2. Socioeconomic Environment

2-1 Administrative Organization

(1) Sabah State Administrative System

Sabah State has a one-chamber Legislative Assembly (54 seats), where laws are enacted.

The Head of State is called Yang Di-Pertua Negeri, appointed by the King of Malaysia. In practice, the state administration is managed by the Chief Minister.

The organization of the Sabah State Government consists of the following as shown in Figure II-4.

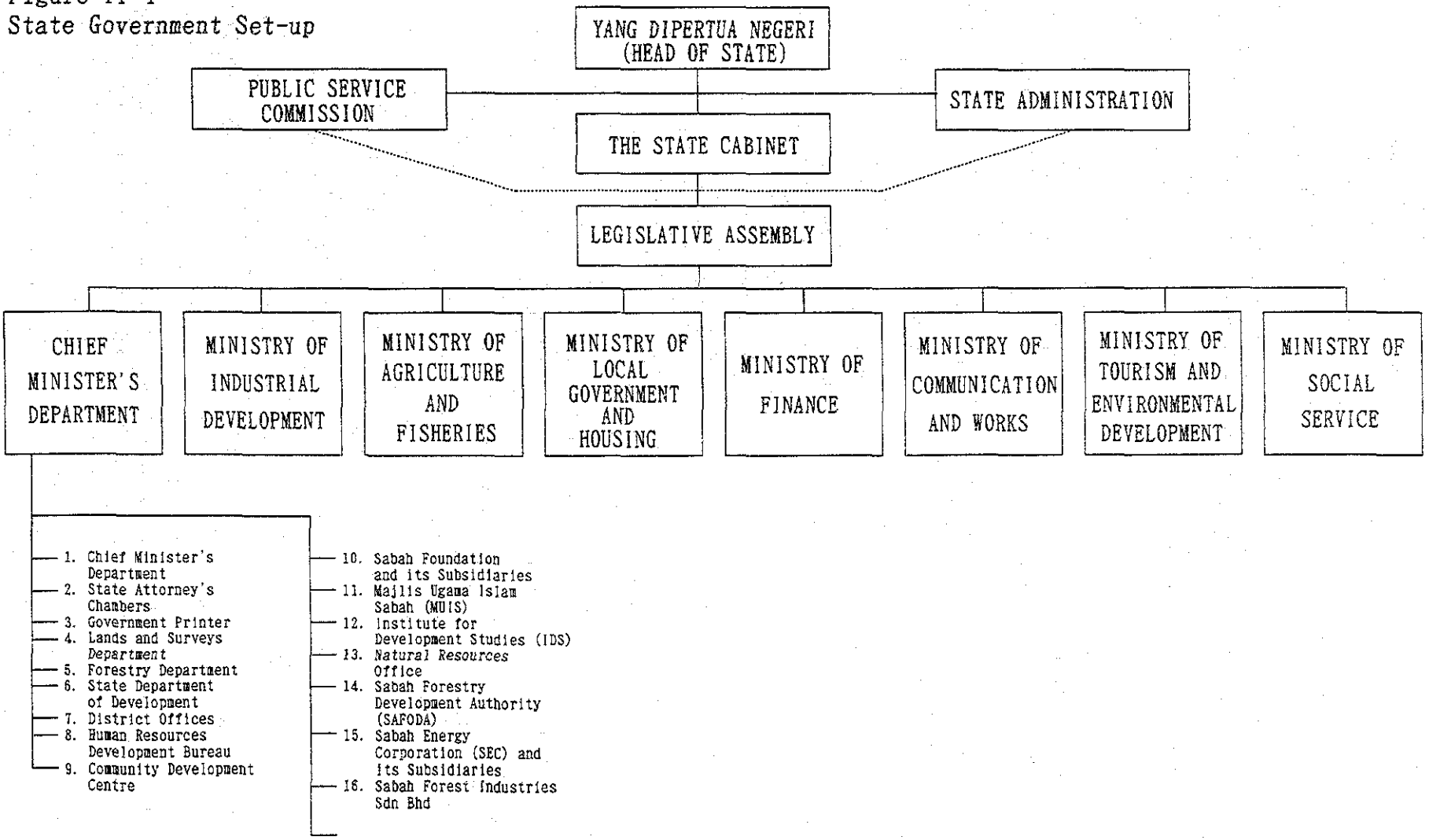
- Chief Minister's Department (CMD)
- Ministry of Industrial Development
- Ministry of Agriculture and Fisheries
- Ministry of Local Government and Housing
- Ministry of Finance
- Ministry of Communication and Works
- Ministry of Tourism and Environmental Development
- Ministry of Social Services
- Ministry of Culture, Youth and Sports

The CMD includes the State Department of Development (SDD), which is in charge of development planning and is the secretariat to the State Development Planning Committee and the State Development Action Committee. The CMD has control over the Forestry Department and the Lands and Surveys Department. Besides these departments, there are three major organizations: the Sabah Land Development Board (SLDB), the Sabah Foundation, Sabah Forestry Development Authority (SAFODA).

(2) Administrative Divisions

Sabah is divided into five divisions, each of which is subdivided into several districts and subdistricts. The five divisions are as shown in Fig. II-5.

Figure II-4
State Government Set-up



Source: Sabah - Investment Guide 1992/1993

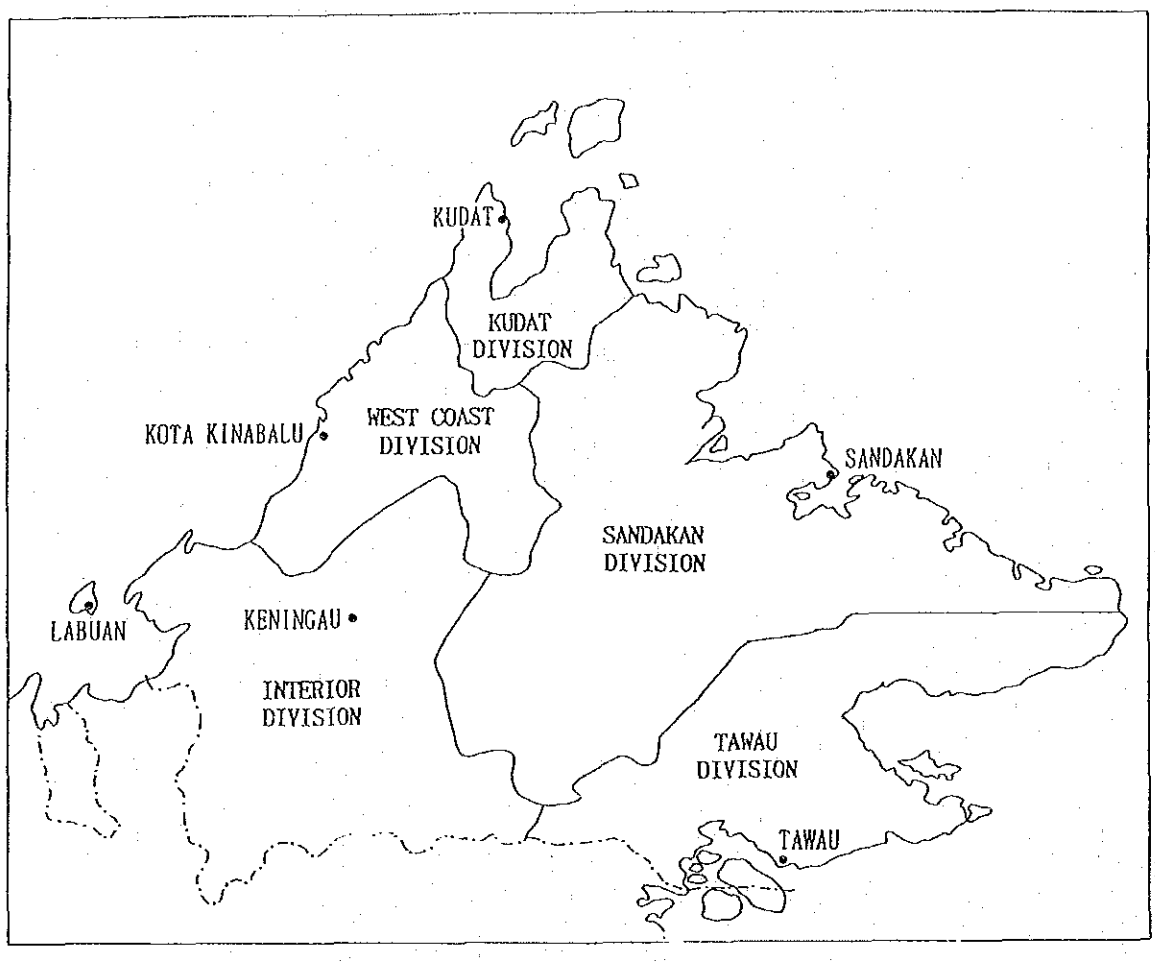


Figure II–5 Divisions of Sabah

Each district is further subdivided into towns (Bandar(s)) and villages (Kampung(s)).

The area covered by this study comprises the following administrative districts:

1. Kota Belud (West Coast Division)
2. Kota Marudu (Kudat Division)
3. Kudat (Kudat Division)
4. Pitas (Kudat Division)

(3) District Administrative System

District Offices (Pejabat Daerah) are located in Kota Belud, Marudu, Kudat and Pitas Towns.

Local offices of state ministries and departments, including legal organizations, are located in the same towns.

(4) Sabah's Administration of Forests and Forestry

The Forestry Department is responsible for forest and forest policies formulated by the Office of Natural Resources under the Chief Minister's Department. Forest development is also implemented by other government agencies such as Sabah Forestry Development Authority (SAFODA), the Sabah Foundation and Sabah Forest Industries Sdn Bhd (SFI).

(4)-1 Forestry Department

The Forestry Department (Head office located in Sandakan since 1916) is led by a director with the assistance of a deputy director and senior assistant director, and consist of the following ten specialist divisions:

1. Management and Control
2. Trade and Marketing
3. Extension and Education
4. Planning and Monitoring
5. Research and Development
6. Urban and Recreational Forestry
7. Finance and Budget
8. Law and Enforcement
9. Personnel and Establishment
10. Common Services

Sabah is also divided into 23 forest districts for the purpose of forest administration, and one district forest office is located in every forest districts.

The study area is under the jurisdiction of Kudat Regional Forest Office, and the four district forest offices of Kota Belud, Kota Marudu, Kudat and Pitas are located in this area.

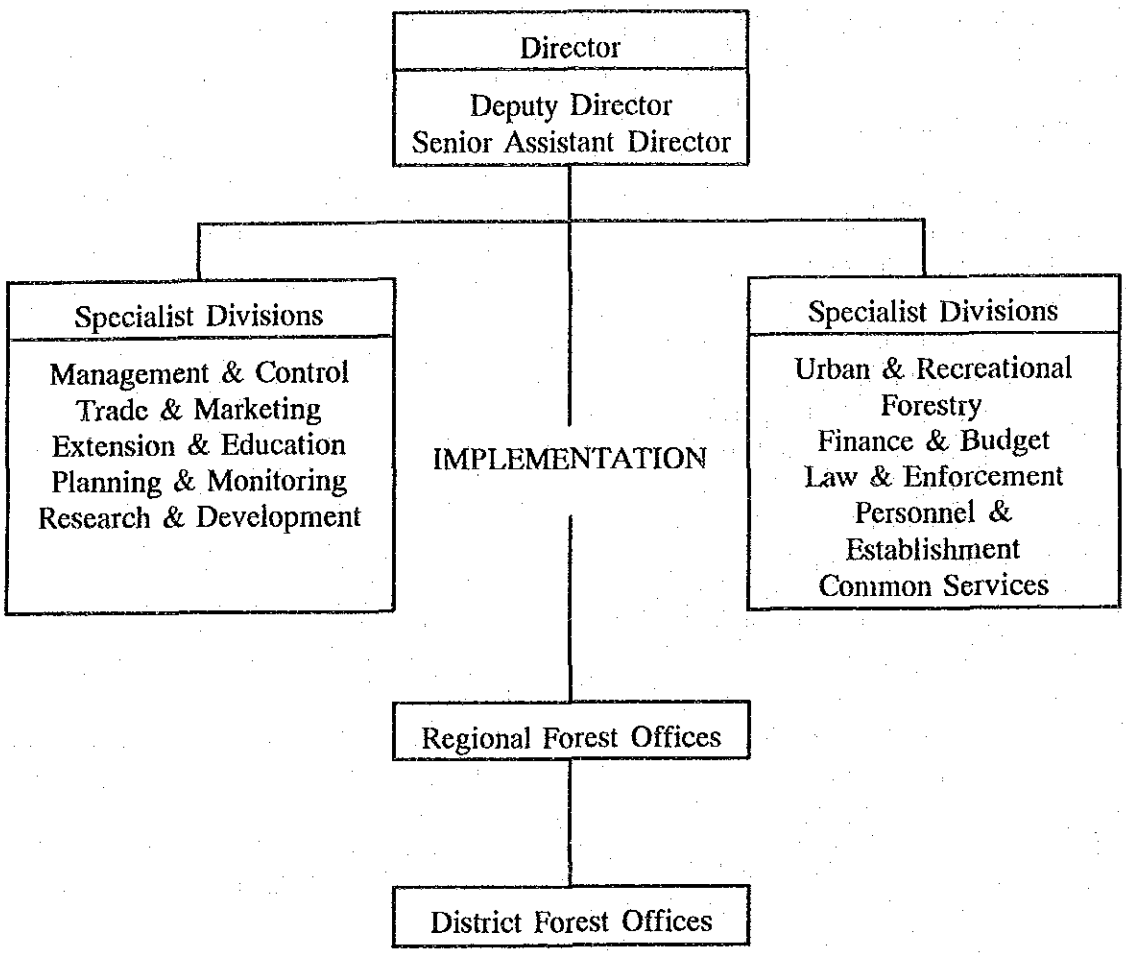
The Forestry Department has a staff of about 1,100 full-time and about 900 part-time employees. Of these, about 500 members are assigned to work on the site operations.

The organization of the Forestry Department of Sabah State is shown in Figure II-6.

(4)-2 Sabah Forestry Development Authority (SAFODA)

Sabah Forestry Development Authority was set up in December 1976 under state law to implement the state government's policies for forest protection and conservation through promotion of afforestation/reforestation. Its objectives are to improve wasteland and marginal farmland for forestry production, shift timber and forest by-products from natural forests to man-made forests, and encourage inhabitants to participate in new afforestation and reforestation in pursuit of more employment and better living standards under the Forest Settlement Scheme and other similar programmes.

Figure II-6 Organization Chart of Sabah Forestry Department



In practice, this agency undertakes the following three projects:

- Large-scale settlement and forestation in Bengkoka and Karamatoi.
- Forestation of Intermittently Degraded Areas
- Small-scale Forestation of Private Lands

The organization of SAFODA is shown in Figure II-7. Of its staff, about 270 members work in the administrative sections and about 740 members are engaged in work-site operations.

2-2 Social and Economic Policies

The Malaysian Government pursued its New Economic Policy (NEP) from 1971 through 1990. The long-term goal is to achieve an annual average growth rate of 8.0% under the Outline Perspective Plan (OPP). Regarding the results of the plan for the 15 years up to 1985, an actual annual growth of 7.6% was achieved despite some unfavourable circumstances such as the oil crises in the first decade. In the following five years, however, the rate fell to 5.8% due to the drop in the prices of export commodities and the influence of the world recession (Government of Malaysia, 1986).

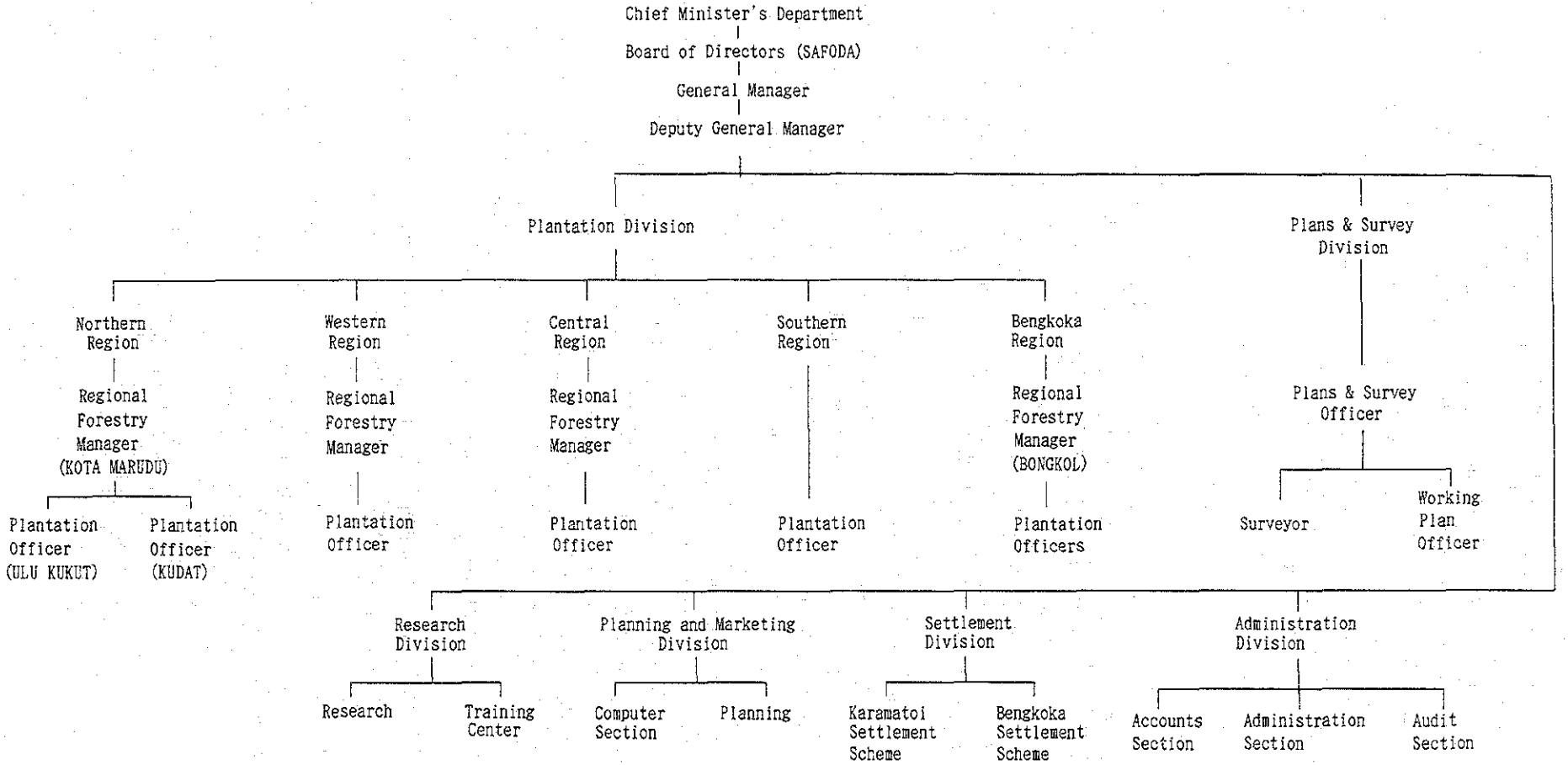
After the completion of the Fourth Malaysia Plan (1981-1985) under the NEP, the Fifth Malaysia Plan (1986 - 1990) was established. In the plan, the government recognized that there was still an industrial, regional and ethnic structural imbalance in the country which might obstruct the general development of its economy and society. The government switched from rapid growth to slower growth in order to maintain stable economic development in the long term. While maintaining the fundamental vision of the NEP, the government set a target of 5% for actual economic growth for this period. Although this plan was started during a recession and an uncertain outlook for the national economy, the country achieved rapid growth for the three years to 1990, and an annual growth of 6.7% over the whole period, higher than the target of 5%. As a result, per-capita income rapidly increased to RM6,180 by 1990, despite a slight fall in 1986. It is more significant that the increase was achieved under stable price conditions. The inflation rate, as measured by consumer price index, was 2% on average in the period of the plan. Investment from private companies in the last three years expanded at an annual rate of 27.5%, supported by domestic and foreign capital (Government of Malaysia, 1991).

The NEP period ended in 1990 and was followed by the National Development Policy (NDP) for the period 1991 to 2000, as announced in June 1991.

The two objectives of the NEP, namely (1) eradication of poverty and (2) social restructuring, have been essentially succeeded by the NDP, which also aims at well-balanced development emphasizing the following points as important tasks:

Figure II-7

Organization Chart of Sabah Forestry Development Authority (SAFODA)



(1) Reduction in the relatively poor and eradication of the absolutely poor.

(2) Fast development of the Bumiputera commercial and industrial community.

(3) The private sector's contribution in the process of restructuring.

(4) Development of human resources, including moral values.

The NDP is also based on the long-term vision proposed by Prime Minister Dato' Seri Dr. Mahathir that Malaysia should attain the objective of becoming a fully developed nation by the year 2020.

The Sixth Malaysia Plan (SMP, 1991 to 1995) is the first implementation stage of the Second Outline Perspective Plan (OPP2, 1991 to 2000). The OPP2 specifically describes the NDP, and its composition of a wide range of policies, strategies and targets to determine the direction of a national development were outlined in 1990.

According to "Malaysia Business and Investment Opportunities", the most important targets and goals of the SMP are as follows (Tan Cheng Leong, 1992):

- Average annual economic growth of 7.5% over next 5 years (Year 1991 to 1995).
- To achieve a GNP figure of RM205 billion by 1995 with a per capita income of RM10,200.
- The manufacturing sector to reach 32.4% of GDP by 1995.
- Employment to grow at 3.2% per annum to 7.8 million in 1995.
- Unemployment rate to be reduced to 4.5% in 1995 (from 6% in 1990).
- Population size is anticipated to reach 20.26 million by 1995.
- Private sector to take the lead in agricultural development in an effort to revitalise the sector.
- High-tech, small and medium-sized industries (SMIs) are emphasised.
- The thrust of industrial development is to promote new sources of growth to strengthen and diversify the industrial base. Emphasis is on development of export-oriented, high value-added and high-tech industries. Allocation for industrial development is to increase from RM2.812 billion to RM3.187 billion.
- RM3 billion allocation for Bumiputera:
- To regulate and increase foreign labour employment (for a period of 2-3 years) for selected sectors to overcome shortage problems. The government is also studying a foreign worker levy system.

The Malaysian economy has steadily developed and the Fifth Malaysia Plan from 1986 to 1990 was successfully completed. Subsequently, the Sixth Malaysia Plan was launched in 1991. Looking at annual growth rates in GDP by sector under the Fifth Malaysia Plan, it is notable that manufacturing industry, with a share of 19.7% in GDP (in 1985 unless otherwise noted hereinafter in this section), achieved substantial growth of 13.7%, higher than the initial target of 6.4%. Agriculture and forestry, with a share of 20.8% in GDP, achieved growth of 4.6%, higher than the initial target of 2.6%.

The Sixth Malaysia Plan also attaches importance to the development of secondary industries, including manufacturing and construction, and the share of the manufacturing industries in GDP is expected to be 32.4% in 1995. Thus, the country is progressing step by step toward the goal of becoming a fully developed nation by the year 2020.

Table II-3 Growth Rates and Proportion of GDP by Sector under the Fifth Malaysia Plan

Sector	Annual Average Growth Rate			Share of GDP		
	5th Plan	Its Results	6th Plan	1985	1990	1995
Agriculture & Forestry	2.6	4.6	3.5	20.8	18.7	15.5
Mining	3.1	5.2	1.5	10.4	9.7	7.3
Manufacturing	6.4	0.4	8.0	19.7	27.0	32.4
Construction	5.6	0.4	8.0	4.8	3.5	3.6
Government Service	4.0	4.0	4.3	12.2	10.7	9.2
Average	5.0	6.7	7.5	-	-	-

Source: The Sixth Malaysia Plan (Malaysian Government)

2-3 Regional Development Plan

The Sabah State economy is dependent on primary industries, with agriculture having a 26.0% share of GDP (in 1990 unless otherwise noted hereinafter in this section), forestry 10.4% and fisheries 1.9%. The mining industry also has a high share with 20.1%. With regard to growth rates in GDP from 1988 to 1990, agriculture exceeded 10% both in 1988 and 1990, though it was marginally negative in 1989. Forestry showed a negative growth of over 10% in these three years under the influence of lower yields from cutting standing trees. On the other hand, the manufacturing industries, which have a low share of 7.7% in Sabah's GDP, achieved a high growth of over 10%.

Table II-4 Growth Rates and Sectoral Shares in Sabah's GDP

(%)

	1988		1989		1990	
	Growth	Share	Growth	Share	Growth	Share
Agriculture	14.8	25.2	-0.1	23.7	13.7	26.0
Forestry	-10.4	14.8	-13.8	12.0	-10.6	10.4
Fisheries	-1.2	1.9	0.6	1.8	7.3	1.9
Mining	3.7	18.4	27.5	22.2	-6.1	20.1
Manufacturing	20.5	6.7	12.2	7.1	11.9	7.1
Construction	-1.2	3.7	6.0	3.7	0.8	3.6
Government service	3.1	7.5	4.0	7.4	4.8	7.5
Average	5.5		6.1		3.6	

Source: Sabah - Investment Guide, and Sabah Basic Facts and Information

Thus, industry in Sabah is based on the primary industries, especially agriculture and forestry. Sabah places great hope on agriculture and forestry to utilize its land area extensively for its small population. Major products are currently oil palm, cocoa, rubber and paddy rice, and the former two are exported. Logs produced from natural forests and timber products are also important items. Crude oil is also an important export commodity for Sabah.

According to Sabah-Investment Guide Book, 1992, Sabah's development targets and strategies under the Sixth Malaysia Plan are as follows (Department of Industrial Development and Research, Sabah, 1991/1992):

(1) Objectives

Development objectives in Sabah are formulated under the guidelines of National Economic Policy. The broad development objectives of the Sixth Malaysia Plan are:

- to achieve economic growth of 6 per cent per annum and to upgrade the standard of living.
- to redress poverty in general and hardcore poverty in particular
- to reduce socio-economic imbalances between regions and within communities
- to accelerate the development of infrastructure and public facilities
- to raise productivity, quality and effectiveness of capital, natural and human resources
- to increase food production for local consumption and exports
- to accelerate economic diversification particularly in downstream processing, tourism and service sectors.

(2) Strategies

- Public sector as a catalyst for development and private sector as the driving force
- Reduction of incidence of poverty by 1 per cent per annum
- Restructuring of society through education and training and entrepreneurship development of Bumiputera
- Industrial sector as the engine of growth, with special attention on small and medium scale industries (SMIs)
- Agricultural (including fisheries and livestock) development through modernization and commercialization
- Attain sustainability of forest resources through better management, operation, re-forestation and afforestation
- Promote tourism development
- Mining development through updating of policies and conditions
- Further development of physical infrastructure
- Improve productivity and efficiency through human resources development
- R&D (Research and development) to support growth sectors
- Enhance role of women in socio-economic development
- Integrate environmental aspects in development

2-4 Present Land-use

About 64% of Sabah's territory, or about 4,732,000 ha, is still forest land, and Sabah is a forest-rich state. Of the forest land, about 1,140,000 ha is the state land. On the other hand, arable land occupies an area of 2,140,000 ha, accounting for 29% of Sabah's territory (Sabah Forestry Department, 1989).

In the northern part of Sabah which this study covers there is traditional shifting cultivation in the Crocker Range from the Bengkoka Peninsula, with its gentle hills, to the south of Kota Marudu to Mt. Kinabalu. Kudat Town was once the capital of Sabah State, and since that time the population has been concentrated in the Kudat Peninsula. As a relatively flat terrain extends in the northern part of the peninsula, paddy rice and coconut palm have conventionally been cultivated extensively in lowlands. Shifting cultivation has been prevailing in hill areas. As a result, most of the virgin forest land disappeared, and only small areas of secondary regenerated forests remain. Flat areas in Kota Marudu, like the northern part of Kudat, are extensively occupied by paddy fields and coconut palm plantations. Flat areas in Kota Belud are extensively used as paddy fields.

The Malaysian Government incorporated a policy for converting logged-over forests into farmland in the Third Five-year Plan (1976-1980) to promote food production in anticipation of an increase in future population and primary industry. Steady efforts have been made to increase food production and promote primary industry. In Sabah, where the export of timber is a key industry, forest development is positively promoted, and logged-over forests are partially converted into farmland, where large-scale agricultural estates (rubber, oil palm and cocoa) have been expanded. In contrast with this expansion and following the increase in population, the area of forests has been gradually decreasing due to the spread of illegal and disorderly shifting cultivation in addition to traditional shifting cultivation. Therefore, in the northern part of Sabah, where the soil is less fertile, many

places have become degraded in productivity by shifting cultivation and finally abandoned. SAFODA is very active in promoting such places to recover vegetation and develop industrial forestation. SAFODA is also active in encouraging private land owners to carry out industrial forestation, and an area of over 1,000 ha has already been transformed into tree farms.

The forms of land use are classified as follows in the four districts in the northern part of Sabah.

Table II-5 Land-use Classification

(ha)

	Kudat	Pitas	Kota Marudu	Kota Belue	Total
Reserve Forest Land	1,829	29,753	19,131	4,193	54,906
Natural Park	-	-	-	37,000	37,000
Military Land	-	-	-	32,623	32,623
Land under cultivation	31,485	7,073	18,827	23,441	80,826
SAFODA's Project	4,890	63,350	2,296	5,273	75,809
Others	29,546	41,754	151,406	36,030	258,736
Total	67,750	141,930	191,660	138,560	539,900

Source: SAFODA 1993
Note: 'Others' above include forest (owned by the state), wilderness (wasteland), privately owned lands, urban areas, rivers and roads.

2-5 Population

Sabah State has a total population of 1,736,902 (1991). The populations of northern districts in Sabah are as follows according to the data obtained from the Sabah Branch of Department of Statistics Malaysia (Department of Statistics, 1992).

Kudat	55,932
Pitas	24,143
Kota Marudu	42,410
Kota Belud	58,155
Total	180,640

In every district, urban areas have developed on the basis of agriculture, and the population ratio of urban areas to rural areas in Sabah is generally 1 to 3. Thus, the population is spread in a scattered distribution pattern throughout the state. The composition of Sabah's population is Indigenous groups, 86%; Chinese, 14%; and, there are some Indians and other races (mainly Filipinos and Indonesians). This seems to be also the general situation in northern Sabah.

2-6 Current Situation of Local Industries

a. Agriculture

According to statistics in 1991 from the Sabah State Agriculture Department (the same hereinafter unless otherwise noted), the total area of land under cultivation in 1991 in Sabah was 792,000 ha: 324,000 ha in Tawau Division; 244,000 ha in Sandakan Division; 88,000 ha in Interior Division; 59,000 ha in Kudat Division; and 71,000 ha (of which 23,000 ha in Kota Belud District) in the West Coast Division. Thus, Kudat Division has the smallest area of land under cultivation in northern Sabah (Department of Agriculture, 1991).

Major crops in the northern part of Sabah vary from district to district, and are shown in the following table along with their respective areas and shares in the total area of Sabah:

Table II-6 Area under Cultivation

Crop	Kudat		Pitas		Kota Marudu		Kota Belud		Total	
	ha	%	ha	%	ha	%	ha	%	ha	%
Rice	1,362	2.3	2,014	3.4	7,291	12.4	12,339	21.0	23,006	39.2
Rubber	4,234	4.8	–	–	3,875	4.4	5,079	5.8	13,188	15.1
Coconut	19,674	24.0	2,398	4.1	6,831	11.8	613	1.1	29,516	50.9
Oil Palm	965	0.3	1,292	0.4	2,207	0.6	13	–	4,477	1.3
Cocoa	1,855	0.9	496	0.3	1,432	0.7	1,770	0.9	5,553	2.8
Others	1,078		773		1,614		3,661		7,126	
Total	29,168		6,973		23,250		23,475		82,866	

Source: Agricultural Statistics of Sabah, 1990 – 1991

Note: 'Others' above include vegetables, fruit, maize, coffee, tobacco and sugar cane.

Looking at the data on cultivated land in these districts, it is evident that the area of such land is small in Pitas compared with the other districts mainly because the fertility of soil is very low, though a flat area extends over the Bengkoka Peninsula. In addition, conventional shifting cultivation has degraded the soil further so that cultivation is no longer possible. Every district has its local characteristics: there are many coconut palm plantations in Kudat District, while there are many paddy areas in Kota Belud. However, many of these

plantations have already reached the limit of productivity after long-term use, and are abandoned. There is a recent tendency of switching these crops to oil palm.

The recent situation regarding cultivation of major crops is as follows:

* Rice (paddy and upland rice)

In flat areas where water is available, the cultivation of paddy rice is given priority. Although this crop is cultivated in all four districts, the area of paddy fields is small in Kudat and Pitas on the peninsula where no large basin exists. By contrast, the area is large in Kota Marudu and Kota Belud, both of which have large basins. The area of paddy fields in Kota Belud is particularly large, occupying 21% of the total in Sabah, and half the total area of cultivated land in this district.

Table II-7 Rice Cultivation in Northern Sabah (1991)

(ha)

	Kudat	Pitas	Kota Marudu	Kota Belud	Total
Paddy (main season)	1,067	1,667	3,573	9,096	15,403
Paddy (off season)	-	-	3,032	299	3,331
Upland rice	295	347	686	2,944	4,272
Total	1,362	2,014	7,291	12,339	23,006

Source: Agricultural Statistics of Sabah, 1990 - 1991

Whereas rice consumption in Sabah State has increased year by year, rice production has not significantly risen, and self-sufficiency has gradually declined since 1982. According to statistics from the Sabah State Agriculture Department, the rate of self-sufficiency fell from 44.72% in 1982 to 32.42% in 1985, and thereafter the rate has stayed at 32%. Rice production and self-sufficiency in Sabah State are as shown in the following table.

Table II-8 Rice Production and Consumption in Sabah State (1982 to 1992)

(Tons)

	Production	Consumption	Imports	Self-sufficiency
1982	56,207	149,320	93,113	44.72%
1983	53,491	177,874	124,383	40.72
1984	46,090	145,849	99,795	37.24
1985	49,342	190,090	140,674	32.42
1986	49,294	142,036	92,742	31.60
1987	62,091	183,043	120,952	31.03
1988	69,191	191,191	122,000	32.39
1989	70,960	216,437	145,477	32.61
1990	68,755	217,428	148,673	33.71
1991	64,941	239,386	174,445	32.07
1992	91,338	263,519	172,181	32.38

Source: Agriculture Department, Sabah, 1993

* Rubber

Rubber has historically been one of main export products of Malaysia, and Sabah also has a long history of rubber plantation. In recent years, however, synthetic products have superseded natural rubber, whose price has fallen, and rubber plantations are facing management difficulties. Some plantations have very old and less productive trees and have stopped tapping and maintaining the trees. Such plantations are often seen in the north of Sabah. Rubber is cultivated in Kudat, Kota Marudu and Kota Belud, but not at all in Pitas.

Table II-9 Rubber Plantations in Northern Sabah (1990-1991)

(ha)

	Kudat	Pitas	Kota Marudu	Kota Belud	Total
1990	5,139	-	2,983	5,313	13,435
1991	4,234	-	3,875	5,079	13,188

Source: Agricultural Statistics of Sabah, 1990 - 1991

Rubber products are semifinished through primary processing, and are mainly exported to Singapore. The area of rubber plantations in Sabah was 87,483 ha in 1991. Rubber exports have declined even though the planted area increases by about 2,000 ha every year, partly because the price of rubber has been falling year by year. The quantity and value of rubber exports were 28,940 tons and RM62,165 respectively in 1991.

* Coconut Palm

The northern part of Sabah accounts for 50% of the total plantation area of coconut palm in Sabah, and Kudat District accounts for 35% of the total area of coconut palm plantations in Sabah.

Table II-10 Areas and Management Forms of Coconut Palm Plantations in Northern Sabah (1991)

Plantation	Kudat	Pitas	Kota Marudu	Kota Belud	Total
Small-holders	14,675	596	3,688	611	19,570
Government Agencies	2,083	1,184	2,794	2	6,063
Private estate	2,916	618	394	-	3,883
Total	19,674	2,398	6,831	613	29,516
	34.0%	4.1%	11.8%	1.1%	49.8%

Source: Agricultural Statistics of Sabah, 1990 - 1991

Like rubber, the price of copra and coconut oil are falling year by year on the world market. There are coconut oil refineries in Kudat, and about 50% of copra and palm oil produced in Sabah is exported from the port of Kudat. The quantity and value of these exports were 11,225 tons and RM6,801,000 respectively in 1991.

As the price falls year by year, some coconut plantations are abandoned plantation or are shifting to other crops.

* Oil Palm

The plantation of oil palm has recently spread over Malaysia at a rapid pace, and has outstripped that of coconut palm. In Sabah, the plantation of this crop is also promoted by large-scale plantations located in logged over areas. The area of oil palm plantations is now nearly six times larger than that of coconut palm plantations. Almost half of them are run by the state governmental agencies. Some coconut palm and rubber plantations, which have very old and less productive trees, have begun to be converted into oil palm plantations. Oil palm and cocoa are major export products in Sabah, behind crude oil and timber. However, the planted area of this crop in northern Sabah is 4,477 ha, less than 1.3% of the total area of Sabah, mainly due to the low fertility of the soil. According to data on exports from

Sabah in 1991, the quantity and value of crude palm oil exports were 436,753 tons and RM332,265,000; those of processed palm oil were 260,100 tons and RM185,911,000. The areas and forms of oil palm plantations in northern Sabah were as follows in 1991:

Table II-11 Areas and Management Forms of Oil Palm Plantations in Northern Sabah (1991)

(ha)

Plantation	Kudat	Pitas	Kota Marudu	Kota Belud	Total
Small-holders	30	-	14	4	48
Government Agencies	935	1,241	2,165	9	4,350
Private estate	-	51	28	-	79
Total	965	1,292	2,207	13	4,477

Source: Agricultural Statistics of Sabah, 1990 - 1991

* Cocoa

Like oil palm, cocoa is also a crop whose plantation has shown a rapid increase in area through the location of large-scale plantations on the sites of logged over areas. Sabah has an area of 201,327 ha under crop in 1991. Cocoa, like oil palm, depends on soil fertility for growth, and its productivity falls significantly in less fertile soils. For this reason, the area of cocoa plantations in the northern Sabah remains low at 2.8% of the total area of Sabah, or 5,553 ha. Pitas has the smallest area at 496 ha. The areas and management forms of cocoa plantations in northern Sabah were as follows in 1991:

Table II-12 Areas and Management Forms of Cocoa Plantations in 1991

(ha)

Plantation	Kudat	Pitas	Kota Marudu	Kota Belud	Total
Small-holders	1,304	423	1,308	382	3,417
Government Agencies	405	-	-	1,388	1,793
Private estate	146	73	124	-	343
Total	1,855	496	1,432	1,770	5,553

Source: Agricultural Statistics of Sabah, 1990 - 1991

The quantity and value of cocoa beans exported from northern Sabah were 126,924 tons and RM347,902,000 respectively in 1991. In addition, processed products such as cocoa butter and powder are also exported. The total value of these exports was RM2,725,000.

b. Livestock Industry

To promote the livestock industry, both the Federal and Sabah State Governments allocated M$45,000,000 and M$35,000,000 for the industry, respectively, in the Sixth National Development Plan (1991 to 1995), and entrusted the Sabah State Department of Veterinary Services and Animal Husbandry with a survey of stock raising and the planning of production, training, expansion and technical assistance.

Ruminants (cows, oxen, buffaloes, goats and sheep) increased from 1985 through 1990, and annual average rates of increase were 4.9% for cows and oxen, 1.6% for buffaloes, and 5.7% for goats. Non-ruminants, such as pigs, and domestic fowls and ducks, also increased: 124% for egg layers, 106% for broilers, and 120% for pigs. The consumption of these animals in Sabah State has also increased year by year to such an extent that it cannot be satisfied by domestic production, and all of them but domestic fowls are currently imported. Projections for cattle from 1985 to 1992 are as follows:

Table II-13 Projections for Cattle in Sabah State (1985-1992)

	Cow/Ox	Buffalo	Goat	Sheep	Pig	Domestic fowl	Duck
1985	30,000	49,123	28,000	1,500	100,000	2,672,000	403,000
1986	32,000	48,000	30,000	1,800	100,900	2,874,000	481,000
1987	35,000	47,000	32,000	2,000	110,000	3,093,000	490,000
1988	36,000	46,000	34,000	2,000	111,000	3,168,000	472,500
1989	37,000	45,300	36,000	2,000	112,000	2,041,000	496,000
1990	38,000	43,870	37,000	2,000	113,000	2,500,000	500,000
1991	39,000	44,700	38,000	2,000	115,865	2,616,000	550,000
1992	40,000	43,200	39,000	2,000	116,000	2,700,000	520,000

Source: Department of Veterinary Services and Animal Husbandry 1993

Note: The numbers of pigs and domestic ducks are based on standing populations.
Estimated numbers of ducks: standing population x 5 (years' cycle)
Estimated number of pigs: standing population x 2 (years' cycle)

There are regional variations in the number of slaughtered domestic animals in Sabah State, which seem to reflect regional variations in the number of raised animals. Whereas the number of slaughtered beef cattle has tended to increase, that of buffaloes has fallen.

Table II-14 Slaughtered Domestic Animals by District in Sabah State (1985 to 1992)

(head)

	WEST COAST			EAST COAST			INTERIOR			TOTAL		
	Baffaloes	Beef cattle	Pigs	Baffaloes	Beef cattle	Pigs	Baffaloes	Beef cattle	Pigs	Baffaloes	Beef cattle	Pigs
1985	3,575	4,072	42,213	24	3,719	48,255	1,283	720	8,415	4,882	8,511	98,883
1986	3,263	4,996	48,900	2	3,377	54,911	1,285	643	9,764	4,550	9,016	113,575
1987	3,296	5,401	51,168	9	3,691	59,817	1,265	648	11,734	4,570	9,740	122,719
1988	3,503	5,434	48,492	3	4,066	61,149	1,238	773	11,053	4,744	10,273	120,694
1989	3,323	5,428	56,583	6	3,942	58,874	1,075	865	12,541	4,404	10,235	127,998
1990	2,686	5,979	60,815	-	4,284	57,195	1,153	944	12,872	3,839	11,207	130,882
1991	2,724	5,865	57,100	2	4,172	53,235	1,009	1,089	12,553	3,735	11,126	122,888
1992	2,329	6,227	56,961	12	3,960	39,803	969	1,235	13,865	3,310	11,422	110,629

Source: Department of Veterinary Services and Animal Husbandry 1993

c. Fisheries

The coastline of Sabah extends 1,067 miles (1,600 km), and the state is rich in fisheries resources. However, due to a shortage of storage and processing facilities, lack of fishing technology and investment in this sector, these abundant resources cannot currently be fully made use of. About two thirds of Sabah's population live along the coast in the eastern, northern and western districts, and about 11,000 people are engaged in fishing. Dragnet fishing of prawns is important in Sabah, and prawns have recently reached a high share of 75% and more of the value of marine products exported.

Despite abundant fish resources, the catch is small due to insufficient equipment. There is no large fishing port except Kudat in this area, despite facing the South China Sea. Fisheries are mainly coastal. The Sabah Department of Fisheries hopes to develop a prawn farm in the mouth of the Telaga River on the Bengkoka Peninsula in the future. Exports of frozen prawns and other marine products from Sabah are as follows:

Table II-15 Exports of Frozen Prawns and Other Marine Products from Sabah
(tons and RM million)

	Prawn			Others	
	Catch	Exports	Value	Exports	Value
1985	8,233	4,101	58.78	6,812	73.87
1986	8,352	4,363	71.36	7,306	85.08
1987	9,205	4,333	74.98	9,252	92.80
1988	7,350	4,370	79.05	8,645	90.98
1989	7,019	4,748	78.09	13,270	101.70
1990	7,408	5,343	86.24	13,997	115.43

Source: Sabah - Investment Guide, 1992/1993

d. Others

Various industrial projects approved by the central (FML) and state (SGA) governments are as follows in Sabah as of September 1992:

SGA (State Government Approval):
Commercial approval of the state government.
Companies with a capital of RM2.5 million or less and 75 or less employees.

FML (Federal Manufacturing License):
Commercial license of the central government.
Companies with a capital of more than RM2.5 million and more than 75 employees.

Table II-16 Number of Industrial Projects Granted SGA and FML by District, Up to September 1992

Division	Companies (Number)		Project Cost (RM million)		Employment Opportunity	
	SGA	FML	SGA	FML	SGA	FML
Sandakan	198	118	272.73	1,405.53	17,890	14,915
Tawau	136	133	137.58	1,092.36	2,968	17,753
Interior	105	71	71.93	1,870.35	2,243	15,879
West Coast	602	228	315.67	1,764.68	11,081	20,352
· Kota Belud	19	1	1.75	7.50	140	45
Kudat	46	12	28.84	30.41	974	600
· Kudat	27	8	17.74	16.19	444	311
· Kota Marudu	11	3	1.80	11.07	127	238
· Pitas	8	1	9.30	3.15	403	51
Labun	7	16	1.11	906.76	87	1,790
Total	1,094	578	827.86	7,070.09	35,243	71,289

Source: Sabah-Investment Guide, 1992/1993

Mineral resources in northern Sabah are not covered by this study. However, copper is now mined in Ranau District (Mamut) in the south. Copper, chromite, manganese, asbestos, antimony, gold and silver ores were discovered in the islands of Banggi and Malawali, around Mt. Kinabalu, and in the Bengkoka Peninsula. However, mining of these deposits has not yet been commercialized.

3. Situation of Forestry and Forest Products Industries

3-1 History of Forestry in the State of Sabah

In this subsection, the history of forestry in the State of Sabah is taken from the book "Forestry in Sabah in 1989".

The first logging concession in Sabah was established in Gaya Island at 1879. In 1914, the Forest Department was established by the British North Borneo Company for the purpose of managing forest logging operations. During the period from 1930 to 1950, however, log exports remained at a low level because logging practices were conducted with axes and saws during this period. Mechanization of forestry works then started late in the 1950s when chain saws were introduced and skid-mounted tractors were first used to open roads and haul logs.

Although the first plywood factory was constructed in the 1960s, commercial sawmills had already been at work as early as 1888.

A forest inventory covering all areas of the state was conducted in 1969. Based on the results of this inventory, the forest management plan of Sabah was revised during the period from 1968 to 1969 by substituting new systems for outdated ones. In this revision it was decided to proceed with designation of Forest Reserves, which increased from 2.27 million ha in 1963 to 2.95 million ha by 1973.

Forestry research centre was established at Sepilok in 1974, when they started to conduct technical guidance on plantation practices, and SAFODA was established in 1976 as an agency working with plantations of fast growing tree species on the northern and western coastal areas.

To stabilize forestry, an essential economic activity of the State of Sabah, 2 million ha of forests were legally designated as permanent Forest Reserves. (The above is a summary of "Forestry in Sabah", 1989.)

Revenue relating to timber significantly contributes to the state finances, so that changes in timber production have a major impact. Timber is the most important revenue source in the state and have always been evaluated in connection with state finances.

Since 1977, the Sabah State Government has carried out a policy of prohibiting or reducing log exports and increasing processed product exports through the promotion of the domestic forest industry.

Forests in Sabah are almost all natural forests which have been managed through selective cutting. The Sabah State Government announced its policy for forestry management in 1954, and since then the concept of sustainable forest management has been the mainstay of the policy. The forest management system of Sabah is strongly affected by that of the Malay Peninsula, and the Malayan uniform system (MUS) was naturally applied. As a variation of the MUS, the management system was subsequently changed and called the Minimum Girth System in 1971.

3-2 Forestation in Sabah

Forestry in Sabah was mainly the harvesting of natural forests before the 1970s when forestation was launched. Large-scale industrial forestation has been up to date undertaken by three organizations: Sabah Softwood Sdn. Bhd. (SSSB), which is a joint venture of Sabah Foundation and NBT Corp.; SAFODA, the legal organization of the State; and Sabah Forest Industries Sdn. Bhd. (SFI), an integrated wood company completely owned by the State government. They were established in 1974, 1976 and 1982, respectively, and manage their own tree plantations, some of which have reached cutting age. They carry out log production based on such plantations. Other than the above three organizations, small companies and private tree farms are scattered in the state.

The export of logs from man-made forests is very low when compared with the export of logs from natural forests, but the former is steadily expanding. The tree species for export are *Paraserianthes falcataria, Acacia mangium* and *Gmelina arborea*, and the export of these species is expected to grow in the future.

Table II-17 Export of Logs from Man-made Forest by Year

Year	Quantity (m^3)	FOB price (RM)
1979	NIL	NIL
1980	NIL	NIL
1981	2,500	97,500
1982	16,168	1,280,331
1983	36,802	1,773,488
1984	70,740	4,045,243
1985	67,851	4,300,593
1986	145,757	9,923,794
1987	160,284	12,996,373
1988	162,619	13,534,579
1989	246,828	19,734,486
1990	106,114	7,954,613
1991	179,739	13,327,897
1992	132,404	9,494,990

Source: Forestry in Sabah, Forestry Statistics

The history of man-made forests by the above-mentioned three organizations is as follows.

SSSB has forests blocks at Brumas (41,000 ha), northwest of Tawau, and at Kalabakan (20,000 ha), and it is the first company to begin large industrial forestation in Malaysia. As the name implies, the company started plantations of *Pinus caribaea*, a softwood, but gave up planting softwoods because other hardwoods that were planted at the same time were better in growth, and continued with hardwoods. During the term from the switchover until now, the company has continued research and development efforts to find better species for

industrial plantation. As a result, *Acacia mangium* has been added to *P. caribaea, Paraserianthes falcataria, Gmelina arborea*, and *Eucalyptus deglupta* that were planted from the beginning. *P. caribaea*, with which sufficient growth cannot be expected in short rotation, and *E. deglupta,* which grows poorly depending on site condition, were excluded from plantation. A hybrid between *A. mangium* and *A. auriculiformis* was discovered by chance, and the species, being superior in growth and shape, has been propagated by breeding by selection and is being held in the progeny test as an excellent species for future forestation.

The area of plantations established by this company reached 27,000 ha, and is now on the increase.

SAFODA was established with the intention of foresting devastated areas or agriculturally marginal areas, promoting forestry settlement, and improving welfare of the local people through forestry. The initial target of forestation was set at 10,000 ha by 1998. Up to now, forestation has made progress mainly in northern and western Sabah. Fast-growing species, especially *A. mangium*, has been planted. Although it is said that SAFODA, which has facilitated "Tree Farm" as social forestry, is faced with socioeconomic and technical problems (Sabah Forestry Department, 1989), it seems that such farms have spread remarkably in this area.

SFI has reforested the logged-over forests from which material logs were supplied to its pulp and paper mill at Sipitang in western Sabah. The company plans to plant up to 100,000 ha of fast-growing trees. It also encourages farms near its mill to plant trees, and provides them with technology and seedlings. Among planted trees, some trees of *A. mangium* have already reached cutting age, and were felled as test cutting between February and April, 1993.

A notable phenomenon of forestation has appeared in the private sector. That is, a large number of farms have planted *A. mangium* trees under the SAFODA project for encouraging "Tree Farms". This tendency is often found in this area, and small plantations have been created in various places: some trees are planted under coconut palm trees in Kudat, while some are planted 20 km inland from the coast. Although only a few planted trees of *A. mangium* have reached cutting age, a small amount of timber is sawn for practical use in some cases. There is also a plan to produce woodcraft items from planted trees. Farmers also seem to be very interested in the sale of planted trees. If they actually earn incomes by selling planted trees, they may become active in planting trees.

Many studies of tropical fast-growing species have been carried out in tropical countries in the last two decades, and has led to several cases of success. In Sabah, various types of experimental or commercial forestation have been implemented. Recent successful cases of planting fast-growing species in Asia and the Pacific region will be introduced from Indonesia and Papua New Guinea.

The Indonesian Ministry of Forestry has promoted industrial afforestation/reforestation (Hutan Tanaman Industri:HTI) in order to reinforce timber production and gives financial assistance preferentially to HTI enterprises. In the case of HTI Pulp to produce chips for pulp, large-scale projects for planting *Acacia mangium* are under way on Sumatra and Kalimantan. For example, the Barito Pacific Group carrying out forestation on Sumatra

started the project in 1990 and completed about 100,000 ha of plantation in the three years to 1993. It plans to achieve another 200,000 ha of plantation by 1995. *A. mangium* is spaced 2 m x 3 m and planted at a rate of 1,666 seedlings per ha. In the increment survey of *A. mangium* in the test plot, it is reported that seven-year-old trees showed a MAI of 25.3 to 28.3 m^3/ha. The group attempted to carry out agroforestry for the benefit of local people in the coverage area of the project. As a result, conventional shifting cultivation has allegedly declined (JOFCA, 1991a).

ITCI (International Timber Cooperation Indonesia) based in East Kalimantan, the first HTI, started planting fast-growing species in 1974 and forested an area of about 5,300 ha in the first decade. Afterward, an area of 3,000 to 5,000 ha has been forested every year. *Eucalyptus deglupia* and *A. mangium* are major species for forestation. In recent years, *Albizia falcataria* has also been extensively planted. *Albizia falcataria* is spaced 3 m x 3 m and planted at a rate of 1,111 seedlings per ha. It is reported that five-year-old trees showed a MAI of 31.9 m^3/ha. The planting of slow-growing species is also attempted in this region, and *Dryobalanops* spp. and *Leucaena leucocephala* are planted in lines (JOFCA, 1992, Miyagawa H., 1993).

In Papua New Guinea, industrial forestation is carried out by the joint ventures between Japanese companies and the local government, and major ventures are represented by JANT and SBLC. The former was established in 1974 for the purpose of producing wood chips for pulp, and owns the logging concession of 88,000 ha of forests. It launched a forestation project in 1975. An area of 300 to 500 ha was annually forested until 1984, and reduced to around 100 ha per year from 1985 due to the difficulty of leasing land. *E. deglupta* as an indigenous species acounts for 80% of the total. Harvesting man-made forests began in 1986, and all products are chipped at local chip mills and exported to Japan (JOFCA, 1990 and 1991b).

On the other hand, SBLC is a processing company of forest products established in 1970 and owns the logging concession of 187,000 ha of forests. It started full-scale forestation for sawn wood in 1982, and has forested an area of about 8,000 ha so far. The final target is 20,000 ha. *E. deglupta* accounts for 65% of the total, *Octomeles sumatrana* and *Terminaria brassii* for 25%, and *Tectona grandis* as an exotic species for 5%. The cutting periods range from 20 to 25 years. The expected destinations of timber markets are Australia and New Zealand (JOFCA, 1990 and 1991b).

Based on the results of such forestation, four species were chosen as optimum for planting and eleven species were chosen as second best in terms of incremental growth, commercial value and local adaptability. These selected species are as follows according to "Cultivated and Potential Forest Plantation Tree Species" (Ti Teow Chuan and Wilfred M. Tangau, 1991).

A. Optimal Species

1. *Acacia mangium*
2. *Paraserianthes falcataria*
3. *Gmelina arborea*
4. *Eucalyptus deglupta*

B. Highly Acceptable Species

1. *Acacia auriculiformis*
2. *Anthocephalus chinensis*
3. *Araucaria hunsteinii*
4. *Endospermum peltatum*
5. *Eucalyptus camaldulensis*
6. *Leucaena leucocephala*
7. *Maesopsis eminii*
8. *Pinus caribaea*
9. *P. kesiya*
10. *Pterocarpus indicus*
11. *Tectona grandis*

Based on information obtained during the field survey in Phase I, it is judged that *A. mangium* is the most preferable species among the industrial tree plantation species, which accepts natural condition in northern Sabah. However, mono-species plantation on a wide scale may cause environmental problems such as disease, insect damage or alteration of ecosystem. Furthermore, such management will be sensitive to price fluctuations in the market. Therefore, mono-species plantation should be limited. Consequently, other potential tree species are to be selected, and the following species are recommended.

Gmelina arborea
Paraserianthes falcataria
Tectona grandis

Of these three species, it is recognized that *G. arborea* is very sensitive to soil conditions for growth. If this species is introduced, planting sites whose soil condition should meet this species must be carefully selected.

Considering long-term rotation, good candidates are species of Dipterocarpaceae such as *Dryobalanops lanceolata* and *Shorea leprosula* which are indigenous to Sabah. These species have been experimentally planted in some areas, including peninsular Malaysia. It is necessary to review highly adaptable good species and silvicultural techniques with reference to the results of such experiments.

In addition to these species, there is still room for considering the planting of rattan as a highly marketable forest resource.

3-3 Current State of Forest Products Industry in Sabah

The economic structure of Sabah is based on exports of primary products such as timber and crude oil. With the manufacturing industry underdeveloped, the Sabah economy is supported by productive activity centred on agriculture, including oil palm, cocoa and paddy rice. The two items of timber and crude oil account for about 60% of the total value of exports. The share of timber-related items (logs, sawn timber, plywood, veneer, etc.) in the total is half of that figure or about 30% (1989). Timber-related industries have made a great contribution to the state's finances (revenue), and represented about 50% of the total in

1990 and about 40% in 1991 (budget). However, the decrease of forest resources makes it difficult to secure the previous level of yield in the future. In response to this situation, the state government has already developed a policy of industrial diversification, mainly in the timber processing industry, in order to generate high revenues.

Table II-18 Changes in the Share of Timber-related Income in Sabah State Finances (Revenue)

(Million RM)

Year	Timber-related	Revenue	%
1981	782,790,234	1,206,110,099	64.90
1982	984,119,172	1,481,737,889	66.41
1983	804,949,029	1,315,649,989	61.18
1984	701,153,333	1,336,171,488	52.47
1985	504,122,801	1,156,430,687	43.59
1986	552,711,578	1,099,474,945	50.27
1987	1,000,648,825	1,411,508,644	70.89
1988	1,080,638,499	2,037,913,054	53.02
1989	912,239,536	1,743,997,895	52.30
1990	818,074,515	1,619,924,315	50.50
1991	699,814,522	1,479,959,795	47.29
1992	856,540,801	2,004,693,320	42.72

Source: Budget and Finance Division, Sabah Forestry Department.

Most of the logs harvested in the 1970s were a good shape, larger in diameter and without defects. These logs were cut from untouched virgin forests. However, more and more logs were harvested from forests in the State of Sabah to meet the increasing demands of timber-consuming countries. The timber industry has grown into one of the area's major industries. At the same time, more land in the interior was sought for logging. Thereafter, loggers returned to the neighboring forests which were more profitable requiring shorter yarding distances, changing to a system where trees remaining uncut from previous logging operations were relogged. The natural consequences were a reduction in the number of larger logs and an increase in the number of defective ones. It is said that at present, the only undeveloped areas of forest in Sabah are restricted to a part of Tawau District and the forest reserves which are controlled by the Sabah Foundation and SFI. The majority of loggers have no choice but to repeat relogging, which is the reason for the considerable deterioration in the quality of timber currently available.

Due to the above-mentioned condition of natural forest resources, log output in Sabah maintained a level of about 10 million m^3 from the 1970s to the early 1980s, but fell after peaking in 1987 to 8.16 million m^3 in 1991. However, output again reached the 11 million m^3 level in 1992. Although most of the logs produced were previously exported, logs processed domestically began to increase in 1987, and log exports have fallen to below 50% in 1990. The quantity of logs exported (3,126,500 m^3 in 1992) dropped to one fourth of the peak in parallel with the fall in output. This is attributed to the fact that the government

promoted log processing by improving existing sawmill facilities under its incentive policy for downstream timber processing.

Table II-19 Log Output and Exports from Sabah

Year	Log Output	Log Exports	
	Quantity (m^3)	Quantity (1000 m^3)	FOB Price (RM1000)
1959	1,562,782	1,386.1	57,393
1960	2,165,037	1,770.7	86,174
1961	2,631,351	2,254.4	100,668
1962	2,803,573	2,465.6	120,600
1963	3,464,311	2,974.9	148,667
1964	3,385,212	3,348.5	146,519
1965	4,162,760	3,797.0	183,595
1966	5,554,723	4,856.1	258,771
1967	5,708,809	5,321.6	316,299
1968	5,908 794	5,796.6	334,052
1969	6,201,081	6,187.7	374,423
1970	6,560,680	6,150.1	395,807
1971	6,953,140	6,558.4	419,001
1972	8,526,905	7,708.4	409,332
1973	11,104,463	10,143.9	799,710
1974	10,030,544	9,733.1	870,581
1975	9,119,611	8,991.0	567,781
1976	12,589,154	12,061.3	1,193,485
1977	12,979,428	12,337.3	1,241,473
1978	13,290,856	13,127.1	1,326,265
1979	10,841,476	10,332.2	2,179,194
1980	9,064,188	8,510.4	1,845,250
1981	11,731,709	9,361.2	1,726,660
1982	11,739,263	9,949.7	2,119,229
1983	11,991,410	9,495.5	1,704,226
1984	10,504,738	7,339.6	1,482,470
1985	10,757,425	8,442.3	1,411,384
1986	9,811,078	8,218.4	1,453,299
1987	12,174,344	9,449.2	2,198,990
1988	10,980,563	7,585.7	1,978,360
1989	9,494,113	5,549.5	1,526,475
1990	8,443,725	4,190.4	1,073,977
1991	8,163,409	3,442.5	934,641
1992	11,632,596	3,126.5	881,900

Source: Forestry in Sabah, Forestry Statistics

As the mainstay of the state government policy for promoting timber processing, the timber industry had to secure material logs and yet compete with log exports as one of major state financial resources, and suffered a shortage of material logs. This is why the state government stopped issuing licences to the new operation of primary processing industries such as sawn timber and veneer in 1991. The government decided to shift emphasis to secondary processing industries with high value added such as kiln drying of wood and mouldings, and provided them with incentives, including tax privileges. Moreover, the Malaysian Federal Government enforced a measure to place an embargo on log exports from Sabah State in January 1993 in order to secure logs for processing in the state. Although this measure was lifted in April of the same year, the Sabah State Government adopted a similar measure.

The total amount of log exports from Sabah was 3.126 million m^3 in 1992, about 71.4% of which was exported to Japan and 9.0% to Korea. On a FOB basis, the total value of log exports reached RM882 million.

Table II-20 Sabah's Log Exports by Destination (1992)

(m^3: RM1,000)

Destination	Quantity	%	FOB Price	%
JAPAN	2,233,336	71.4	687,189	77.9
KOREA	281,086	9.0	61,546	7.0
PHILIPPINES	208,027	6.7	35,388	4.0
CHINA	155,909	5.0	33,752	3.8
TAIWAN	88,949	2.8	18,229	2.1
HONG KONG	79,786	2.6	25,197	2.9
THAILAND	32,217	1.0	10,023	1.1
P. MALAYSIA	25,584	0.8	5,409	0.6
U. KINGDOM	7,248	0.2	1,024	0.1
PAKISTAN	5,960	0.2	1,209	0.1
INDIA	2,121	0.1	1,066	0.1
LEBANON	2,072	0.1	723	0.1
AUSTRALIA	1,370	0.1	190	–
SINGAPORE	1,305	–	376	0.1
HOLLAND	767	–	263	–
SARAWAK	676	–	337	0.1
SWEDEN	71	–	12	–
GRAND TOTAL	3,126,484	100.0	881,933	100.0

Source: Forestry Statistics 1992

In Sabah as of 1992, there were 217 sawmills (187 in operation and 30 out of operation), 19 plywood mills, 28 veneer mills, 7 block-board mills, 2 laminate-board mills, 1 match mill, 1 paper and pulp mill, and 54 moulding mills (38 in operation and 16 out of operation).

Table II-21 Changes in Wood Processing Mills in Sabah

Year	Sawn	Plywood	Veneer	Block	Moulding	Laminate	Match	Paper and pulp
1986	152	4	10	1	0	0	1	0
1987	143	4	8	1	0	0	1	1
1988	148	6	10	1	0	0	1	1
1989	216	11	17	4	12	1	1	1
1990	227	12	21	7	40	1	1	1
1991	202	10	21	4	43	2	1	1
1992	217	19	28	7	54	2	1	1

Source: Statistics 1991, and the Report of the 11th Malaysia Forestry Conference (1990)

In comparison with other parts of Sabah, the ratio of natural forests which can produce logs in the north is low, and the output from the forests is small. Nevertheless, a considerable amount of timber has been produced for export and local consumption, and forestry is still an important industry in this area. There are three sawmills in Kudat, two in Kota Marudu and six in Pitas, all of which received licenses from the Forestry Department. Of them, however, two sawmills in Kudat and two in Pitas are now out of operation. Therefore, seven sawmills are now in operation. Timber products produced at the sawmills under the jurisdiction of the Kudat Regional Forest Office in 1993 are as follows:

Table II-22 Current Situation of Sawmills in Northern Sabah

	Sawmills	Stock used (m^3)	Output (m^3)
Kota Belud	0	–	–
Pitas	4	49,112	27,207
Kota Marudu	2	23,861	13,198
Kudat	1	1,388	569
Total	7	74,361	40,974

Source: Pitas, Kota Marudu, Kudat, Kota Belud District Forestry Office 1993

There are currently no log processing mills other than sawmills in northern Sabah. Charcoal, rattan and mangrove poles are also produced in other forest products.

Machinery and equipment in timber processing mills do not seem to be sufficient. In particular, it would be difficult to export products made in smaller sawmills to countries such as Japan where product quality is highly controlled, because most of these sawmills use manually operated machines which do not allow adequate quality control. Although quality controls exist in recently-established sawmills that are generally larger in scale and equipped with modern machines, many of them do not have a kiln dryer. A kiln dryer and a facility to apply insecticide are the minimum requirements for producing quality products. In

addition, it is desirable to equip timber processing factories with integrated facilities in which wood residue can be used in order to increase the yield.

According to 1992 statistics from the Forestry Department, 2.80 million m^3 of sawn timber products were produced from 5.99 million m^3 of logs, and 2.11 million m^3 of such products were exported from Sabah. The yield rate of timber is 46.7%.

Table II-23 Log Consumption to Produce Sawn Timber in Sabah

(m^3)

	1985	1986	1987	1988
Consumption	2,196,528	1,527,501	1,576,422	2,038,646
Production	1,133,418	809,295	832,437	1,067,346
Yield (%)	51.6	53.0	52.8	52.4
	1989	1990	1991	1992
Consumption	2,595,074	3,819,035	5,059,686	5,988,920
Production	1,338,222	1,910,137	2,402,181	2,797,054
Yield (%)	51.6	50.0	47.5	46.7

Source: Forestry Statistics 1991 & 1992, Forestry and Forest Industry

With regard to employment in forestry-related sectors in Sabah, the number of employees is decreasing in logging following the decrease in log output, while it is rapidly increasing in sawmills, and plywood and veneer mills. As a result, employment as a whole is on the increase. The output of processed-timber products in Sabah is also rapidly increasing, mainly in sawn timber, plywood and veneer.

Table II-24 Employees in Forestry-related Sectors in Sabah

Year	Logging	Sawmills	Veneer/ Plywood mills	Total
1986	12,000	4,500	2,000	18,500
1987	12,000	5,000	2,200	19,200
1988	8,500	6,041	2,328	16,869
1989	8,300	7,000	2,783	18,083
1990	8,300	12,567	2,602	23,469

Source: Forestry Department, Sabah

3-4 Product Market Trends

Changes in the output of sawn products from the State of Sabah have rapidly increased since 1990. At the same time, the level of exports of sawn products increased reaching about 2.10 million m^3 in fiscal 1992. This figure is expected to further increase because of the log embargo enforced in fiscal 1993.

As with the rapid increases in the output of sawn products, the production of plywood and veneer has increased rapidly from 1991 and 1990, respectively. The production of plywood reached approximately 420,000 m^3 in 1992, an increase of about 200% over the previous year. Veneer production rapidly increased from 1990 to about 820,000 m^3 in fiscal 1992.

Table II-25 Output of Processed-wood Products in Sabah (1989 - 1991)

(m^3)

	1989	1990	1991	1992
Sawn timber	1,338,222	1,910,137	3,402,181	2,797,054
Veneer	180,157	278,800	494,196	817,337
Plywood	157,722	176,012	229,401	420,724
Block board	1,446	7,447	28,958	34,897
Laminate	-	-	-	27,069
Moulding	-	-	166,227	219,690

Source: Forestry Statistics 1991 and 1992

Table II-26 Changes in the Production and Export of Sawn Timbers Produced in the State of Sabah

Year	Sawn timber production	Sawn timber export	
	Quantity (m^3)	Quantity (m^3)	FOB Amount (1,000RM)
1959	not available	30,063	3,761
1960	75,643	30,380	4,575
1961	62,073	16,735	2,124
1962	53,951	12,285	1,505
1963	46,942	6,414	940
1964	55,684	5,326	742
1965	63,801	7,127	837
1966	63,597	3,164	355
1967	57,061	3,464	528
1968	69,868	4,013	596
1969	68,905	10,016	936
1970	74,177	11,897	1,031
1971	92,671	6,442	445
1972	93,438	8,354	671
1973	126,825	12,577	2,331
1974	139,040	4,277	857
1975	135,466	9,442	809
1976	135,273	16,430	4,376
1977	177,320	35,693	11,975
1978	149,117	32,807	7,957
1979	220,903	77,075	25,029
1980	541,546	258,424	86,261
1981	675,736	427,329	143,406
1982	897,214	641,398	224,676
1983	1,107,068	1,038,213	366,405
1984	893,735	840,635	306,075
1985	1,133,418	1,133,418	330,861
1986	975,855	831,907	330,861
1987	965,676	838,694	382,797
1988	1,067,346	1,003,534	506,906
1989	1,338,222	1,293,536	813,225
1990	1,910,137	1,873,858	1,167,266
1991	2,402,181	2,055,262	1,208,055
1992	2,797,054	2,104,992	1,345,427

Source: Forestry in Sabah, Forestry Statistics

Table II–27 Changes in the Production of Plywood and Veneer Produced in the State of Sabah

Fiscal Year	Plywood production (m^3)	Veneer production (m^3)
1963	NIL	NIL
1964	NIL	6,378
1965	* 83,475	7,628
1966	* 455,788	8,236
1967	* 911,494	9,533
1968	3,784	11,761
1969	6,155	17,167
1970	8,475	27,030
1971	7,481	24,516
1972	14,391	17,586
1973	22,524	39,623
1974	15,679	25,271
1975	28,442	41,581
1976	33,364	44,230
1977	24,072	31,890
1978	36,002	22,798
1979	43,903	25,260
1980	48,852	54,916
1981	50,536	66,516
1982	46,267	75,133
1983	47,054	142,808
1984	51,517	143,674
1985	42,969	114,520
1986	78,968	106,463
1987	129,955	142,376
1988	161,016	171,825
1989	157,722	180,157
1990	176,012	278,800
1991	229,401	494,196
1992	420,724	817,337

* in m^2

Source: Forestry in Sabah, Forestry Statistics

The production of block board has also increased rapidly from fiscal 1990 in the same way as the other timber products.

Table II-28 Changes in the Production of Block Board Produced in the State of Sabah

Fiscal Year	Production
1985	5,435.00 m^2
1986	4,952.00 m^2
1987	1,531.72 m^2
1988	89.66 m^2
1989	1,445.54 m^3
1990	7,466.63 m^3
1991	28,958.42 m^3
1992	34,897.00 m^3

Source: Forestry and Forest Industry, Forestry Statistics 1991 & 1992

3-5 Timber Exports

Log exports from the State of Sabah in 1990, 1991 and 1992 were 4.19 million, 3.44 million and 3.05 million m^3, respectively, indicating a gradual decrease. The values on a FOB basis were RM1,074 million, RM934.6 million and RM 868.4 million, respectively. However, the volume of log exports are probably smaller actual exports because they represent only licensed exports before the log embargo of 1993.

(1) Changes in the Wood Processing Industry

In the State of Sabah, various types of processing factories were established in 1992 because the export of processed timber products steadily grew along with recommendations of the wood processing industry that was conducted by the Forestry Department prior to the execution of the log embargo. There was a chronic log shortage before the log embargo. The log shortage naturally became serious.

A bright hope of the timber industry is the fact that processing factories dealing with a wide range of products, including block board and laminated lumber, are being established in addition to conventional sawmills and plywood factories. Continually available logs consisting of a single tree species such as those from man-made forest will attract more attention.

(2) Changes and Prospects for Product Exports

Tropical timbers generally compete with other timbers, and it is impossible to establish market prices exclusively based on the circumstances in one producing country. This means that prices vary depending on the market conditions for other timbers, and, of course, price should be set within a certain limit. Therefore, it is necessary to make processed timber products using wood waste to increase yield so that production costs can be reduced as much as possible to develop products with high added-value, and

export a wider range of high-quality processed products which meet the needs of consuming countries.

The problem of exhausting natural resources is a worldwide issue and this problem is also facing the State of Sabah where natural forests are decreasing. Industrial plantation are steadily increasing, and processing of timber from man-made forests has commenced. For example, 80% of logs used in a blockboard factory in Tawau District consists of plantation tree species. Therefore, it is expected that plantation tree species, which can be constantly supplied from larger man-made forests, will increasingly be used for timber processing in order to develop a wide range of products.

However, according to an interview with medium and large timber processing companies in northern Sabah, they intend to continue processing logs from natural forests as long as natural logs are available. When depleted, they will discontinue the operation.

4. Aerial Photographs and Preparation of Forest Base Map

4–1 Subcontracting

Aerial photographs of the area surveyed were taken and a forest base map of northern Sabah was prepared in order to provide basic materials for various surveys required for this study.

Initial drafts of a contract and specifications were prepared under the assumption that the aerial photography and the preparation of the forest base map would be subcontracted to local surveying companies due to the survey situation in Sabah. Preparation was also made for materials relating to the aerial photographs.

Technical details of the aerial photographs and forest base map were explained to some local surveying companies, a hearing was held to enable them to present their operation performing capacity and technical capabilities and they were asked to submit written estimates.

In addition, for the preparation of the forest base map, each company's working method was inspected to check if it could cope with the task.

Specifications were approved by the Japan International Cooperation Agency on April 9, 1993. The major items of the contents of the specifications are listed below:

(1) Aerial Photography

Photograph scale	1:25,000
Photographing camera	wide-angle camera (focal length 153mm, 23cm × 23cm)
Photographing course	east–west course, about 36 courses (as shown in the attached map)
Photographing height	average terrain clearance about 3,750m
Photographing overlap rate	standards: overlap 60% sidelap 30%
Area	365,000ha
Produced materials	Negatives (all rolls were submitted to the Lands and Survey Department, Sabah)
Contact photographs	2 copies
Photograph record	1 copy
Index map	original 1 copies 3
Double-developed	photographs about 110 pieces
Accuracy control chart	1 copy

(2) Forest Base Map

A topographical map (scale: 1/50,000) that existed in Malaysia has been traced. The tracing was carried out by digitizing and by manual tracing.

Scale	1:50,000	
Area	540,000ha	
Indicated items (general items)		
	Contour lines, rivers, lakes and marshes, roads, settlements and notes	
Indicated items (items designated by the Japan International Cooperation Agency)		
	Compartment boundary and compartment number	
Amended items	Based on materials of forest roads (SAFODA)	
Produced materials	Topographical map (first original)	1 copy
	Forest base map (first original) with compartment boundaries (entered)	1 copy
	Ditto – (second original)	1 copy
	Ditto -- (positive)	3 copies

As a result of bidding, Jurukur Perintis was selected for both aerial photography and the preparation of a forest base map. A subcontract was concluded with the company after the approval of the Japan International Cooperation Agency.

4–2 Aerial Photographs

Aerial photography was carried out jointly by SAFODA's counterpart, the subcontractor and study team members responsible, after the approval of the Sabah Lands and Surveys Department in the period from April 16 to June 28, 1993 according to the schedule.

Under the photography plan, aerial photographs were taken from April 16 to June 28, 1993. The planned area could be photographed better than we had expected from the tropical rain forest zone. However, the area was partially covered with cloud, and about 5% of all the photographs could not be used.

The study team gave up photographing the remaining about 5% covered with cloud in light of the budget, period of photographing and the weather conditions of the area (around Mt. Kinabalu).

To supplement the work, the corresponding photographs taken in 1986 were used.

The coverage of aerial photography is shown in Fig. II–8.

4–3 Preparation of a Forest Base Map

A map was drafted in compliance with specifications, and its layout and contents were reviewed. Subsequently, rivers, contour lines, colonies and roads were traced using the latest 1:50,00 topographical map available in Sabah. Forest roads were indicated on the basis of SAFODA's materials.

Tracing was conducted by a cartographer, and digitizing was also applied.

Minimizing the number of drawings to cover this area was taken into consideration and a map was prepared in accordance with the sectionalization of the existing survey maps of Malaysia. The sectionalized map and section names are shown in Fig. II-9.

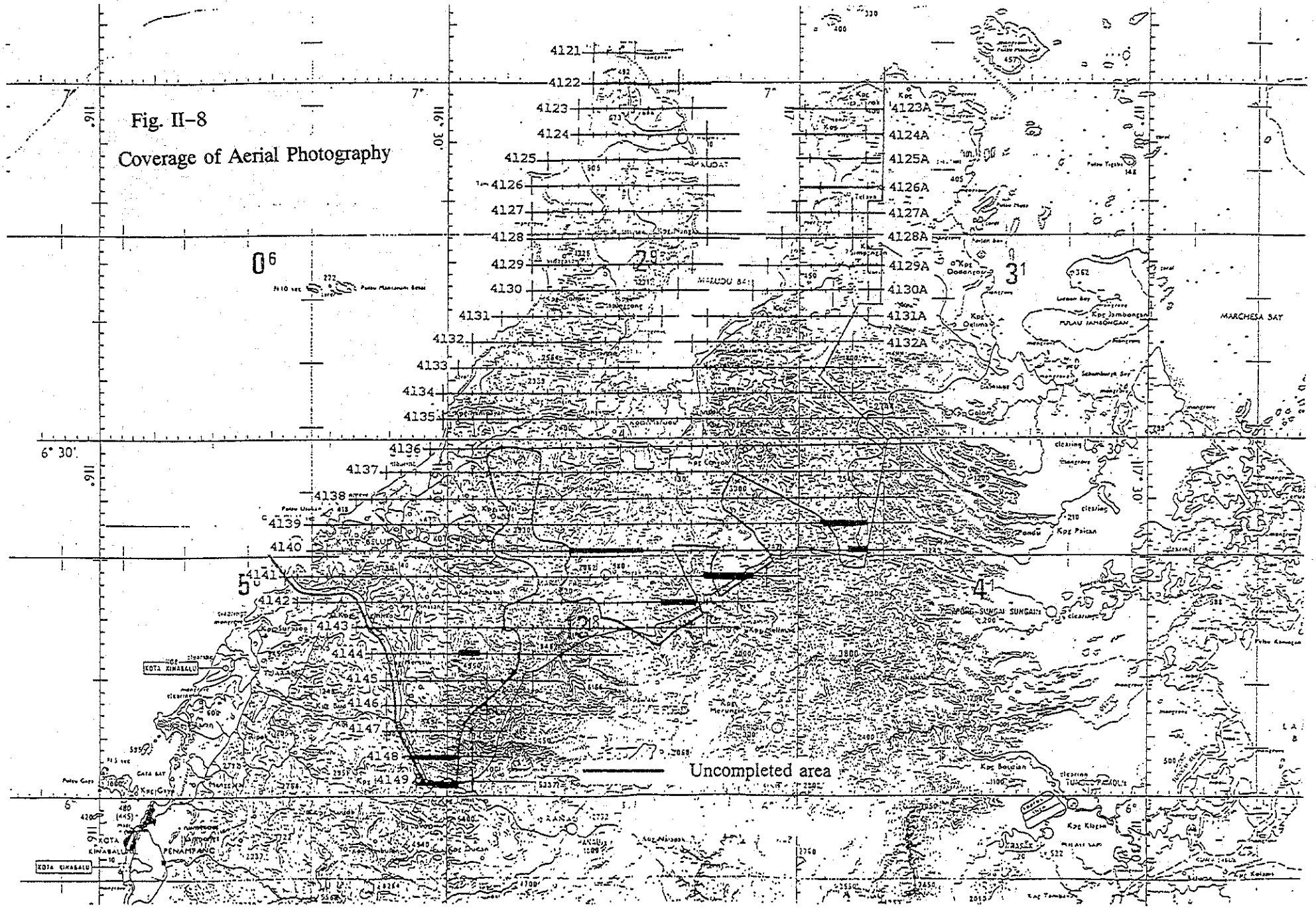


Fig. II–8
Coverage of Aerial Photography
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Uncompleted area

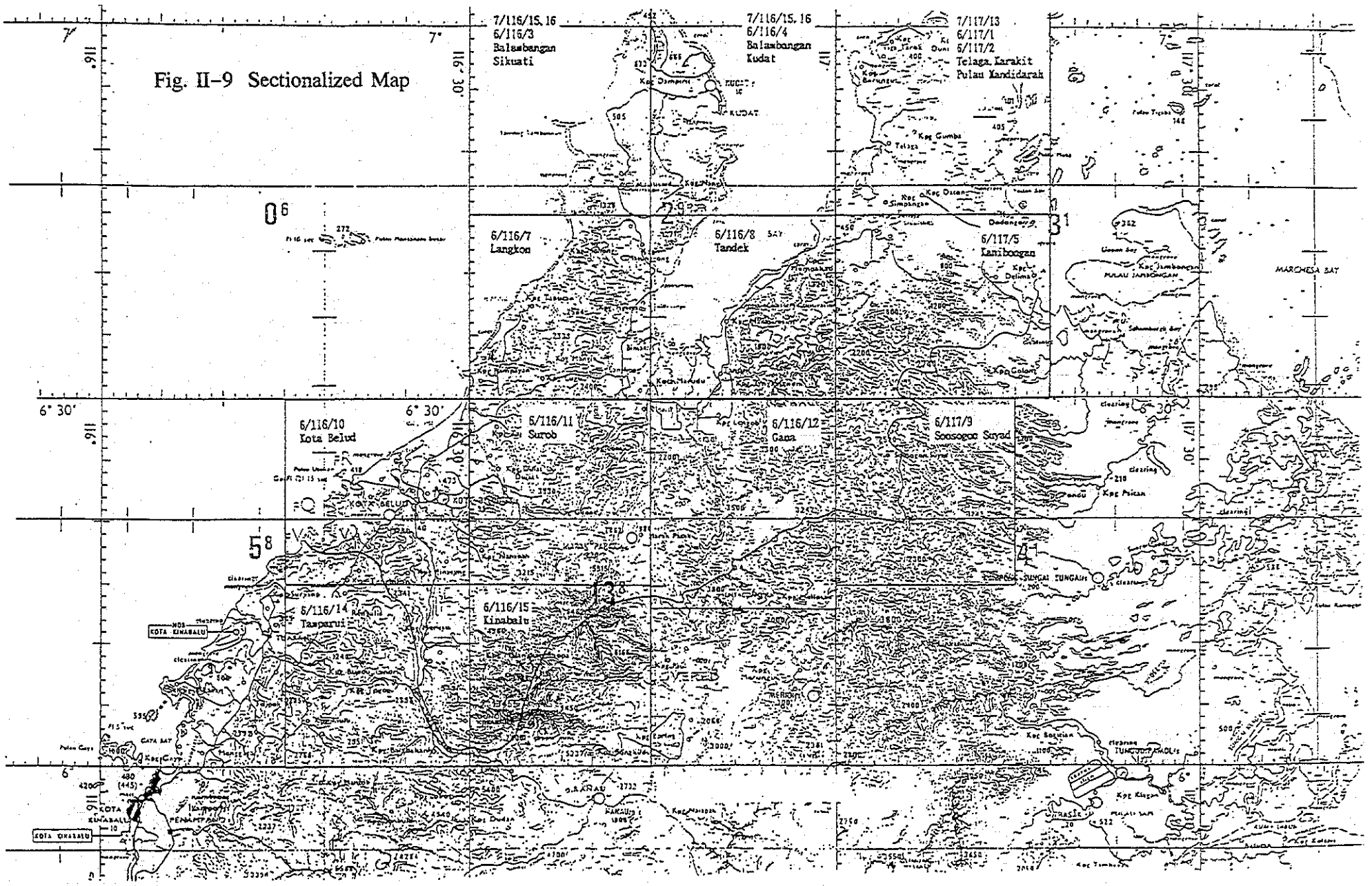


Fig. II–9 Sectionalized Map

5. Forest Inventory

5-1 Forest Survey

The major objectives of the second field survey in Phase I included gaining an understanding of forest conditions at the target site, compiling a forest inventory book with the help of the results of the aerial photograph interpretation, and collection of basic materials for future forest plantation development. A large quantity of data was collected from 27 points for the natural forest survey, 32 points for the man-made forest survey and 21 points for the soil survey. This was only possible due to the exceptional cooperation of the Forestry Department, Lands and Surveys Department and SAFODA.

The forest inventory covered stands representing specific forest types in order to determine criteria for the interpretation of aerial photographs. The results of the inventory were reflected in the interpretation of such photos. The criteria for these forest types are as follows.

Table II-29 Forest Types and Their Criteria

Type	Criteria	Code
High Forest - type A	Forests with a tree height of 30 m or more, and with a crown density of 50% or more	D_1
High Forest - type B	Forests with the tree height of 30 m or more, and with a crown density of 30 - 49%.	D_2
High Forest - type C	Forests with a tree height of 30 m or more, and with a crown density of 10 - 29%.	D_3
Medium High Forest	Forests with a tree height of 15 - 29 m.	F_1
Low Forest	Forests with a tree height of 6 - 14 m.	F_2
Shrubs	Forests with the tree height of 5 m or less.	F_3
Mangrove		Ma
Man-made forest		Af
Grassy areas	Lalang	G

The sizes of plots covered were 50 m x 20 m for natural forests and 20 m x 20 m for man-made forests. After the preliminary interpretation of aerial photographs, a site typical of each plot was chosen. Then, the location of each plot was accurately marked on the map drawn to a scale of 1:50000 with reference to aerial photographs and the global positioning system.

(1) Method of Surveying Natural Forests

Since uniformity cannot always be expected from natural forests, in order to maintain uniformity among plots, care was taken to make sure that no out-of-use forestry roads, no relatively new remnants of slash-and-burn fields, no small swamps, and no gaps were included in the plots.

For the survey of natural forests, the trees were classified into three groups according to D.B.H. Classification criteria and examination items were as follows:

(1)	With D.B.H. of 30 cm or more:	D.B.H., tree heights, clear lengths, top end diameters, and tree species
(2)	With D.B.H. of 20 - 29 cm:	D.B.H., tree heights, and tree species
(3)	With D.B.H. of 19 cm or less:	D.B.H., average tree heights inside the plots, and tree species

For forests with D.B.H. of 19 cm or less, square sub-plots of 10 m x 10 m within the rectangular plot of 50 m x 20 m were surveyed. If, however, no trees with D.B.H. of 20 cm or more were found in the smaller square plots, the above items were surveyed outside these square sub-plots within the outer rectangular plots.

The purpose of classification into the above three groups was to use the results as indices to determine the marketable volume of trees with D.B.H. of 30 cm or more, the condition of the next generation of forests (succeeding trees), i.e., those with three of D.B.H. of 29 cm or less, and the conditions of intermediate forests with trees of D.B.H. of 20 - 29 cm. Tree species were identified by an experienced expert of the District Forest Office.

(2) Method of Surveying Man-made Forests

This part of the survey was carried out mainly on SAFODA's *Acacia mangium* forests in the Bengkoka Peninsula, Ulu Kukut and around the border separating the districts of Kudat and Kota Marudu where *Acacia mangium* is being regenerated.

The main items investigated were D.B.H., tree heights, and ages after planting, and complementary items were (1) conditions at planting such as the planting distance, (2) details of planting methods such as fertilization, pruning, thinning and others, (3) destruction by forest fires, and (4) undergrowth around the plots. As was done in the case of natural forests, diameter gauges or tape measures were used to measure. In the plots where sectional measurement of volume was done, first D.B.H. and tree heights of each tree were measured, the sample trees were selected and cut using

chainsaws at every two meters, then the butt-end diameters, top diameters and lengths were measured.

(3) Number of Plots Surveyed

The distribution of the plots covered by the forest inventory in Phase I is shown in Table II-30.

Table II-30 The Distribution of the Plots Surveyed

Forest Type	No. of Plots
D_1	2
D_2	8
D_3	5
F_1	2
F_2	3
F_3	4
Af	32
G	1
Others*	2

* Outside of aerial photographed area

5-2 Results

State-owned natural forests in the study area have been considerably logged over, to the same extent as the hinterland. High forests mainly consisting of dipterocarp species are unexpectedly few, while secondary forests are dominant. The small number of high trees remaining in these stands are not worth using because of being damaged.

According to the results of the soil survey, Horizon A of the forest soil is thin in this area, and its pH value ranges generally from 5.2 to 5.6.

(1) Natural Forest

This survey was done mainly in the southern part of Kota Marudu district because forests of certain extent of the unit could no longer be found except far inland. It was observed that large lalang grasslands were spreading inland of Kota Marudu district as well as around Kota Belud and Kudat.

These secondary forests seem to take a long time to be dominated by useful broad-leaved trees. Since high forests were logged over several times in a short period, their resources have deteriorated. As shifting cultivation is carried out even in the hinterland, fields are often abandoned after cultivation and some places were burnt several times and transformed into lalang grassland.

The natural forests observed by the study team were not primary forests but had experienced cutting at least once, and some had already been cut four or five times. Therefore the stand volume of forests were probably smaller than it appeared to be. In addition, forest destruction by slash-and-burn shifting cultivation seemed to be significant. The study team actually observed that trees with a D.B.H. of more than 30 cm were being cut to prepare for shifting cultivation on an incline neighbouring a steep slope with a grade of more than 30 degrees. As forestry roads for logging are extended into the hinterland, shifting cultivation fields are moving deeper inland, and some farm houses were settled along forestry roads.

(2) Man-made Forests

While SAFODA's plantations account for a majority of man-made forests, there are some private plantations of *Acacia mangium* which have been assisted by SAFODA's private tree farm promotion activities. While SAFODA's large-scale plantations in the Bengkoka Peninsula were in a good state, tending looked unsatisfactory in many private plantations. In addition, as observed in the plantations at Ulu Kukut, forest fires occur frequently. During plantation development, it is essential to make efforts to prevent damage by forest fires. Therefore, activities for tending forests and preventing forest fires are needed in the future.

From the result of survey of man-made forests, the average D.B.H., average tree heights, and the basal area of every species were calculated. Also, for plots where the breast height form factor was calculated using the sectional volume measurement method, the tree volume at sample plots and the tree volume per hectare were calculated using a formula in which the products of the average basal areas and the average tree heights were multiplied by the breast height form factor. The mean annual increments (MAI) were also calculated by dividing the number of growth years into the tree volume per hectare.

As a result, it was found the MAIs of *Acacia mangium* vary widely between a minimum of 8.40 m^3/ha/yr and a maximum of 25.95 m^3/ha yr.

(3) Soil Survey

Soil surveys were conducted at 21 of these 59 plots (15 natural forests and 6 man-made forests). The items observed included (1) layer classification, (2) soil colour, (3) humus quantity, (4) existence of gravel, (5) soil structure, (6) soil hardness, (7) moisture conditions, (8) eluviation and illuviation, (9) existence of mycorrhizae and hyphae, (10) existence of roots and rhizomes, and (11) pH. Their photographs were taken, and simple sketches of the profiles were made to record soil conditions.

(4) Watershed Conservation

Since there was little rainfall during July and August, 1993, water flow in some rivers in the district was less than in the previous survey in March. Even short spells of rainfall, however, normally raised the water levels of these rivers and made them muddy. Therefore soil and water conservation efforts seem to be required. As the forest roads are constructed by just flattening the ground with bulldozers, sediment discharge due to rainfall in the rainy season is likely to be tremendous. In addition, surface soil discharge from the bare ground due to shifting cultivation will also be considerable.

Considering these factors, the establishment of a forestation plan is an urgent necessity for watershed conservation, as well as for increasing long-term productivity and providing economic gains.

6. Current Land-use and Vegetation

6-1 Aerial Photograph Interpretation

The land-use and vegetation map was prepared and the forest composition and type were discerned from aerial photos that covered 323,000 ha in the study area. Although the study team referred to photos taken in 1986 for those areas that were not possible to take photograph during this study due to bad weather, much attention was paid to the use of photos of 1986 because an on-the-spot survey showed that areas of logging and shifting cultivation had been expanded, and therefore changes in land-use and vegetation were significant.

During aerial photograph interpretation, at first the boundaries of northern Sabah (540,000 ha), the forest reserve, the army area, the state park and the Bengkoka area were clarified based on the aerial photos. Then the draft land-use and vegetation classes to be used as classification items for interpretation of land-use and vegetation, were prepared. Finally, preliminary interpretation was carried out according to the established classification items.

Based on the class collation at the preliminary interpretation stage, and the results of the forest survey, the classification items were reviewed and modified for the analysis of the forest composition and type, and the land-use and vegetation. The revised classification is presented in Aerial Photographs Criteria (Table II-31).

Sectional areas based on Aerial Photograph Criteria are shown Table II-32.

Table II-32 Land-use Vegetation Classes

Code	Land-use Vegetation Class	Area
D1	High Forest (Dense High Forest)	–
D2	High Forest (Medium Density High Forest)	894
D3	High Forest (Scattered High Forest)	4,256
F1	Medium High Forest	54,522
F2	Low Forest	64,027
F3	Shrubs	76,478
Ma	Mangrove Forest	4,713
Af	Man-made Forest	6,837
P	Paddy Field	16,302
F	Farmland	531
R	Rubber Plantation	17,387
O	Oil Palm Plantation	4,675
C	Coconut Plantation	30,294
Mp	Mixed Plantation	8,875
G	Grassland	24,650
S	Settlement	4,463
I	Institutes, Facilities	244
W	Lake	–
Sw	Swamp	4,081
Total		323,229

Logging was being done in almost all forests inside the examined area, and logging roads formed a network. Mangrove forests were generally well maintained. Some small-scale farmers' plantations of *Acacia mangium* could be seen, and oil palm plantations were found in relatively flat areas.

In the southern and eastern parts of Kota Marudu District, although logging activities were being carried on, there still remained harvestable forests. Rubber trees and coconuts were planted on many logged-over areas in western Kota Marudu District.

Because small stands are difficult to trace on the forest base map drawn to a scale of 1:50000, only stands with a certain area were taken up in the interpretation of aerial photographs concerning typical land-use and vegetation.

6-2 Preparation of the Land-use and Vegetation Map

The land-use and vegetation map was prepared by analyzing aerial photos according to the criteria for analysis of aerial photographs and inserting the results onto a topographical map (scale: 1 to 50,000). As a result, it was found that the total area of medium and low forests and shrubs reached 186,000 ha, while grassland occupied an area of 24,000 ha. Grassland includes the sites of rice cultivation and pastures, which could not be identified in detail from the photographs.

Table II-31 Criteria for Analysis of Aerial Photographs (Classification of Land-use and Vegetation, and the Forest Composition/Type)

Class of Land Use & Vegetation			Code	Criteria for Analysis
Forest	High Forests	Crown density of 50% or more	D1	Species of Dipterocarpaceae with tree height of 30 m or more are dominant. The colour tone is whitish gray.
		Crown density of 30-49%	D2	
		Crown density of 10-29%	D3	
	Medium High Forests		F1	Species of Dipterocarpaceae with tree height of 30 m or more and with crown density of 10% or less along with those with a tree height of 15-29 m are dominant. The colour tone is whitish gray.
	Low Forests		F2	Average tree height is 6 - 14 m. The colour tone is whitish gray or gray.
	Shrubs		F3	Average tree height is 5 m or less. The colour tone is whitish gray or gray.
	Mangrove Forests		Ma	These are distributed in seaside areas and along rivers near coasts. The colour tone is a light to medium black.
	Man-made Forest		Af	These consist mainly of plantations of *Acacia mangium*, planted in rows. The colour tone is light to medium black.
Non-forest	Paddy Fields		P	Fields clearly separated by ridges or levees and distributed on flat lowlands. The colour tone is light gray or light black, and they were located mainly around settlements.
	Farmland		F	Clearly separated but the areas are not as small as those of the paddy fields. The colour tone is whitish gray or light gray, and they are located mainly around settlements.
	Rubber Plantation		R	The tree height is almost uniform. Trees of a single species or a rubber-dominant mixture are planted in rows and the colour tone is a medium to deep gray.

Class of Land Use & Vegetation		Code	Criteria for Analysis
Non-forest	Oil Palm Plantation	O	The tree height is uniform. Trees are planted in rows and the colour tone is medium black but the center of the crown is gray.
	Coconut Plantation	C	Trees are planted in rows. The colour tone is gray or light black and the tree height is almost uniform.
	Mixed Plantation	Mp	Rubber trees, coconuts and fruit trees are planted near settlements, either separately with each in a small portion of the land, or in an intermingled manner. The colour tone varies from light gray to medium black.
	Grassland	G	The colour tone varies from light gray to light black. Those which are located on flat lowlands and look light black are semi-swampy or swampy areas that are used for grazing.
	Settlement	S	Classified according to the density of dwellings
	Institutes	F	Mainly located near oil palm plantations.
	Lake	W	The majority are distributed in the swampy area. The colour tone is medium black.
	Swamp	Sw	Distributed on flat lowlands. The colour tone is deep gray or light black. Swampy areas which have small lakes are classified as swamps.

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

The forests are divided into 8 categories. However, some parts of grassland classified as nonforests belong to forest land.

6-3 Compilation of the Forest Inventory Book

The forest inventory book lists present conditions with details of compartment No., area, present land-use, locational factors and forest description as shown in Table II-33.

Table II-33 A Sample Sheet of Forest Inventory Book

Sheet No.

Compart-ment No.	Category No.	Area (ha)	Land-use code	Location factors			Forest description				
				Height above sea level (ft)	Slope	Soil type	Forest type	Tree age	Av. height	Volume/ha (m^3)	Total Vol. (m^3)
K-001	1	100	F3	1,900	2		Natural			–	–
	2	50	D2	2,600	3		Natural			35.6	1,780
	3	20	AF	1,300	1		Planted		20	158.0	3,160
	4	30	G	300	1						

Examination items and contents specified in the forest inventory book are as follows:

1) Division of forests

· Compartment

Forests were classified using a base size of 400 ha, taking into account of landforms such as ridges and valleys. Each compartment no. is headed by the following symbols:

P: Pitas, K: Kudat, M: Kota Marudu, B: Kota Belud

· 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.

2) Land-use

The land-use and vegetation map was read for land use classes of sub-compartments, and codes on the map were copied onto the table.

3) Locational factors

· Height above sea level

The height above sea level was measured in each zone around the centre point of the sub-compartment.

· Slope

A mesh of 1 cm was placed at the centre point of the sub-compartment on the topographical map, and the following classification was made and put into the table according to the number of contours inside the mesh.

Category No.	1	2	3
No. of contours:	0 – 4	5 – 7	8 or more
	Gentle: 15° or less	Medium: 15–25°	Steep: 25° or more

· Soil

The soil type dominant inside a sub-compartment, estimated using an existing map, was considered as the soil type of the sub-compartment.

4) Forest Condition

The forest conditions were specified only when the present condition of the land use fell into the forest category.

· Forest Type

Forests were classified into planted forests and natural forests (high forests, medium high forests, low forests, shrubs, and secondary forests. Mangrove forests were included).

· Average Tree Height

Average tree heights were specified for planted forests based on the existing materials and the results of the forest examination.

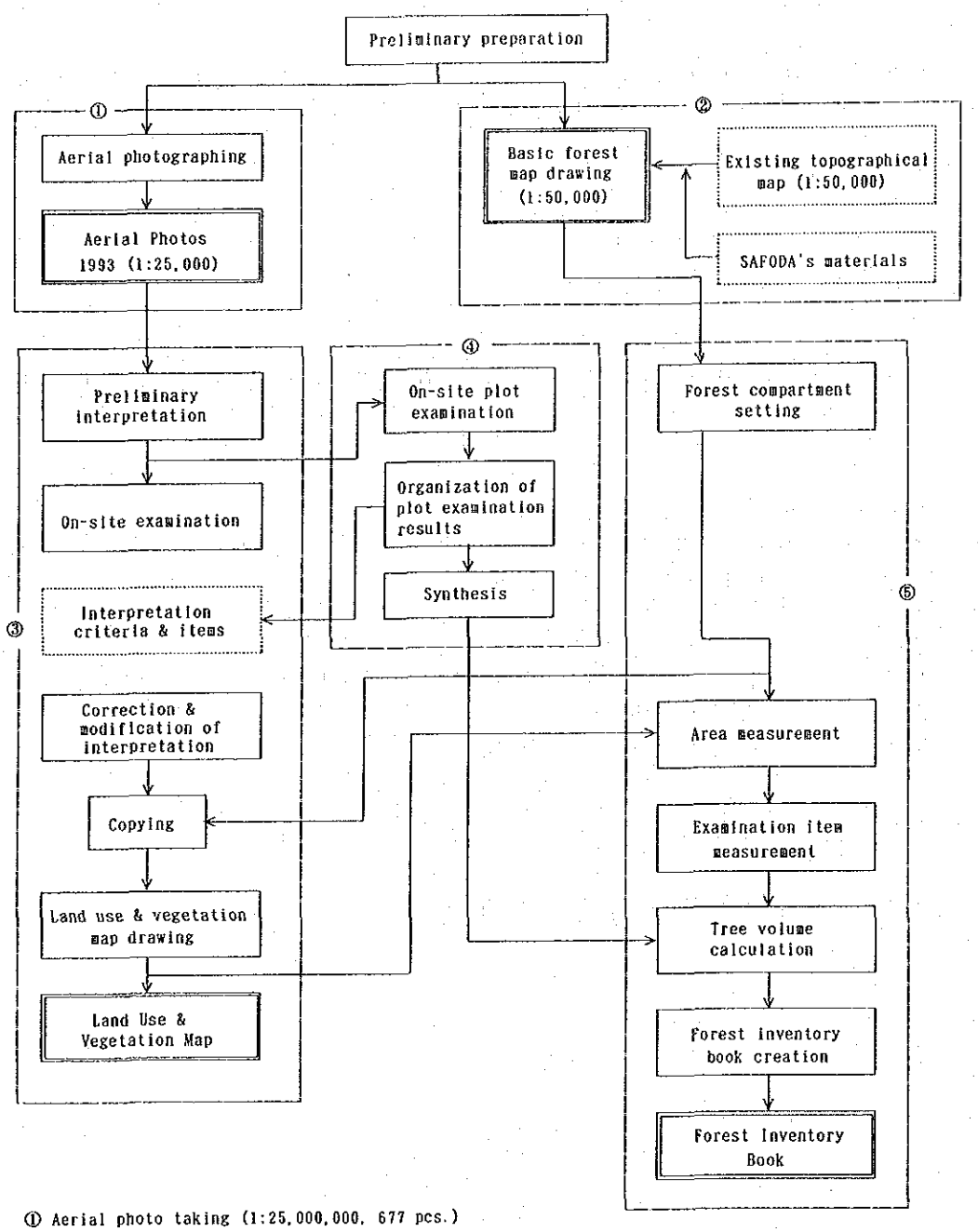
· Tree Volume

The tree volume per hectare of both planted forests and natural forests was calculated using the results of the forest examination and the collected materials.

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

The flow chart of the compilation of the forest inventory book are shown in Figure II-10.

Fig. II-10 Flow Chart of Forest Inventory Book



① Aerial photo taking (1:25,000,000, 677 pcs.)

② Basic forest map drawing (1:50,000, 12 sheets)

③ Land use & vegetation map drawing (1:50,000, 12 sheets)

④ Forest examination

⑤ Forest inventory book compilation

Legend	
	Major work
	Major intermediate materials
	Final creations

7. Forestry Infrastructure

7-1 Forest Road

Necessary forestry infrastructure includes roads, bridges, fire prevention facilities, nurseries and timber yards. Forest roads are indispensable for forest management. In the case of plantations, the planning of forest road networks and the structure depend on the scale of plantation. It is impractical to allocate a large outlay of money to hauling after harvesting because the unit price of small timber from plantations is low. A method for saving the cost of hauling logs from plantations depends highly on the density of forest roads. In this sense, the density is a key factor in forestry management. General public roads as well as forest roads are important facilities for forestry management, and the existence of bridges is particularly important. In the forest zone covered by this study, a sufficient road network does not exist. Even public roads in mountain areas have many problems in structure, surface and cross drainage, and must be improved for transporting timber, especially in the rainy season.

Public main roads are important infrastructure for forestry management. In a review of main roads constituting forestry infrastructure in the northern Sabah under this study, it was found that the highway from the state capital of Kota Kinabalu to the north presented no problems as it is mostly paved, except for the gravel section between Kota Marudu and Pitas.

Main Route

Kota Kinabalu	– Kota Belud	65.0 km
Kota Belud	– Kota Marudu	48.0
Kota Marudu	– Kudat	73.0
Kota Marudu	– Pitas	47.0 (gravel road)

A large number of forest roads for logging and carrying out harvested trees were built in northern Sabah from the ridges down to the valleys during the earlier period of logging of natural forests. The roads used at present have been repaired with graders and bulldozers. Many of the roads have fallen into disuse and have been abandoned.

Since there are few graveled roads through forests (only some principal roads have been graveled), it is difficult to drive on most of the roads even with little rain. Bridges are one of the biggest problems. Most of them are five to six-year-old wooden bridges (made of logs covered with earth), which are in danger of collapsing at any time. Crossings of river without any bridge are passable only when the level of water is low.

Ditches by the side of the roads have not been built except along some parts of the main roads, and there is room for improvement in the maintenance of roads. The gradients of many roads are so steep that sometimes even four-wheel drives have difficulty using them immediately after rain.

7-2 Nursery

Currently, SAFODA owns nurseries in Ulu Kukut and Bongkol to produce seedlings. There are two nurseries which are managed by individuals entrusted by SAFODA with the

production of *A. mangium* seedlings. Seedlings in demand in northern Sabah are produced in the previously mentioned four nurseries whose production capacity is 1.6 million seedlings per year in Ulu Kukut and more than 4 million seedlings in Bongkol. Production capacity of the nursery in Matunggong is about 130,000 seedlings annually. The size of the other individually-run nursery is not clear. These nurseries produce more than 4 million seedlings, and can fully meet demand as long as forestation continues on the present scale. However, if new large-scale forestation is carried out in the southern district of Kota Marudu, a new nursery may be required to open in view of the location of existing nurseries.

7-3 Countermeasures against Forest Fires

Fires are the greatest threat to forests. Once a fire occurs, previous efforts for forestation will be reduced to ashes. The vegetational succession of regenerated natural forests will also be interrupted, and frequent occurrence of fires will transform forests into grassland.

At present, countermeasures against forest fires do not seem to be sufficient in northern Sabah. There are lookout towers constructed by SAFODA to observe man-made forests. The Forest Department has not installed any other tower for natural forests. There are no firebreaks or fire shelter forests, and fire-fighting equipment is also not provided.

On the other hand, administrative agencies, including the Forestry Department, have conducted educational and extension activities against forest fires. These activities need to be improved. Specifically, it is necessary to organize brigades, enlighten the local inhabitants and educate children at schools about fire prevention.

7-4 Bridges

The Bengkoka River on the way from Pitas to Bongkol in Pitas District is presently crossed by ferry boat. If a large amount of logs from plantations is transported, it is obvious that this river will obstruct local development as well as forestry development in the Bengkoka area. In addition, other bridges on the main local roads in mountain areas will create a problem because most of them are wooden bridges unsuitable for log transportation.

If *A. mangium* trees planted in this area are harvested for sale, most of them will be exported in the form of chips. To export them, chipping and loading facilities will be needed, because they currently do not exist in northern Sabah.

Moreover, it is clear that planted trees in small tree farms will reach cutting age in the near future. However, there is no facility for lotting logs harvested from plantations in order to sell profitably. The facility referred to involves not only a timber yard but also an organization like forest owner's association which will combine small amounts of timber. If such a facility is made available to tree farm owners, they will be able to play a major role as small-sized forestry managers in raising incomes in northern Sabah.

8. Environmental Assessment

8-1 Outline of This Project

The master plan to be prepared based on the results of this study will cover industrial plantation and tree farming in an area of about 323,000 ha, and the construction, improvement and repair of necessary forest roads in northern Sabah in Malaysia. Forests in the coverage areas of this study comprise mainly state-owned land and secondary forests, part of which have been transformed into grassland as a result of shifting cultivation and forest fires. This project is intended to contribute to the development of the regional economy and the improvement of the welfare of inhabitants through the afforestation or reforestation of these degraded lands, and timber production.

Afforestation/reforestation will improve land productivity, conserve the natural environment, and promote the development of wood processing industries from man-made forests. This project is expected to have various effects on the regional environment, including on the diversity of plant species and the livelihoods of inhabitants through large-area plantation and forest road construction.

8-2 Conditions of Project Site

1) Social Conditions

i. Community, Population and Racial Structure

There are about 180,000 people in and around the area covered by this project. Major communities are Kudat, Pitas, Kota Marudu and Kota Belud. Native people account for about 80% of the total, and Chinese people are the second largest group. Recently, Filipinos and Indonesians have also moved to Sabah to work. However, there are few in the coverage areas of this study.

ii. Land-use

Rubber, oil palm and coconut palm estates have developed in flat areas, which are intensively farmed. Rice is the dominant crop.

In forest areas, native people produce rice, maize and other crops in dry fields by means of shifting cultivation. Land has been used without special care.

iii. Economic Activity

Economic activity is dominant mainly in estate areas. General economic activity is also found in the areas of small-scale rice production.

On the other hand, shifting cultivation is prevailing in forest areas, where a small harvest is sold in order to purchase daily necessities, including clothes and some food. Besides this, economic activity is rather minor.

In the industrial sector, economic activity related to estates is vigorous and has a major effect on the regional economy.

There is no significant forestation except SAFODA's project. Even in SAFODA's plantations, harvesting is delayed though many trees have already reached their cutting age. Their effect on the regional economy is small compared with that of estates.

Commercial activity is concentrated in Kudat, Kota Marudu, Pitas and Kota Belud, where the number of employees has reached about 2,000.

iv. Workforce

Estates are prevailing in flat areas, where the supply and demand of labour is well balanced. Even small farms can constantly secure labour from their families.

In contrast, subsistence farmers dependent on shifting cultivation must expand arable land following the increase in population. However, such expansion is practically limited, and potential surplus labour is expected from these people.

v. Customary Systems

Whether in agricultural villages or forest areas, customary systems exist for communities and individuals. They are environmental factors which should be fully considered in planning forestation.

Typical systems of communities are the general aid system on the family principle, the neighbourhood association and the joint labour system. As for individuals, permanent leasehold of land and the right to use land are available.

2) Natural Environment

i. Climate

Although the project site falls under the tropical rain forest zone, the annual rainfall varies substantially in different localities. For example, annual rainfall reaches 5,000 mm in the Kinabalu Range, but is below 2,000 mm in the northern area, including Kudat and Pitas. These areas climatically fall under the tropical rain forest zone, though the wetter season and the drier season are relatively distinct.

ii. Forest Vegetation

Forests are tropical rain forests, and their original vegetation is as follows:

Lowland dipterocarp forests (distributed on coastal slopes and in flat areas)
Hill dipterocarp forests (in the whole of coastal mountains)
Mountain dipterocarp forests (in the Kinabalu range of mountains)
Fresh-water marsh forests (in coastal marshes)
Mangrove forests (in coastal areas).

iii. Present State of Forests

Hill and mountain forests mainly composed of dipterocarp species have been cut since early times. Grass (*Imperata cylindrica*) has overgrown excessively and intensely felled areas where secondary forests have also developed following the invasion of pioneer species. There is a general tendency of excessive cutting. Only a few saplings of dipterocarp species remain in logged-over areas. It will probably take a long time to constitute a climax forest again.

iv. Topography

The Kinabalu range of mountains are steep and surrounded by gentle slopes. Basins and deltas have developed on river basins, while hills extend along coastal mountains.

In view of topography, forests are divided into four consolidations, namely 1) Marak Parak, 2) Sonsogon, 3) Tandek and 4) Langkon. The detail will be discussed in Chapter III, Section 2-3.

The absorption of surplus labour is possible in flat areas but difficult in mountain areas. Therefore, the traditional system of shifting cultivation has collapsed, and natural forests are destroyed.

At this moment, this project will have no difficulty in securing labour.

8-3 Expected Effects on Environments

1) Environmental Items Related to This Project

(1) Inhabitants' Life

- Planned relocation
- *Involuntary relocation*
- Change of life style
- Conflict among inhabitants
- Native people, minorities

(2) Population Problems

- Increase in population

(3) Economic Activity

- Expansion of economic activity
- Rising income
- Widening of income gaps

(4) Systems and Customs

- Readjustment of forest concessions
- Reform in existing systems and customs

(5) Health and Hygiene

- More use of agricultural chemicals
- Accumulation of residual toxicity
- Occurrence of endemic diseases
- Increase in garbage and sewage waste
- Spread of epidemics

(6) Historic Sites, Cultural Heritage and Scenic Beauty

- Damage to and destruction of historic sites and cultural heritage
- Loss of valuable scenic beauty
- Adverse effects on deposit resources

(7) Valuable Living Things and Ecosystems

- Change of vegetation
- Invasion and increase of harmful organisms
- Effects on valuable species and indigenous animals
- Decline of biological diversity
- Disappearance of marshes and peat bogs
- Degradation of natural forests
- Destruction of coral reefs

(8) Soil

- Erosion
- Contamination
- Saltification
- Reduction in fertility

(9) Land

- Devastation
- Occurrence of landslides
- Degradation of such functions as windbreak, prevention of shifting of sand, control over tide and prevention of fire
- Ground subsidence

(10) Hydrology

- Change in water level
- Occurrence of droughts and floods
- Decrease in surface water flowing
- Sedimentation of earth and sand
- Silting of river beds
- Effects on transportation by boat
- Burying of lakes

(11) Water Quality and Temperature

- Water contamination
- Change in water temperature

(12) Atmosphere

- Air pollution
- Increase in CO_2
- Change in microclimate
- Occurrence of noise

2) Significant Environmental Conditions and Requirements in the Coverage of This Project

o: Present, x: Absent

Category	Within this area	Beyond this area
1) Specially Designated Areas		
Habitats covered by Convention on Wild Fauna & Flora*	o	o
Swamps covered by International Convention on Wetlands	x	x
Forest reserves	o	o
State parks	o	o
Protected forests, sanctuaries	o	o
2) Social Environment		
Settlements of natives or minorities	o	o
Historic sites, cultural heritage and scenic spots	o	o
Economic activity areas subject to major negative effects	x	x
3) Natural Environment		
Arid and semiarid areas	x	x
Tropical rain forest areas	o	o
Marshes	o	o
Peat bogs	x	x
Mangrove forests	o	o
Coral reefs	x	o
Rocky, steep or devastated areas	o	o
Lakes, marshes & man-made ponds	o	o

* Convention on International Trade in Endangered Species of Wild Fauna and Flora

8-4 Results of Initial Environmental Assessment

The initial environmental assessment produced the following results.

The effects of relevant development operations under this project on environments were classified by intensity as follows:

Symbol ★ stands for a strongly adverse effect, Symbol ☆ stands for adverse effect, Symbol Δ stands for a slightly adverse effect, and Symbol ◎ for a good effect. A blank means not relevant. Effects marked with ★ or ☆ will be fully examined in the field survey in Phase II.

Appropriate measures for preventing them will be proposed in the master plan. For effects marked with ◎, alternatives will be considered to enhance these effects.

Environmental Items	Developmental Actions									Remarks
	Logging	Forest Road Construction	Forestation	Natural Regeneration	Seedling Production	Forest Conservation	Agroforestry	Timber Processing	Timber Distribution	
Social life										
1. Planned migration			◎				◎			
2. Forced relocation			△	△						
3. Changes in lifestyle	★	◎	◎	◎			◎	◎	◎	
4. Conflict among local people			◎				◎			
5. Effects on natives people	★		△	△			◎			
Population Increase										
1. Population increase			◎					◎	◎	
Economic Activity of Local People										
1. Extension of economic activity	★	◎						◎	◎	
2. Income increase			◎		◎		◎	◎		
3. Expansion of income gaps		☆					◎			
4. Decline of transportation by boat, cattle and horses		★							☆	
Systems and Customs										
1. Readjustment of the right to use forests	★		△	△		△				
2. Reforms of existing systems	★	△					◎			

Environmental Items	Developmental Actions									Remarks
	Logging	Forest Road Construction	Forestation	Natural Regeneration	Seedling Production	Forest Conservation	Agroforestry	Timber Processing	Timber Distribution	
Health and Hygiene										
1. An increase use of fertilizers			△		△				△	
2. Residual toxicity								△		
3. Occurrence of endemic disease				△						
4. Infection by epidemics				△						
5. An increase in waste	☆	★						★	☆	
Historic Sites, Cultural Heritage and Scenic Beauty										
1. Damage to and destruction of historic sites and cultural heritage	★	★	△			△		△	☆	
2. Loss of scenic beauty	★	☆	◎					△	☆	
3. Effects on buried resources		☆				△				
Wildlife and Ecosystems										
1. Change of vegetation	△	☆	△				△			
2. Invasion and propagation of harmful organisms	☆	△								
3. Impact on precious species and indigenous animals	★	☆	△			△	△			
4. Lowering of biological diversity	☆	☆	△			△	△			
5. Disappearance of swamps and peat bogs	△	△						△	△	
6. Deterioration of natural forests	△	△	◎					△		
7. Destruction of coral reefs								△		
Soil										
1. Soil erosion	△	☆	◎	◎		◎	◎			
2. Saltification of soils						◎				
3. Lowering of soil fertility	△	△	△							
4. soil contamination		△						△		

Environmental Items	Developmental Actions									Remarks
	Logging	Forest Road Construction	Forestation	Natural Regeneration	Seedling Production	Forest Conservation	Agroforestry	Timber Processing	Timber Distribution	
Land										
1. Land degradation			◎	◎		◎	◎			
2. Landslides	△	☆		◎		◎	◎			
3. Occurrence of wasteland						◎	◎			
4. Lowering of functions such as protection against wind, prevention of sand shifting, tide control and prevention of fires	☆		◎	◎		◎	◎			
5. Land subsidence		△						△		
Hydrology										
1. Changes in the level of water	△	△	◎	◎	△	△		△		
2. Occurrence of water shortages and floods			◎	◎		◎	◎			
3. Soil and sand deposits	★	★	◎			◎	◎			
4. Siltification	△	△	◎	◎		◎	◎			
t. Rising of the riverbed		△				△				
6. Burying of lakes	△					◎				
Water Quality and Temperature										
1. Water pollution	△	☆	◎	◎		◎		△	△	
2. Changes of water temperature	☆		◎			◎				
Atmosphere										
1. Air pollution			◎	◎				△		
2. Occurrence of carbon dioxide								△		
3. Changes in microclimate	△		◎	◎		◎	◎			
4. Occurrence of noise	△	☆	◎	◎				△	△	

8-5 Conclusion

This study is primarily designed to prepare a master plan for forestation, which is not subject to the Environmental Quality Act (1974) enacted by the Malaysian Government which requires environmental impact assessment.

The forestation plan under this project will be mainly carried out in the form of large-scale industrial plantation and involve the construction and improvement of forest roads. Forestation is expected to have various effects on rivers, inhabitants, economic activity and traffic. Such effects may be minor as long as forestation is small-scale; however, if it covers a large area, the forestation project may have negative effects on various environments even though full-scale environmental assessment is not compulsory. Therefore, if the implementation of this project is expected to entail negative impact on environments, such effects must be identified and countermeasures developed. When planning forestation, improvement measures need to be proposed in order not to exert any adverse effect on the environment.

9. Survey of Farmers in the Areas Covered in the Forestation Project

9-1 Purpose of the Survey

Farmers are important potential workers for forestation project. They are related with the proposed planting sites as shifting cultivators and will be directly affected by environmental changes resulting from forestation. This is why their intentions need to be understood at the planning stage of forestation. It is also necessary to consider how to treat them in planning forestation. Therefore, a survey was carried out by distributing questionnaires to farmers living in the areas covered in this forestation project. The subjects covered in the questionnaire include:

(1) Family structure
(2) Agricultural management
(3) Attitudes toward forestation
(4) Future life

This survey was carried out from January through February 1994 with cooperation from SAFODA's staff. Unusually heavy rain towards the end of 1993 damaged several sections of the access roads to villages in most of mountain areas in northern Sabah. Rain fell incessantly even during the survey and forced the schedule to be changed. Nevertheless, the replies were received from forty-two families and it was therefore identified the problems of farmers living in the mountain areas and their views regarding their way of living.

9-2 Results

1. Tribe

According to the results of the survey, many of the Rungus tribe live in Kudat, while many of the Dusun tribe live in Kota Marudu and Kota Belud. Only a few of the Bajau tribe resulted in saving only a few respondents of this survey.

	Tribe					
	Kudat	Pitas	Kota Marudu	Kota Belud	Total	%
Rungus	11	0	0	0	11	26
Bajau	0	2	0	0	2	5
Dusun	0	2	13	12	27	64
Unknown	0	0	2	0	2	5
Total	11	4	15	12	42	100

2. Family Structure and Annual Income

The average number of members per family is 7.0. Of them, men account for 45% or 3.3 persons, while women account for 54% or 3.9 persons. The number of children is 4.8 persons per family. Of them, schoolchildren are 2.8 persons.

All the respondents possess farmland, and some work as drivers of small buses between villages and towns, teachers or employees.

In terms of annual income, those who have some job other than agriculture earn a much higher income than those who live on agriculture alone. They earn about RM7,670 on an average, which is about 3.5 times as much as agriculture-dependent people, who earn only about RM2,200. All of the respondents in Pitas manage coconut estates and earn an average of RM3,300. The income of farmers in other districts is RM2,200 or less, and these farmers face difficulties in subsisting with such a low income. They therefore wish to increase their incomes by getting another job if the opportunity for employment becomes available.

Family Structure

District	Kudat	Pitas	Kota Marudu	Kota Belud	Average			
Number	7.8	7.3	6.8	6.2	7.0			
Men	3.3	3.5	3.3	3.2	3.3	46%		
Women	4.5	3.8	4.2	3.2	3.9	54%		
Children	5.5	5.3	4.5	3.7	4.8			
Schoolchildren	2.9	4.0	2.6	1.8	2.8			
Age/Husband	43	47	40	40	41.0			
Age/Wife	41	35	34	40	38.0		Annual income (average)	
Agriculture	10	4	13	7	34	83%	RM	2,211
Employment	1	0	0	1			RM	6,362
Teacher	0	0	0	2			RM	11,375
Driver	0	0	1	2	7	17%	RM	6,080
Unknown	0	0	1	0				

Note: 1. Since the average number of family members was calculated on the basis of effective replies, the total is not necessarily consistent with the real number of family members.

2. Self-consumed crops are excluded from the calculation of annual incomes.

3. Agricultural Management

(1) Rice Cultivation

Paddy rice is cultivated mainly in Kota Belud where lots of flat areas exist, and 75% of all farmers possess paddy fields. Of the respondents, half possessed paddy fields. It is obvious that farmers wish to cultivate paddy that harvests more rice than dry fields and is more stable. This is understandable because the rice harvested from paddy fields is nearly three times as much as that obtained from dry fields (shifting cultivation). Judging from their incomes, it seems that they cultivate a limited area to meet their families' consumption rather than to earn a certain income due to the difficulty in operating shifting cultivation and the limited availability of an arable area in one year. In the total income, the share of earnings from paddy cultivation is significantly big as a single crop except in Kudat.

About 60% of all the farmers have not yet registered their lands under shifting cultivation. Whereas none of the farmers in Kota Belud has registered, 60% of the farmers in Kota Marudu have registered.

Farmers think that a proper rotation period of shifting cultivation is generally 3 to 5 years, which seems too short when compared with the traditional crop rotation of 15 to 20 years. This change has probably occurred because there remain only a few suitable sites for shifting cultivation, and a limited area of land must be used in a short rotation. All the respondents replied that the use of the same dry field for rice cultivation was limited to one year.

Paddy Rice Cultivation

District	Kudat	Pitas	Kota Marudu	Kota Belud
Owners (number)	5	1	4	7
(percentage)	55%	25%	27%	58%
Owned Area (acres)	1.7	3.0	2.8	2.3
Harvest (kg/farm)	792	3,600	1,510	1,900
Harvest (kg/acre)	474	1,200	539	826
Self-consumption (kg)	792	1,600	545	634
Sale (kg)	0	2,000	965	1,266
Income (RM)	0	1,400	633	939

Dry Rice Cultivation District	Kudat	Pitas	Kota Marudu	Kota Belud
Owners (number)	11	1	10	5
(percentage)	100%	25%	67%	42%
Owned Area (acres)	3.0	4.0	3.3	3.3
Registered	4	0	7	0
Unregistered	7	1	4	7
Proper Rotation:				
1 Year	0	0	0	5
2 Year	0	0	0	1
3 Year	1	1	2	0
4 Year	0	0	3	0
5 Year	10	0	3	0
10 Year	0	0	0	1
Distance to Field (km)	1.1	0.5	1.9	1.9
Harvest (kg/farm)	865	920	856	1,092
Harvest (kg/acre)	288	230	259	331
Self-consumption (kg)	865	920	361	572
Sale (kg)	0	0	495*	400
Income (RM)	0	0	347	333

Note: 4,950 kg of rice is sold by a single farm which earns RM3,465.

(2) Situation of Idle Farmland

According to the results of the survey, 70% of all the farmers have left their own farmlands as they practice shifting cultivation. This figure includes those who wait for the next cultivating time. Main reasons for this negligence are:

Shortage of labour	12 persons
Waiting for the circulation period	5
Deficient funds	5
Forest fires	3
Too busy	2
Others	4

In most cases where shortage of labour is given as a reason, the farmers have probably begun to cultivate another plot of land and the land with low-productivity is the last to be cultivated or already abandoned. If their low annual income of RM2,200 and their past efforts for cultivation are taken into account, it seems they do not neglect their cleared land just due to a shortage of labour. Even though they admit that they have given up cultivating their land for the time being, they seem to justify their

negligence with a plausible reason in order to claim their rights to the lands in the future. On the other hand, there is one farmer who replied that his land was no longer fertile.

A farmer lost a plantation of *A. mangium* with an area of 30 acres owing to a forest fire. This underscores the significance of countermeasures against forest fires in any forestation project in the future.

Idle Farmland Owners:

District	Kudat	Pitas	Kota Marudu	Kota Belud	Total
Number	9	1	14	5	29
Percentage	82%	25%	93%	42%	70%

(3) Dry Field Farming

Every farm cultivates vegetables and fruits for self-consumption. There are only a few farms which produce crops for sale, such as vegetables and passionfruit. The price of passionfruit, however, is only RM0.20/kg and falling. Thus, the importance of this as a cash crop has also declined. A shortage of flat areas for cultivation is a possible cause of inactive dry field farming.

(4) Livestock and Poultry Farming

Most farms in every district raise poultry as a source of food for their families. Any surplus can be sold in the market. Poultry is one of the important domestic animals in farms. Poultry is, however, not raised on a large-scale with purchased feed, but on a small scale without any feed costs. This is also true of other livestock raising. In this area, livestock is not raised intensively, but in the intervals between farming. In Kota Belud, however, livestock and poultry farming is vigorous and generates a high income as compared with the other districts.

Possession of poultry and livestock:

District		Kudat	Pitas	Kota Marudu	Kota Belud
Fowl	Farms	15	1	12	8
	Number	28	10	16	26
Swine	Farms	4	0	2	0
	Head	5	0	11	0
Cattle	Farms	0	3	0	0
	Head	0	8	0	0
Buffalo	Farms	1	1	1	1
	Head	1	1	1	4
Duck	Farms	0	0	4	0
	Number	0	0	12	0
Goat	Farms	0	0	1	1
	Head	0	0	2	37

(5) Estate Crops

Estate crops refer to coconut, rubber and cocoa in this report. Estate means that a farmer plants one or more of these crops on his own land on a small scale. In particular, coconut estates are extensively distributed everywhere, especially in Kudat, where development began early and coconut plantation prospers. This tendency is also seen in Pitas. Ten out of eleven farms (90%) and four out of four farms (100%), respectively, manage coconut estates in these two districts. In these districts, coconut estates are an important source of income for farmers. As against this, there are only a few coconut estates in Kota Marudu and Kota Belud. For rubber plantations, however, the shares of these districts are as high as 80% and 60%, respectively. Thus, both coconut and rubber provide an important source of income to farmers in this area.

Situation of Estates:

District		Kudat	Pitas	Kota Marudu	Kota Belud
Coconut	Farms	10	4	3	1
	Area (acres)	5.4	8.5	1.7	0.5
	Annual sale (RM/farm)	358	1,750	80	0
Rubber	Farms	1	0	12	7
	Area (acres)	12	0	4.3	5.3
	Annual sale (RM/farm)	0	0	860	1,414
Cocoa	Farms	0	0	0	2
	Area (acres)	0	0	0	4.0
	Annual sale (RM/farm)	0	0	0	750

4. Forestation

(1) Tree Farms

Fourteen out of forty–two respondents possess tree farms. They have planted trees on an average area of 6.2 acres (2.51 ha) per farm. This type of forestation has been carried out with SAFODA's promotion and guidance because all of the farms chose *A. mangium* for forestation. One of the farmers planted trees in 1985, and these trees have reached the cutting age. The planted trees in the other plantations have not yet reached this age. All of these plantation sites were formerly used for cultivation. Farmers are consciously using land effectively and raising income by means of forestation.

The reasons that farmers gave for forestation are:

i. Sale (more income)
ii. Self–consumption: building, agriculture, fuel; a surplus is sold.

Thirty–four (about 81%) of all the respondents are willing to afforest land. The reasons are (1) more income, (2) effective land–use, and (3) self–consumption. Those who are reluctant to afforest land have no land and are also busy with agriculture.

While 23 respondents (about 55%) are willing to afforest idle farmland, 13 (about 31%) are reluctant to do so. The reasons that they gave are as follows:

Attitudes toward Forestation:

Willing		Reluctant	
1) More income	11	1) No interest	1
2) Effective land-use	3	2) Shortage of labour	1
3) Self-consumption	1	3) Unknown	11
4) For future of family	2		
5) Soil improvement	2		
6) Unknown	11		

Note: Plural replies were accepted.

The reason why they wish to afforest their own lands is to increase their incomes. In other words, they intend to increase their incomes by even a little by using their idle land effectively. Most of these farmers refer to *A. mangium* as a species for forestation probably because of SAFODA's guidance. A few farmers listed fast-growing species such as *Paraserianthes falcataria*.

Participation in Forestation:

District	Kudat	Pitas	Kota Marudu	Kota Belud	Total
Experienced (Persons)	1	3	4	6	14
Acres/farm	8.0	13.0	2.3	5.2	6.2
Species	*A. mangium*	*A. mangium*	*A. mangium*	*A. mangium*	*A. mangium*
Willing (Persons)	7	3	13	11	34 (81%)
Reluctant (Persons)	0	1	1	1	3 (7%)
Desired Species	*A. mangium* *P. falcataria* Any hardwood			Unknown	5 (12%)

Planting to Idle Farmland

Willing to forest	7	1	9	6	23 (55%)
Reluctant to forest	2	3	2	6	13 (31%)
				Unknown	6 (14%)

With regard to desired species other than the above-mentioned forestation species, they replied as follows (plural replies):

Desired Fruit Trees:

	Kudat	Pitas	Kota Marudu	Kota Belud	Total
Durian	1	1	9	8	19
Manggo	6	3	4	5	18
Rambutan	0	1	10	3	14
Jack-fruit	6	0	1	2	9
Langsat	1	1	4	2	8
Orange	2	0	3	0	5
Terap	2	0	3	0	5
Soursop	2	0	0	0	2
Banana	1	0	0	3	4

(2) Interest in Forestation

Although 24 respondents replied "I don't know" about the significance of forestation, about 80% of all the respondents wish to work if any forestation project exists. This result suggests that farmers are waiting or looking for job opportunities. In fact, they are willing to work for 214 days a year in order to increase their incomes and secure stable employment. Farmers in Kudat want to work for forestation for 312 days annually. Assuming twenty-five working days a month, they will work for 300 days a year. In this case, this means that they wish to be employed by any forestation project. In other words, they intend to "work for forestation on a regular basis and yet perform agricultural operations in between". They also wish to have wages of about RM17.00 a day, which is higher than that currently received from SAFODA. In other words, they seem to be reluctant to make a livelihood from agriculture.

Desire to Work if a Forestation Project Existed

	Kudat	Pitas	Kota Marudu	Kota Belud	Total
1. Want to Work	7 86%	3 75%	9 60%	11 92%	30 79%
(Reasons)	More income Stable employment Interested				
2. Desired Working Days (per year)	312	230	165	159	Average 214
3. Desired Daily Wage (RM)	11	15	13	25	Average 17

4. Reluctant to work	0	1	3	1

(Reasons) Elderly
Deficient time
Developing own land

5. Livelihood

To the question "Are you satisfied with your present life?", five farmers gave no reply. All the remaining farmers replied, "No". About "a future style of living", most farmers replied "better living" or "modern living". Some replied "a job for stable earnings".

In short, they wish to live a more modern life than the present one by getting a job with a higher income than agriculture.

To the question "Will you participate in a settlement project, if any?", 34 respondents (about 81%) replied, "Yes", while 5 (about 12%) replied, "No". Farmers replying in the affirmative gave reasons such as (1) improvement in living, and (2) expectation of government's assistance. Farmers replying negatively stated that they (1) are not interested in such projects, or (2) prefer independence.

The former seem to expect a better living with more assistance from the government. Their replies suggest no anxiety about the present living customs or styles (including religion). Such anxiety is, however, reflected to some extent in the replies from those who prefer independence. They were included in the five persons replying "No" above.

Participation in Settlement:

	Kudat	Pitas	Kota Marudu	Kota Belud	Total
Willing	10	4	12	8	34 (81%)
Reluctant	0	0	2	3	5 (12%)
Unknown	1	0	1	1	3 (7%)

6. Expectations for Administration

With regard to "expectations from the administration", a majority of respondents expect subsidies for their living or agriculture. Expected early government measures include the repair and improvement of roads destroyed by the recent heavy rains and floods.

If these results are to be interpreted superficially, farmers seem to easily demand government assistance. These result can, however, also reflect the fact that farmers

cannot make a living without public assistance. In this situation, it is certain that any forestation project will make a great contribution to the region.

Expectations of Government

	Kudat	Pitas	Kota Marudu	Kota Belud	Total
Assistance:					
Living	3	2	2	6	13
Agriculture	7	1	7	5	20
Funds	4	0	0	0	4
Technical Assistance	0	0	0	2	2
Expansion of Job Opportunities	3	0	0	0	3
Construction & Repair of Roads	0	3	4	0	7
Active Granting of Rights to Land	0	0	1	0	1

9-3 Conclusion

It is somewhat doubtful if this survey achieved the initial purpose of understanding farmers' intentions because of the small number of respondents. The results, however, outlined the present condition of agriculture, farmers' expectations for forestation and their views on their way of life.

Most farmers who live in mountain areas have been making their living by shifting cultivation. They have their own culture including customs, which has provided them with a basis for living. Their preference for children, however, caused a rapid increase in population. As a result, the deficiency of arable land inherited by their children became serious. Children who could not receive any land went to remote areas in the mountains, where they felled natural forests for cultivation. The patchwork clearance of land is a reality in this area. Abandoned exhausted land is scattered in this area. This is also proved by the existence of many farmers who have idle untended land as shown in the survey. Thus, farmers are badly off as a result of having small amounts of arable land. This is underscored by their low cash income and their hope for employment.

An important point made clear by the survey is that farmers intend to work in order to increase their incomes and stabilize their livelihoods if any opportunity for employment, including forestation, becomes available. If so, they are not reluctant to give a low priority to agriculture. They have already been driven into a situation in which they cannot help seeking sources of income other than agriculture in order to relieve themselves from poverty. They are, therefore, willing to adapt their living styles to employment if any job opportunities, including but not limited to forestation, become available in this area. If this happens, they will not have to secure arable land by clearing natural forests. The results of the survey show how important regional

development is in terms of improvement of livelihood, forest protection and environmental conservation. This is an urgent problem to be considered immediately. Therefore, it is the conclusion of the survey that a plan must be drawn up at once for the prompt implementation of this project from the standpoint of the farmers as well as of industrial plantation, social forestry and environmental conservation.

III. Proposed Plan for Forestation

1. Forestation and Its Effects

1-1 Necessity of Forestation in Northern Sabah State

Malaysia has achieved remarkable economic development and high economic growth by adopting its own economic policies since independence in 1957, stabilizing the political system and introduction of foreign capital. As a result, the economy has shifted from primary to manufacturing industries. For the 2020 Vision, Malaysia has adopted policies for further economic and social development with the intention of joining advanced countries by 2020. This vision is Malaysia's national plan, and the whole nation is making every effort to realize the goal.

According to Malaysia's new economic plan (NDP, OPP2), Malaysia aims at industrialization based on by the private sector driven exports. The percentage of exports to GDP is to be raised from 60.4% in 1990 to 81.8% in 2000. Average economic growth of 7.0% is to forecast for the 1990s (Nomura Research Institute, 1993).

In Sabah State, efforts will also be focused on economic and social development within the same vision. However, judging from its geographical location and past economic development, Sabah has unfavourable position to develop manufacturing, finance and service industries up to the level comparable to the Peninsula Malaysia. The distance from Singapore is disadvantageous to the electronic industry in which Malaysia is strong. However, an industry is needed as a locomotive for the entire development of the state's economy.

Of the resources of Sabah, land, especially extensive areas of forests attracts attention. It is important to make land-use more sophisticated to improve the productivity of grasslands and shrubs on state-owned land with low productivity. As a means of developing the state's economy, these vast forests should be under forestry management in a sophisticated manner, which will lead to develop wood processing industries as downstream industries.

When considering the sophisticated use of forests, being renewable resources, their functions for the public interest should be taken into consideration. If young trees of useful species survive without damage, they are capable of growing to marketable size in the future. The existence of forests makes a contribution to the conservation of the natural environment, including wildlife species. If these factors are taken into consideration, land improvement will be needed where the maintenance of the present vegetation may create a problem in using forest resources. Less-productive low forests, shrubs and grasslands can be considered for improvement in the study area. Appropriate measures for improvement are to apply enrichment planting method for less-productive low forests and forestation by clear cutting shrubs and grasslands.

The economic development of any region cannot be achieved only by government policies. The local people's efforts are essential. In other words, the local people must be willing to improve their economic condition, and the government will reflect their enthusiasm in its policies. As an example of their effort, it is notable that the inhabitants in the coverage of this study has been participating in the plantation of *Acacia mangium*. They think the plantation of *A. mangium*

could be a source of revenue in the future. They accept SAFODA's extension activity to plant *A. mangium*.

The output of logs from natural forests in Sabah has declined. According to Rahim Sulaiman, a large part of commercial forests has already been selectively cut. Harvest from state-owned forests is too small to meet the needs of wood processing industries in the near future. Therefore, he stresses the necessity of log supply from man-made forests. Suitable species for planting such as *A. mangium, Paraserianthes falcataria* and *Gmelina arborea* are recommended (Rahim Sulaiman, 1993).

Logs produced from man-made forests are small in diameter and cheap, and cannot meet long-distance transportation from economic point of view. Wood processing industries need to process these logs near the log production area. Therefore, it is recommended that the government should give incentives for developing a timber industrial park near the supply area of logs from man-made forests.

The production of small-diameter logs and processed wood products cannot run without demand. Conversely, the market cannot exist without materials for sale, and no demand cannot be met without the production of materials. As the production of large-diameter logs from natural forests decreases, it is inevitable that logs from man-made forests should be used in the future. The first step to forest rehabilitation in northern Sabah is to plant trees and produce logs. The sale or processing of produced logs will probably play a role as a locomotive for developing the local economy.

1-2 Forests and their Utilization

Generally speaking, land-use in agriculture is more productive than in forestry, and the agricultural use of land can support more people in the same area if highly fertile. However, when using land with very low fertility to agricultural purpose, investment is excessive and output is small. If land is steep, soil is likely to be eroded by heavy rain and lose its fertility even though originally fertile. Lost nutrients from the soil will flow into the sea and never be used for agriculture. Soil erosion is a serious waste of resources.

On the state-owned land within the study area, shifting cultivation has been carried out on quite steep slopes, and erosion as mentioned above has occurred. Shifting cultivation is based on the local culture and cannot be absolutely rejected. Nevertheless, it is critical to minimize the loss of resources resulting from such action and recover the lost productivity of land. The traditional method for natural recovery is to return the land whose fertility declined after cultivation to a forest and leave it for a certain period.

The state-owned land covered in this study has partially been transformed into grassland whose fertility cannot be easily recovered. There are also poor stands covered with intolerant shrubs which may be easily transformed into grassland after fire. Low stands contain only a few young trees of large-diameter species. Some stands are exposed to the risk of a forest fire in seasons when the forest floor dries. If these stands are left unattended, a forest fire is likely to occur. If they are damaged by fire several times, they will be transformed into grassland with low fertility. However, if tree plantation is applied in these