X	for board
	5	Keruing	Dipterocarpus	X	X			X	for 2x4
	6	Kundasang		X				X	for board
	7	Kintap					X	X	boild bark for drinks for stomachache
x	8	Manggis	mangosteem			X		X	fruit (mangosteen)
x	9	Rambutan b janis	rambutan			X		X	fruit
x	a	-mongitom				X		X	fruit
x	b	-rawgalau				X		X	fruit
x	c	-pudson				X		X	fruit
x	d	-koromundui				X		X	fruit
x	e	-kolomongis				X		X	fruit
x	f	-rumokot				X		X	fruit
x	10	Durian b jenis	durian			X		X	fruit
x	11	Mantus				X		X	seeds
x	12	Pomotodon				X		X	seeds
x	13	Tampui (Tampoi?	Baccaurea malayana?			X		X	fruit
x	14	Mata kuching	longan			X		X	fruit
	15	Mandahasi					X	X	boild roots for blooding
	16	Kayu ara						X	
	17	Urat mata	Parashorea	X			X	X	for borad/bark for stomachache
	18	Menpuing		X				X	for board
	19	Merabau		X				X	for board/taking honey
x	20	Mangaris	Koompassia excella	X				X	for 2x4/taking honey
	21	Kayu manggalang					X	X	bark for stomachache
	22	Bogil					X	X	bark for stomachache

x Trees that people do not want to be logged.

Valuable Tree Species in the Model Area

(3) Kg.Kotud

	Important Trees in Surrounding Natural Forest								
	#	Local name	English Name or academic name	For build mtl	For house hold	For food	For medi-cine	For fuel-wood	Other information (use, etc.)
	1	Komuning		X				X	
x	2	Kayu kapur	Dryobalanops	X	X				
x	3	Seraya	Shorea curtisii	X	X				
x	4	Sekangan kaca		X	X			X	
x	5	Urat mata	Dipterocarpus	X	X			X	
x	6	Rotan sago	Calamus	X	X			X	
x	7	Pulai (Jelutung)	Dyera costulata	X	X		X	X	
x	8	Pugis				X		X	
	9	Palak bum					X		

x Trees which cannot be found anymore

Tree Species Planted Around the Houses and on the Farmland

(1) Kg.Sunsul

	Trees Planted on Farmland/near Home						
	#	Local name	English name or academic name	For food	For sales	For house hold	Other information (use, price, etc.)
	1	Kelapa	coconut	X		X	cooking oil
x	2	Rambutan	rambutan	X	X		fruit (RM100-150/tree/yr)
x	3	Tarap (Terap)	Artocarpus elasticus	X	X		fruit(RM50/tree/yr)
x	4	Langsat	Lansium domesticum	X	X		fruit(RM300/tree/yr)
	5	Rapayang		X	X		fruit(RM10/kg)
	6	Jambu merali	guava spp.	X	X		fruit(RM50/tree/yr)
	7	Manggis	mangosteen	X	X		fruit(RM20/tree/yr)
x	8	Mangga	mango	X	X		fruit(RM100/tree/yr)
x	9	Nangka	jack fruit	X	X		fruit(RM80/tree/yr)
x	10	Cempadak	jack fruit spp.	X	X		fruit(RM250/tree/yr)
	11	Limau	lime	X	X		fruit(RM20/tree)
	12	Buluno		X	X		fruit(RM30/tree)
	13	Bambangan	Mangifera pajan	X	X		fruit(RM15/tree)
	14	Pompui		X	X		fruit(RM50/tree)
x	15	Mata kuching	longan	X	X		fruit(RM300/tree)
x	16	Durian	durian	X	X		fruit(RM500/tree)
	17	Kopi	coffee		X		(RM0.4/kg)
	18	Bambu	bamboo	X		X	for floor, house and wall
	19	Getah	rubber		X		latex
	20	Jati	teak		X		for 2x4
	21	Safoda	A. mangium				for house building
	22	Kayu kertas			X		for paper, pulp
	23	Pandan	Pandanus boninensis			X	leaves for fiber
	24	Rumbia	Mascarena sagu			X	stems for sago flour
	25	Rotan sago	Calamus.			x	stems for strings
	26	Talupid		x	x	x	
	27	Kelisiwan		x	x		

x Trees that people are interested in planting

Tree Species Planted Around the Houses and on the Farmland

(2) Kg.Polipikan

	Trees Planted on Farmland/near Home						
	#	Local name	English name or academic name	For food	For sales	For house hold	Other information (use, price, etc.)
	1	Buluno		x	x		fruit(RM300/tree)
x	2	Mangga	mango	x	x		fruit(RM100/tree/yr)
x	3	Tarap (Terap)	Artocarpus elastiicus	x	x		fruit(R200/tree/yr), leaves to eat
x	4	Rambutan	rambutan	x	x		fruit (RM100/tree/yr)
x	5	Durian	durian	x	x		fruit(RM300/tree)
	6	Nangka	jack fruit	x	x		fruit(RM50/tree/yr)
x	7	Cempadak	jack fruit spp.	x	x		fruit(RM150/tree/yr)
x	8	Mata kuching	longan	x	x		fruit(RM300/tree/yr)
	9	Memphalan	small mango spp.	x	x		fruit (RM20/tree/yr)
x	10	Lampun	durian spp.	x	x		fruit (RM10/tree/yr)
	11	Bambangan	Mangifera pajan	x	x		fruit(RM150/tree/yr)
x	12	Langsat	Lansium domesticum	x	x		fruit(RM350/tree/yr)
	13	Safoda	A. mangium				
x	14	Getah	rubber		x		latex (at least RM300/mth)
x	15	Pisang	banana	x			fruit (RM3/fondan)
x	16	Belimbing	star fruit	x	x		fruit(RM1/kg)
	17	Jambu batu	guava	x	x		fruit
x	18	Jambu merali	guava spp.	x	x		fruit(RM50/tree/yr)
	19	Limau asam	lime	drink			fruit (RM100/kg)
	20	Limau bajah	orange spp.	x			fruit(RM50/tree/yr)
x	21	Limau manis	sweet orange	x			fruit(RM20/tree/yr)
	22	Jagus (Gajus)	cashew	x			fruit(RM20/tree/yr)
	23	Kogopon		x			fruit(RM10/tree/yr)
	24	Manggis	mangosteen	x	x		fruit(RM200/tree/yr)

x Trees that people are interested in planting

Tree Species Planted Around the Houses and on the Farmland

(3) Kg.Kotud

	#	Local name	English name or academic name	For food	For sales	For house hold	Other information (use, price, etc.)
		Trees Planted on Farmland/near Home					
x	1	Getah	rubber		x		latex(RM300-2000/acre/mth) Also used as firewood
	2	Tarap	Artocarpus elastiicus	x	x		fruit(RM100-150/tree/season)
	3	Kelapa	coconut	x	x		fruit (RM600-700/acre/season)
	4	Langsat		x	x		fruit
	5	Pangie		x	x		seed(RM2/kg)
	6	Bambu	bamboo	x	x	x	RM5/tree
	7	Tulu	bamboo spp.		x	x	RM5/tree
	8	Tuhau		x	x		RM1/tree
	9	Rambutan		x	x		fruit (RM20/tree/yr)
	10	Durian		x	x		fruit(RM12/kg)
	11	Nangka	Mangifera pajan	x	x		fruit(RM2/kg)
	12	Cempedak	jack fruit spp.	x	x		fruit(RM2/kg)
	13	Mangga	mango	x	x		fruit(RM1-3/kg)
	14	Bambangan	Mangifera pajan	x	x		fruit(RM1-2/kg)

x Trees that people are interested in planting

Attachment 25

MINUTES OF THE MEETING WITH KK, JKKK AND HEAD OF GOVERNMENT AGENCIES IN AREAS AFFECTED BY THE FEASIBILITY STUDY OF THE FOREST DEVELOPMENT PROJECT IN MARAK-PARAK CONSOLIDATION, NORTHERN SABAH

DATE	:	**3RD FEBRUARY 1997**
TIME	:	**11:00 A.M.**
VENUE	:	**CONFERENCE ROOM OF THE KOTA MARUDU DISTRICT COUNCIL BUILDING**

Attendance

NO	NAME	POSITION/DEPARTMENT	VILLAGE
1	Mr. Peter Chee Nyuk Foh	Kota Marudu District Officer	N/A
2	Mr. Patrick Mojinun	Kota Marudu Assistant District Officer.	N/A
3	Mr. John Charles Mikat	CDO -Langkon	N/A
4	Mr. Silil Mohd Ali Yassin	Kota Marudu District Chief	N/A
5	Mr. Burhan Buminjal	Native Chief (KAN)	N/A
6	Mr. Mohd Ishak	K.M. District Agriculture Officer	N/A
7	Mr. Zaini Dungit	K.M. Sabah Rubber Fund Board	N/A
8	Mr. Aftah Den	AFO-Kota Marudu Forest Dept.	N/A
9	Mr. Kalik Pandarak	Pemaju Mukim Marak-Parak	N/A
10	Mr. Isang Rawai	Pemaju Mukim Kota Marudu	N/A
11	Mr. Dalut Yantik	Chairman JKKK	Bambangan
12	Mr. Gador Sumpiti	KK	Kias
13	Mr. Joseph Torintim	Chairman, JKKK	Kias
14	Mr. Kuidau Langgu	KK	Kotud
15	Mr. Korom Yatung	Chairman, JKKK	Kotud
16	Mr. Komoi Panggali	Chairman, JKKK	Lombiding
17	Mr. Motis Budan	Chairman JKKK	Marak- Parak
18	Mr. Jusika Tiaras	KK	Melangkap Darat
19	Mr. Gondi Kuim	Chairman, JKKK	Melangkap Darat
20	Mr. Bandawa Sondigan	KK	Melangkap Tengah
21	Mr. Niol Lompitau	Chairman, JKKK	Melangkap Tengah
22	Mr. Mariding Posoi	KK	Mensusurod
23	Mr. Yakum Unggut	Chariman, JKKK	Natu
24	Mr. Rosidin Pandawar	Chairman, JKKK	Paka
25	Mr. Joili Aduk	KK	Paliu Sumbuh
26	Mr. Mosumping Kuyut	Chairman JKKK	Paliu Sumbuh
27	Mr. Bulagoi Baruid	KK	Polipikan
28	Mr. George Bulagoi	Chairman, JKKK	Polipikan
29	Mr. Seleh Tampisal	Chairman, JKKK	Pompadon
30	Mr. Egul Bokiah	Chairman, JKKK	Sorinsim
31	Mr. Kudoh Kerimau	KK	Sunsui
32	Mr. Sogulot Lungkidau	Chairman, JKKK	Sunsui
33	Mr. Milundun Kandayan	KK	Talamason
34	Mr. Yasah Kulai	KK representative	Talamason
35	Mr. Dorutik Timas	KK	Talas
36	Mr. Rusman Salamat	Chairman, JKKK	Tandahawon
37	Mr. Keritek Damu	KK	Tandahawon
38	Mr. Nafry Soligi	Chairman, JKKK	Tangkol
39	Mr. Lakasan Sayanti	KK	Tangkol
40	Mr. Soligi Sombilan	Chairman, JKKK	Tungab
41	Mr. Salmoh Guntilib	KK representative	Tungab

NO	NAME	POSITION/DEPARTMENT	VILLAGE
42	Mr. Freddy Lee	Surveyor, SAFODA HQ.	N/A
43	Mr. Cadoly Lagang	SAFODA, Northem Region Office	N/A
44	Mr. Elias Modohou	SAFODA, Northem Region Office	N/A
45	Mr. Vun Phau Kuwansai	PTF- SAFODA	N/A
46	Mr. Edward Masing	PTF- SAFODA	N/A
47	Mr. Handa Tsutomu	Study Team Leader (JOFCA)	N/A
48	Mr. Fujii Kigoshi	Study Team Sub-Leader(JOFCA)	N/A
49	Ms. Hirouchi Yasuyo	Socio-Economic Consultant -Study Team	N/A
50	Dr. B.Beth Baikan	Local Consultant	N/A

INTRODUCTION

1.1 The meeting was called to order at 11:08 a.m.

1.2 Mr. Peter Chee, the Kota Marudu District Officer welcome everyone in attendance and introduced the Study Team Leader Mr. Handa Tsutomu, Ms Hirouchi Yasuyo - the Socio Economic Consultant and Mr. Freddy Lee of Safoda.

1.3 The D.O then brief all attendees, the JKKK and KK in particular, the purpose of the meeting and asked them to be attentive and cooperative with the study team, before handing over the floor to the SAFODA Officer, Mr. Freddy Lee, for further clarification.

2.0 BACKGROUND OF THE STUDY

2.1 Mr. Freddy Lee briefly explained the background of the Feasibility Study (as stated in para 1 of attachment 1-agenda of meeting on 3rd Feb, 1997) and stressed on the objectives of the Master Plan of the study as outlined in attachment 1. He indicated that the proposed Forest Activities in the Master Plan includes the development of commercial plantation on degraded land and the promotion of small scale tree planting on private lands.

He then asked Mr. Handa, the study team leader, to explain the study.

3,0 OUTLINE OF THE STUDY

3.1 Mr. Handa first explained the area of the study which include four mukims in the Marak-Parak Consolidation namely: Luba Pelumpung, Simpangan, Talantang and Gana. He also explained that one of the major objective of the Feasibility Study is to identify a suitable area to be used as models of the study within the study area for the preparation of a detailed implementation plan and to determine their feasibility taking into account the interest of the local community.

4.0 SOCIO-ECONOMIC SURVEY

Results and findings of Phase 1 study.

4.1 Ms. Hirouchi Yasuyo presented the results of the Phase 1 socio-economic survey and indicated that the concerns of the local community gathered in the first phase of the survey regarding land matters have been highlighted in the interim report. She also indicated that a meeting on the interim report was held in Kota Kinabalu on Monday 27th January, 1997, attended by the Kota Marudu District Officer (or representative).

She explained that based on that meeting, the following decisions were reached:-

a) Lands with legal titles will NOT be expropriated

b) Commercial forest plantation will respect land with Native Title including surveyed LAs and those LAs already approved by the Land Utilisation Committee (LUC).

c) For those LAs that have NOT been processed, they will be reviewed and ascertained first through normal procedures.

She indicated that she would be going to the likely affected villages to interview and discuss the project with the villagers so that the project can be people friendly. She also asked for assistance from the CDO and KAN to inform the KK and JKKK of the likely affected villages to meet with her for further discussion about the project and the purpose of her survey.

She then handed the floor to the District Officer for the General Discussion Session.

5.0 GENERAL DISCUSSION SESSION

The D.O opened the floor for general discussion and question and answer.

5.1 Q. from Mr. Egul Bokiah, JKKK Chairman, Kg. Sorinsim.

a. 'Are the land with unprocessed LAs in this village be considered degraded and be submitted/ given to SAFODA/and this 'Japanese Company', or do we still have any claim on them? Will the District Office still process our application?'

b. 'If this project is implemented, wouldn't this destroy the livelihood of the village, or will the village be resettled into a settlement scheme?'

c. 'Regarding the status of the KK and JKKK, at the moment, there are several villages in this mukim and as such each village has its KK and JKKK. So when the project is implemented and the villages are resettled in one settlement scheme, this will definitely need only one KK and JKKK. What will happened to the rest of the present KK and JKKK?'

d. 'Regarding our communal grazing land, will this also be planted with SAFODA tree and land ownership given to SAFODA or can this be excluded from this project?'

e. 'What infrastructures/benefit will the Japanese Team bring to this village?'

***Explanation from Ms. Hirouchi Yasuyo.**

Ms. Hirouchi explained that lands with Native Title and surveyed LAs have been identified with the help of the Land and Survey Department and therefore will be respected including those land approved by the Land Utilisation Committee. For land with unprocessed LAs, villagers applications will be reviewed and ascertained first through the normal process.

Answers from the D.O to Q.(a., c and d), SAFODA to Q (b) D.O and SAFODA to Q (e)

a. Land with NT title and approved LA will not be given over to SAFODA and land with unprocessed LAs will be ascertained first through normal procedures. Suitability of the land will be determine when awarding land titles.

b. This is a feasibility study for Forest Development and will not involve resettlement scheme.

c. Regarding the status and positions of KK and JKKK, this project will not affect their status since this is not a settlement scheme.

d. As already indicated, villagers' land application will first be reviewed and ascertained and this includes application for the Communal Grazing land if this have LA. It is up to the Land and Survey Department to approve/not approve land application based on the suitability of the land. Nonetheless, LAs will be reviewed and ascertained first.

e. A. from SAFODA: It need to be noted here that if this project is implemented, it does not mean that the contract to carry out the project is given to the Japanese. The Japanese group is here to provide technical assistance at their Government expense to do a feasibility study for Forest Development at the request of the Malaysian Government.

A. from D.O.: If this project is accepted by the local communities and implemented, it will bring with it the improvement of roads and job opportunities in which priorities will be given to the local communities.

5.2 **Q. from Mr. Kalik Paudarak, Pemaju Mukim Marak-Parak.**

a. About 80% of the land with LAs in this Mukim have not been cultivated. So the villagers view on this matter is that - all land with LAs must be surveyed first then submit to SAFODA for development while the villagers retain ownership of the land.

Answer from D.O.

a. As already indicated, all villagers' LAs will first be reviewed and ascertained. But reviewing of all LAs takes a long process and it is the responsibility of the Land and Survey Department to survey the land applied by villagers and not SAFODA' responsibility.

5.3 **Q. from Mr. Bandawa Sondigan, KK Melangkap Tengah.**

a. 'According to what's already explained by the team here, one of the major objective of this project is to improve the socio-economic condition of the local people and to bring infrastructural development. But to this day, we have not seen any development. From our past experience, SAFODA (PTF) has promised this before and has not fulfilled their past promises. In fact, they (SAFODA-PTF) has polluted our water through their activities.
So what economic development are you talking here?'

-Strongly reject the project and prefer planting rubber as it generates cash income.
-Only reject SAFODA but will welcome other Government Agencies like SRFB.
-Views were supported by 80% of KK and JKKK present.

Answer from D.O.

a. 'Villagers will not be forced to participate in the project if they don't want to, besides, this is only a feasibility study to prepare for the implementation plan. Suitability of land for Agricultural and other tree crops such as rubber is taken into account in the study. Land suitable for these purposes will be excluded from the Forest Activities. The project is interested in rehabilitating degraded lands no longer suitable for Agricultural purposes. It is not the intention of the government to rob villagers land.'

5.4 **Q. from Mr. Jusika Tiaras, KK Melangkap Darat.**

a. Seventy percent of the land in this village have LAs but the rest have not been applied as we reserved them for our children.

If viewed from these experts' point of view, we agree that all these land are unsuitable for agricultural purposes due to the steepness of the slope. But for us villagers, slope is not an obstacle to cultivate the land to feed our family. So if based on suitability, what if the Land and Survey Department decides that all these land are not suitable for our use and be given to SAFODA and this 'Japanese Company'? Where will the villagers who have no land elsewhere go?

***Explanation from Kota Marudu Agriculture Officer,**

From the survey of Agricultural Department, it is true that land in this area are not suitable for Agricultural purposes.

Answer from SAFODA (Mr. Freddy Lee)

a. Land that are suitable for Agriculture will be excluded from Forest Activities. If this project is implemented, it does not mean that all land areas will be planted by SAFODA. Our aim is to rehabilitate degraded land - land not suitable for Agricultural purposes.

***Explanation from Mr. Handa - in response to [5.1(a) and 5.4 (a)]**

The Japanese Study Team are not here to take away villagers land nor to support the Government. They are here to study and recommend appropriate use of the land and villagers should not fea that their land be taken away.

***Explanation from Ms. Hirouchi.**

Surveyed LAs suitable for Agriculture Farmland in the study area have been identified and plotted in the map to be excluded from Forest Activities. Because JICA and the Study Team feel that it is important to involve the villagers in discussions regarding the survey, they had asked the DO, CDO, and KAN to have this meeting so that the villagers understand well, the purpose of their study.

5.5 **Q. from Mr. Lakasau Sayanti, JKKK Chairman, Kg. Tangkol**

a. What species of tree that will be planted?

b. Is the small scale farming be done through contract or through Agricultural Department?

Answers from SAFODA (Mr. Freddy Lee)

a. Species of tree will be determined in the study.

b. Methods of implementation will also be determined in the study.
Ms. Hirouchi added that the reason for her survey is to solicit views from the villagers as to how this project could benefit the local communities.

5.6 **Q. from Mr. Niol Lompitau, JKKK Chariman, Kg. Melaugkap Tengah**

a. Will the coming of this project destroy our children's chances of applying land in the future?

Answer from D.O.

a. Every village is allotted for village reserve so that villagers will always have land to live on and your children can apply for this land.

5.7 **Q. from Mr. Rosidin Sandawar, JKKK Chairman, Kg. Paka.**

a. Why not SAFODA plant rubber instead of Safoda Tree?

b. Why not SAFODA give subsidy scheme for rubber and oil palm?

c. If this project is implemented, will this project enter into agreement with the villagers and what percentage of the income will be given to the villagers?

Answer from SAFODA (Mr. Freddy Lee.)

a. If the land is suitable for Rubber Plantation, there is an agency (SRFB) responsible for this area and villagers are advised to seek more information and advice from this agency.

b. SAFODA is set-up to carry out Forest Development Activities and not rubber or oil palm.

c. The reason why the Study Team conduct the survey is to determine how this project could benefit the local communities. At this point, we do not have a fixed plan or formula in what way the project could benefit the local communities.

***Explanation from Mr. Burhan Bumiujal, KAN Kota Marudu.**

- The purpose of this study is to study the possibilities of villagers involvement and participation in the project.
- SAFODA is the counterpart of this Project because their (SAFODA) activity is the development of Forest.
- This Study Team are here to study the suitability of land use and suggest appropriate use of the land.

6.0 **Closing remarks**

6.1 The D.O Mr. Peter Chee, in his closing remarks asked the JKKK and KK to give full cooperation to the Study Team so that they can perform their study well. He stressed that this is the request of the Government of Malaysia for them to prepare the detail implementation plan and that without the cooperation of the local people, the study cannot be carried out. He also asked the JKKK and KK to make the people in their respective village understand the purpose of the study so that they can cooperate with the study team.

7.0 ADJOURNMENT OF MEETING.

The meeting was adjourned at 1:13 p.m.

Reported by Dr. B. Beth Baikan, Ph.D.
SEM Consultant (Sustainable Environmental Management Consultant)

Issues for the PTF Programme in the Model Area

1. Reasons that the farmers participated in the PTF programme

The reasons that the PTF farmers in the Model Area planted *A. mangium* are as follows.

(1) Presence of a growing market and high price: SAFODA staff explained to the farmers that a market already existed for *A. mangium* and planting the tree would bring about profits. For example, farmers in Kg. Polipikan were told at an explanatory meeting held in the village that "there is a ready market for the tree to meet the shortage in the world supply of *A. mangium*". Although there was no reference to the price of the tree at that time, they assumed that *A. mangium* could be sold at about RM50 per tree in 7 years and decided to participate in the programme. According to the PTF farmers in Kg. Sunsui, SAFODA staff at an explanatory meeting held in Kota Marudu Town said to them, "a grower could get RM5,000-6,000 per acre in 8 years".

(2) Harvesting at the early ages: Being a fast-growing species, *A. mangium* could be harvested earlier than the other industrial species. Polipikan people were told that the tree could produce income in 8-10 years after planting and that one could start to sell in 4 years at the earliest if he/she is unable to wait for 8-10 years.

(3) Presence of marketing agreements: The farmers believe that SAFODA would purchase a tree reached at the harvesting age. According to the farmers in Kg. Sunsui, this kind of agreement is written in the application form. In Kg. Polipikan, no written document but an oral agreement exists, in which the tree should be sold only to SAFODA (SAFODA's permission is necessary to sell the trees to others).

Very few PTF farmers knew that *A. mangium* improves soil through nitrogen-fixation. The PTF staff seem not to have briefed them on this point. An explanation about nitrogen-fixation can be found in the PTF pamphlet; however, the pamphlets have not been distributed to the farmers in the first place. In any case, the farmers indicated that they would not have planted *A. mangium* to improve the land productivity only. They decided to grow the trees, expecting that SAFODA (or contractors introduced by SAFODA) would buy them at a high price in 4 years at the earliest since there is already a growing market.

2. Reasons that the farmers have stopped planting *A. mangium*

A major reason that the PTF have stopped planting is that, contrary to the above mentioned expectations, they have heard from people in other villages that "*A. mangium* cannot be sold (if sold, at a very low price)[1]. There are other discouraging rumors such as "fish would die if the trees are planted along rivers or ponds[2] and "*A. mangium* needs a lot of water and nutrients to grow and, therefore, nothing would grow on the land after the trees are

[1] Some PTF farmers in Kg. Sunsui continue to plant *A. mangium* in small scale for making two by fours.

[2] According to informants, "SAFODA person" who delivered the seedlings to the village advised not to plant them around rivers and ponds as *A. mangium* kills fish.

harvested", which seem to have aroused their anxiety. Lack of communication between the farmers and SAFODA has aggravated the situation further. The farmers have never discussed the matter with the PTF staff for the following reasons: (1) the planted trees have not been matured yet: and (2) it is no use discussing as there is no market anyway. Even if they want to discuss, there are very few opportunities. Since the initial explanatory meeting in1991, the extension staff have visited Kg. Sunsui only three times in six years for delivery of the seedlings. In Kg. Polipikan, there has been no visit by the PTF staff for three years since the explanatory meeting; no inspection of the applied plots; no technical advice on how to plant[3]; far less opportunities for the discussions. Even the seedlings were not delivered to the village: the PTF farmers had to walk to Kg. Sunsui in order to receive them.

3. Views of Local PTF Office

Regarding a market for *A. mangium*, the local PTF office insists that there should not be any problem, which is to the contrary of how the PTF farmers see the situation. According to the PTF office, the market exists and the contractors in Kota Belud (Syarickat Makmur Sdn. Bhd. and its subsidiary) have started to buy local *A. mangium* (at RM25-45 per ton or RM25-65 per ton) for an export to Taiwan, which will be used for materials for two by fours, walls and floor. It was indicated that the contractors, however, are not interested in the trees in Marak Parak Consolidation at this point and would not go and buy them. The Consolidation is too far; plantations are scattered; and their sizes are rather small. Harvesting and transportation costs would become too high compared to the current price of *A. mangium* . This means that virtually there is no market for *A. mangium* in the area. The PTF office nevertheless claims that there should be no problem as the office has not heard any complaints. (Farmers should come all the way to Ulu Kukut to discuss their problems, if any). According to the office, the cause of a decrease in the planted area of *A. mangium* is not lack of the market but shortage of the budget. Low budget does not allow the PTF to provide subsidies like competing agencies (i.e. SRFB and FELCRA) do. It also makes it impossible to secure enough staff to carry out proper extension services. Moreover, there are no vehicles for the extension staff, which makes it difficult to communicate with the villages in remote areas like Marak Parak Consolidation.

Views of local PTF extension staff are similar to those of the PTF farmers. According to the staff, the major cause of a marked decrease in the number of the PTF participants and the planted area in recent years is that the framers have lost confidence in SAFODA since it has not been able to solve the marketing problem. There are cases where sawmills bought the trees. However, in most cases, there are middlemen and standing price becomes too low to meet the expectations of the farmers. Lack of incentives such as subsidies is also attributable to a subdued interest in planting of *A. mangium*.

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[3] Only a tape measure indicating tree spacing was given to each participant at a delivery of the seedlings.

Examples of Agroforestry Systems

1) Managed Fallow

A. mangium would be planted on the fallows. Advantages include: (a) there would be only a little change from the existing system based on natural regeneration of the secondary growth; (b) tree growers could earn income at the tillage cycle; (c) soil fertility would be improved. A disadvantage is that the fallow period of 7-10 years (gestation period of *A. mangium*) would be necessary, which is longer than the current 4-5 years.

2) Taunya

Farm crops would be intercropped during the early stage of the growing of *A. mangium*. It could be combined with managed fallow system. Advantages are: (a) farm production could be obtained during the first few years; (b) less care would be required in plantation management as the land would be managed by farming activities. Disadvantages are: (a) the intercropping period is rather short as *A. mangium* is fast-growing; (b) the most suitable crops for intercropping with *A. mangium* are unknown at present.

3) Alley Cropping

On a slope, in particular, *A. mangium* would be planted in strips, between which farm crops would be intercropped. Advantages are: (a) soil fertility would be improved; (b) soil is conserved. Disadvantages are: (a) it would require frequent pruning; (b) sales profit of *A. mangium* per acre would be less as it requires certain spacing; (c) it is a new technique for local farmers; (d) the most suitable crops for intercropping with *A. mangium* as well as appropriate spacing are unknown at present.

4) Combination with Apiculture

According to KPD, flowers of *A. mangium* produces good honey. KPD manufactures honey from *A. mangium*. At present, apiculture is not undertaken in Marak Parak Consolidation; however local people collect natural honey from the surrounding forests. It would not be perceived as a totally new technique. An advantage is that farmers could earn income even before the harvesting period. Disadvantages are: (a) farmers are unfamiliar with the apiculture techniques; (b) much care is needed for apiculture; (c) price, market prospect and distribution system are unknown at present[1]

[1] Local KPD officer was not available for further interviews as he was on leave during the study period.

Site Class of Proposed Forestation Area and Empirical Yield Table

1) Site Class of Proposed Forestation Area Based on Forestland Productivity

	I	II	III	IV	Total
Cells (unit)	88	174	328	124	714
%	12.3	24.4	45.9	17.4	100.0
Class According to Mr. Inose's Site Classification	I		II	III	
%	36.7		45.9	17.4	100.0

The side class of the proposed forestation area based on the forestland productivity survey is consistent with Mr. Inose's classification as shown in the Table. As a result, Class II occupies about half the area (45.11%), which corresponds with the results of the survey. Accordingly, it is proper to classify this area as Class II.

2) Empirical Yield Table for Site Class II

Forest Age	Average Diameter	Average Height	per ha Tree Count	per ha Volume	per ha Cross Section	Annual Volume Increment	Average Volume Increment	Growth Rate
1	4.03	4.07	1,100	3.22	1.40		3.22	
2	7.26	7.71	1,010	16.27	4.18	13.05	8.14	80.19
3	9.95	10.74	940	37.25	7.32	20.98	12.42	56.31
4	12.37	13.28	880	63.81	10.59	26.56	15.95	41.62
5	14.60	15.43	770	87.25	12.90	23.44	17.45	26.86
6	16.65	17.25	693	110.96	15.09	23.71	18.49	21.37
7	18.53	18.81	635	134.27	17.14	23.30	19.18	17.35
8	20.24	20.12	592	156.53	19.04	22.27	19.57	14.22
9	21.78	21.23	557	177.38	20.79	20.85	$\boxed{19.71}$	11.75
10	23.18	22.18	530	196.86	22.39	19.48	19.69	9.90
11	24.42	22.99	508	214.54	23.83	17.67	19.50	8.24
12	25.52	23.67	490	230.46	25.12	15.92	19.20	6.91
13	26.50	24.25	476	244.85	26.77	14.40	18.83	5.88
14	27.35	24.73	464	257.41	27.28	12.56	18.39	4.88
15	28.09	25.15	454	268.56	28.16	11.15	17.90	4.15

Mitsuo Inose, Zainal SARIDI and Tsuyoshi Nakamura "Acacia mangium's Growth Analysis (2) Preparation of Empirical Yield Tables", Kitakata Ringyo Vol. 44, No.6, p.19, 1992

Attachment 29

Standard Forestation Process

(1) Acacia magium

per hectare

Year	Work	Item	Workers per ha	Quantity	Unit Cost (RM)	Cost (RM)
1	Land Preparation	Surveying, zoning	2.7	2.7	15.0	40.5
		Low-layer clearance	4.6	4.6	15.0	69.0
		Felling	8.0	8.0	15.0	120.0
		Lopping, piling	2.2	2.2	15.0	33.0
		Burning	0.5	0.5	15.0	7.5
		Clearance of planting lines (2 m wide)	4.2	4.2	15.0	63.0
		Subtotal	22.2	22.2		333.0
	Planting	Marking	3.0	3.0	15.0	45.0
		Digging 1,250 holes	6.0	6.0	15.0	90.0
		Planting, Carrying 1,250 seedlings	8.4	8.4	15.0	126.0
		Supplementary planting (125 seedlings)	1.1	1.1	15.0	16.5
		Transporting seedlings by contract		1,375 s/ha	0.06 s/ha	82.5
		Baskets of seedlings		2	2.5	5.0
		Labor cost		18.5		277.5
		Material and transportation costs				87.5
		Subtotal				365.0
	Tending	First weeding (in lines 1 m wide)	2.8	2.8	15.0	42.0
		Fertilization (80 g NPK per seedling)	4.4	4.4	15.0	66.0
		Fertilizer cost (100 kg/ha)		100 Kg	1.25/Kg	125.0
		Survival and growth survey	2.7	2.7	15.0	40.5
		Assistance for workers' lodges			5.0/ha	5.0
		Labor cost		9.9		148.5
		Material and other costs				130.0
		Subtotal				278.5
1		Labor cost		50.6		759.0
		Material and other costs				217.5
		Subtotal				976.5
2	Tending	Second weeding (in lines 2m wide)	5.7	5.7	15.0	85.5
		Subtotal	5.7	5.7	15.0	85.5
Total		Labor cost		56.3		844.5
		Material and other costs				217.5
	Total					1,062.0

Standard Forestation Process

(2) Paraserianthes falcataria

per hectare

Year	Work	Item	Workers per ha	Quantity	Unit Cost (RM)	Cost (RM)
1	Land Prepara-tion	Surveying, zoning	2.7	2.7	15.0	40.5
		Low-layer clearance	4.3	4.3	15.0	64.5
		Felling	8.0	8.0	15.0	120.0
		Lopping, piling	2.0	2.0	15.0	30.0
		Burning	0.4	0.4	15.0	6.0
		Clearance of planting lines (2 m wide)	4.0	4.0	15.0	60.0
		Subtotal	21.4	21.4		321.0
	Planting	Marking	1.7	1.7	15.0	25.5
		Digging 833 holes	3.8	3.8	15.0	57.0
		Planting, Carrying 833 seedlings	5.4	5.4	15.0	81.0
		Supplementary planting (84 seedlings)	0.7	0.7	15.0	10.5
		Transporting seedlings by contract		916 s/ha	0.06 s/ha	55.0
		Baskets of seedlings		2	2.5	5.0
		Labor cost		11.6		174.0
		Material and transportation costs				60.0
		Subtotal				234.0
	Tending	First weeding (in lines 1 m wide)	2.7	2.7	15.0	40.5
		Fertilization (80 g NPK per seedling)	3.0	3.0	15.0	45.0
		Fertilizer cost (66.7 kg/ha)		66.7 Kg	1.25/Kg	83.4
		Survival and growth survey	1.7	1.7	15.0	25.5
		Assistance for workers' lodges			5.0/ha	5.0
		Labor cost		7.4		111.0
		Material and other costs				88.4
		Subtotal				199.4
1		Labor cost		40.4		606.0
		Material and other costs				148.4
		Subtotal				749.9
2	Tending	Second weeding (in lines 2m wide)	5.4	5.4	15.0	81.0
		Subtotal	5.4	5.4	15.0	81.0
Total		Labor cost		45.8		687.0
		Material and other costs				148.4
	Total					835.4

Standard Forestation Process

(3) Enrichment Planting

per hectare

Year	Work	Item	Workers per ha	Quantity	Unit Cost (RM)	Cost (RM)
1	Land Prepara-tion	Surveying, zoning	2.7	2.7	15.0	40.5
		Low-layer clearance	0.8	0.8	15.0	12 0
		Felling	1.2	1.2	15.0	18.0
		Lopping, piling	0.5	0.5	15.0	7.5
		Clearance of planting lines (5 m wide)	2.0	2.0	15.0	30.0
		Subtotal	7.2	7.2		108.0
	Planting	Marking	0.4	0.4	15.0	6.0
		Digging 150 holes	0.8	0.8	15.0	12.0
		Planting, Carrying 150 seedlings	1.5	1.5	15.0	22.5
		Supplementary planting (30 seedlings)	0.3	0.3	15.0	4.5
		Transporting seedlings by contract		180 s/ha	0.08 s/ha	14.4
		Baskets of seedlings		2	2.5	5.0
		Labor cost		3.0		45.0
		Material and transportation costs				19.4
		Subtotal				64.4
	Tending	First weeding (in lines 5 m x 300 m)	2.0	2.0	15.0	30.0
		Second weeding (in lines 5 m x 300 m)	2.0	2.0	15.0	30.0
		Labor cost		4.0		60.0
1		Labor cost		14.2		213.0
		Material and other costs				19.4
		Subtotal				232.4
2	Tending	Third weeding (in lines 5 m wide)	2.0	2.0	15.0	30.0
		Fourth weeding (in lines 5 m wide)	2.0	2.0	15.0	30.0
		Subtotal		4.0		60.0
3	Tending	Surrounding pruning	2.0	2.0	15.0	30.0
Total		Labor cost		20.2		303.0
		Material and other costs				19.4
	Total					322.4

Standard Process of Seedling Production

1. A. mangium & P. falcataria

per 1,000 seedlings

Work	Item	Number per man	Workers
Preparation for Sowing	Sieving, mixing compost, potting	900 pots/man	1.11
Sowing	Sowing, watering		0.50
Transplanting	1,500 pots per man		0.67
Tending & Maintenance	Watering, shading, weeding, spraying chemicals		1.25
Outplanting	Pot arrangement and seeding selection and loading		1.67
Compost Making	3.75 men per 1 m^3 of ripened compost: 0.0846 m^3 per 1,000 pots		0.32
Survey	Growth, tending and other items		1.50
Total of Workers			7.02

2. Native Species for Enrichment Planting

per 1,000 seedlings

Work	Item	Number per man	Workers
Seeds & Wildings collection	Collection of seeds and wildings of native species		*1.65
Preparation	Sieving, mixing compost, potting	300 pots/man	3.33
Sowing, planting of wildings	Sowing, planting of wildings, watering		1.00
Tending & Maintenance	Watering, shading, weeding, spraying chemicals		3.75
Outplanting	Pot arrangement and seeding selection and loading		3.40
Compost Making	3.75 men per 1 m^3 of ripened compost: 0.0846 m^3 per 1,000 pots		1.00
Survey	Growth, tending and other items		1.50
Total of Workers			15.63

* This figure is based on the experimental data collected in Peninsula Malaysia by The Multi-Storied Forest Management Project.

Basis for Cost Calculation of Seedling Production

Item	Condition	Quantity	Unit Cost(RM)	Cost (RM)
Seed	70,000pieces/kgs, germination rate of 70%	1,430 pieces	1,200.00/kgs	24.51
Soil	Pot capacity 0.283m³/1,000 pots Topsoil 70% of capacity 0.198m³/1,000 pots	0.193m³/1,002 pots	40.00/m³	7.72
Soil	Compost 30% of capacity 0.085m³/1,000 pots (incl. price for straws to make compost)	0.085m³/1,001 pots	25.00/m³	2.13
Soil	Sawdust in sowing trays	0.01m³/1,000 pots	30.00/m³	0.30
Polyethylene Bag	4.46 cm in diameter, 18 cm in height	1,000 bags	13/1,000 bags	13.00
Fungicide	for sawdust Tersan 75WP	0.005kgs/1,000 pots	38.00/kgs	0.19
Fungicide	for nursery beds Benlate WP	0.003kgs/1,000 pots	90.00/kgs	0.27
Insecticide	Decis EC	0.002 l/1,000 pots	30.00/l	0.06
Insecticide	Sipton	0.175kgs/1,000 pots	7.00/kgs	1.23
Fertilizer	Bifolan (NPK liquid)	0.007 l/1,000 pots	12.00/l	0.08
Subtotal of Material Costs				49.48
Subtotal of Workers	Refer to Table Ⅲ.	7.02 man/day	15.00	105.30
Nursery Construction & Maintenance Costs			RM90.00/ 1,000 pots	90.00
Total	per 1,000 pots			244.78

Basis for Cost Calculation of Forest Road

- Equipment

Caterpillar D-6	RM	395,000.00/unit
Durability		5 years
Monthly working days		20 days
Annual depreciation	RM	79,000.00
Annual depreciation	RM	6,583.00
Daily depreciation	RM	329.20

- Fuel & Oil

Light oil price	RM	0.66 liter
Consumption		200.00 liter/day
Daily fuel cost	RM	132.00
Daily oil cost	RM	13.20
Daily total	RM	145.20

- Wages

Operator	RM	25.00/day
Assistant	RM	15.00/day
Total	RM	40.00/day

- Repair and other costs

10% of equipment cost	RM	32.90/day
<u>Daily construction cost</u>	RM	547.30

Basis for Cost Calculation of Training

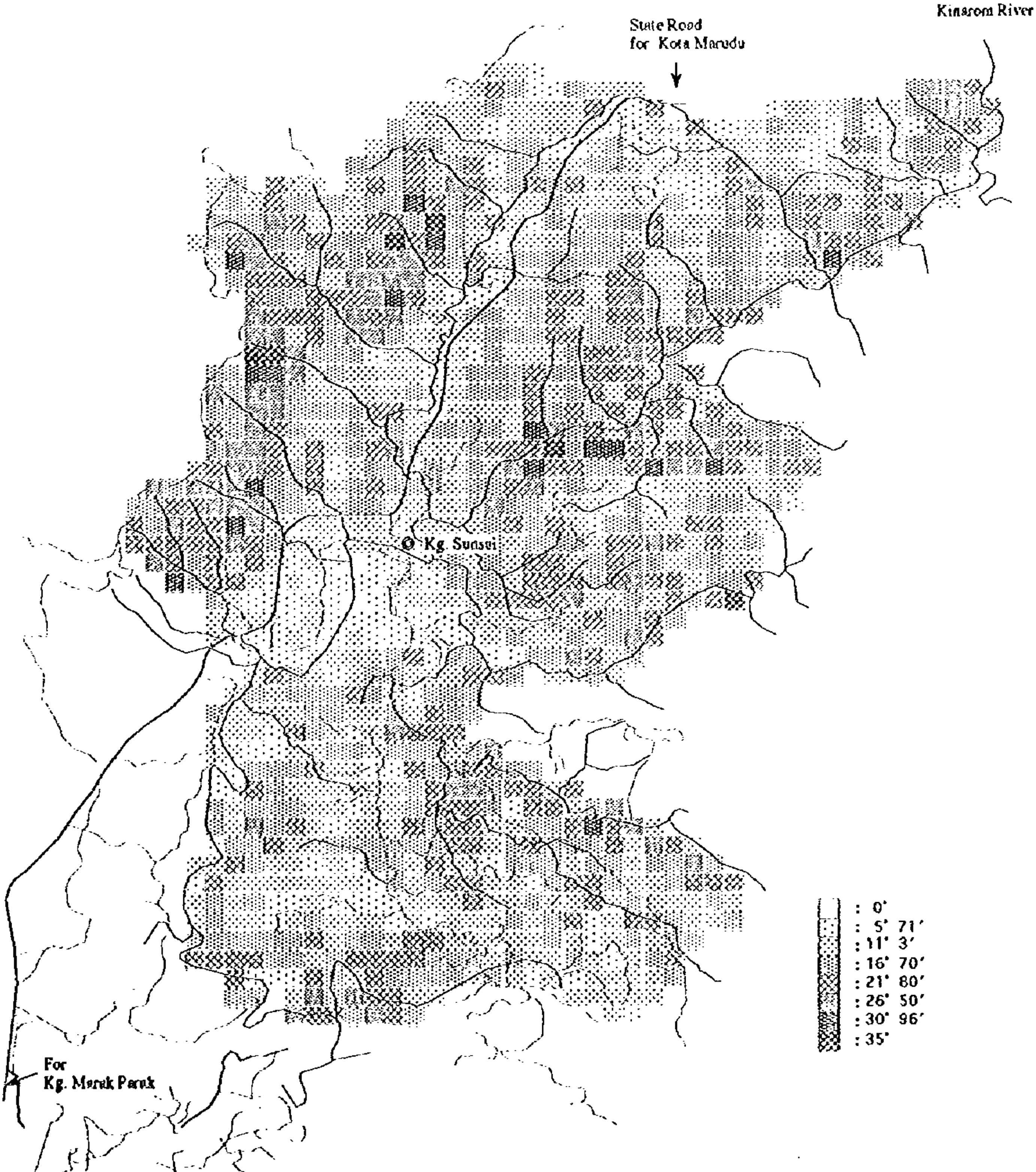
1) Trainees

Training Course	Trainees		Days		Total
Forestation	10 pers.	×	14 days	=	140 pers. · days
Nursery work	9 pers.	×	14 days	=	126 pers. · days
Fire prevention	9 pers.	×	10 days	=	90 pers. · days
Forest road repair	9 pers.	×	10 days	=	90 pers. · days
Total					446 pers. · days

2) Trainees per Course

Training Course	No. of Courses		Trainees		Total
Forestation	1 course	×	10 pers.	=	10 pers. · course
Nursery work	1 course	×	9 pers.	=	9 pers. · course
Fire prevention	1 course	×	9 pers.	=	9 pers. · course
Forest road repair	1 course	×	9 pers.	=	9 pers. · course
Total					37 pers. · course

Slope Distribution in the Model Area



MINUTES OF THE MEETING ON THE EXPLANATION OF THE DRAFT FINAL REPORT ON THE FEASIBILITY STUDY ON THE FORESTRY DEVELOPMENT PROJECT IN MARAK PARAK, IN NORTHERN SABAH, MALAYSIA

In pursuance to the objectives of the scope of work for the Feasibility Study on the Forestry Development Project in Marak Parak in Northern Sabah (hereinafter referred to as "the Study"), signed on 15 December 1995, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Study Team headed by Mr. Tsutomu HANDA to carry out a two-phase study over a period of eighteen months starting from April 1996.

The Study Team submitted 20 copies of the Draft Final Report based on the study done in both phases to the Malaysian side on 18 July 1997 and held one meeting at Kota Kinabalu, Sabah on 24 July 1997 to explain the study done, with the Malaysian authorities and counterparts headed by Mr. Idrus Bin Haji Abdul Ghani, General Manager of the Sabah Forestry Development Authority (hereinafter referred to as "SAFODA"). The list of attendees in the meeting is shown in the Appendix attached.

The results and main comments from the meeting are as follow:-

1. An explanation on the outline of the study results was given. The need for forestry activities in order to restore and improve natural environment, to promote sustainable development and to create employment opportunities was highlighted.

2. The current agricultural and forestry activities in the study area were explained. Economic short-comings and land claim problems were discussed and clarified.

3. A presentation on the forestation program including reafforestation methods, species to be planted, identified areas and annual forestation plan was given and discussed.

4. An explanation on seedling production covering employment preference, nursery selection, production plan, manpower requirements and seedling production costs was given. Also discussed was the cost of collecting dipterocarp wildings.

5. A presentation on the implementation of the project and organisation, with the suggestion that SAFODA be the implementing agency, was given. It was remarked that in order for the plantation to be successful, it should be commercially oriented; thus the salary as detailed in the report may be quite low. Surveying and mapping cost should also be included and accounted for since these activities form part of the establishment costs.

6. Marketing strategy and financial analysis relating to the proposed forestry project in the area were explained. It was noted that the plantable portion of the study area itself is considered as quite small as a supply area for wood-based industries. Alternatives for industries such as chip and paper mill, particle board plant and medium-density fibreboard (MDF) plant were also discussed. It was also suggested that other species such as rubber be planted.

7. A summary of the EIA report was also presented. The report stated that since the effects of this project on the environment was allowable, it will rather make a greater contribution to the regional development if appropriate mitigation measures are taken. It was also recommended that administrative agencies should make a decision on land use classification for the watershed as a whole.

8. The Malaysian side and the Study Team generally agreed to the comprehensive contents of the draft final report. However, it was noted that as stated in the Scope of Works signed on 15 December 1995, the Malaysian side would submit official comments on the report within thirty (30) days from the date stated below to the JICA Malaysia Office.

Kota Kinabalu
29 July 1997

....
Mr. Tsutomu HANDA
Team Leader
JICA

....
Mr. Idrus Bin Haji Abdul Ghani
General Manager
SAFODA

....
Witnessed by
Mr. Masayuki IWASA
JICA Advisory Team

Appendix

LIST OF ATTENDEES FOR THE MEETING ON THE DRAFT FINAL REPORT OF THE FEASIBILITY STUDY ON THE FORESTRY DEVELOPMENT PROJECT IN MARAK PARAK IN NORTHERN SABAH, MALAYSIA

24 JULY 1997
SAFODA HEADQUARTERS, KOTA KINABALU

The Malaysian Side:

1. Mr.Francis G.Otigil	-	Deputy General Manager, SAFODA
2. Mr.Felix Madan	-	Permanent Secretary, Ministry of Resource Development and Enterprise
3. Mr.Shumardijaya Marsudi	-	Office of Natural Resources
4. Hj.Mohd.Yassin B.Hj.Ibrahim	-	Federal Development Department (Sabah)
5. Ms.Maureen Balanggung	-	State Development Department
6. Mr.Rahim Sulaiman	-	Forestry Department HQ, Sandakan
7. Mr.Patrick Mojinun	-	District Office, Kota Marudu
8. Mr.Freddy Kou	-	Lands and Surveys Department
9. Dr.B.Beth Baikan	-	SEM-Consultants
10. Mr.Ahmad Hj.Musli	-	SAFODA, Northern Region
11. Mr.Patar Seluang	-	SAFODA, Northern Region
12. Mr.Freddy Lee	-	SAFODA, Headquarters

The Japanese Side:

Study Team:

1. Mr.Tsutomu HANDA	-	Study Team Leader, JOFCA
2. Mr.Kiyoshi FUJII	-	Study Team Sub-Leader, JOFCA
3. Mr.Toshio SAITO	-	Study Team Member, JOFCA
4. Mr.Hirotsugu NISHIZAWA	-	Study Team Member, JOFCA
5. Mr.Takaki TOYODA	-	Study Team Member, JOFCA
6. Ms.Yasuyo HIROUCHI	-	Study Team Member, JOFCA
7. Mr.Shinichi MORI	-	Study Team Member, JOFCA

Advisory Team:

1. Mr.Masayuki IWASA	-	JICA Advisory Team

Attachment 36

Calculation Basis of Chipping Cost

1. Breakdown of Chipping Cost

1) Labor	US$ 1.66 /BDT
2) Depreciation	US$ 5.76 /BDT
3) Electricity	US$ 1.89 /BDT
4) Administration and Maintenance	US$ 5.18 /BDT
5) Transport to port	US$ 1.51 /BDT
TOTAL	US$ 16.00 /BDT

2. Calculation Basis of Depreciation Cost

(Capacity = 5,000 BDT /month, Durable years = 7 years)

Barker	US$ 600,000 /BDT
Chipper	US$ 160,000 /BDT
Screen	US$ 100,000 /BDT
Conveyor	US$ 160,000 /BDT
Other Equipment and Attachment (Grinder, Air Compressor, etc.)	US$ 480,000 /BDT
Infrastructure Construction	US$ 700,000 /BDT
Log Loader (2)	US$ 150,000 /BDT
Shovel Loader	US$ 70,000 /BDT
TOTAL	US$ 2,420,000 /BDT

US$ 2,420,000 /BDT ÷ 7 years ÷ 12month ÷ 5,000 BDT = US$ 5.76 /BDT