4.4 POTENTIAL AND CONSTRAINTS

4.4.1 Development Potential

(1) Land Potential

Agriculture depends mainly on climate, especially the amount and distribution of rainfall; topography, and soil fertility.[25] Although West and Central Kalimantan together have a total area of 300,000 km^2, their agricultural potential is limited by a long rainy season, slope, and low soil fertility. A large part of the study area has seven to nine consecutive wet months and fewer than two dry months each year, which is unfavorable for the cultivation of many crops, especially rice which requires a dry season for ripening and harvesting. More than 75% of the study area lies below 100 m in altitude, with flat plains and swamps along the coasts which are characterized by poor drainage. Many soils have low fertility due to the parent materials consisting predominantly of sedimentary rocks, shale, and sandstone and are acidic due to weathering and leaching.

Table 4.4.1 indicates the agricultural land potential of the study area based on the RePPProT, which evaluated land suitability for agriculture and transmigration in Kalimantan on the basis of such criteria as hydrology and climate (groundwater quality, risks of inundation, rainfall, temperature, and wind), soils and nutrients (physical and chemical characteristics), and topography (altitude, slope, elevation, and fragmentation). While land suitable for agriculture, denoted as "arable land" in the table, covers 43% of the study area, land suitable for annual crops and wetland paddy account for only 10% of the total. Most of the remaining 57% of the total area is unarable, consisting of lowland peat soils, acid sulfate soils, sandstone, steep slope lands, and coastal sands.

In West Kalimantan, however, a substantial part of the arable land, 47% of the total area, has been presumably converted to agricultural use as the total area under agricultural use had already reached 41% of the province's total area in 1995 (Table 4.2.4). To the knowledge of the study team, most of the priority areas recommended by the RePPProT in the late 1980s for the implementation of transmigration programs have also been developed into agricultural lands. This implies that there is not much potential left for large-scale land development for agriculture, except by converting forests into agricultural lands, since the RePPProT's Recommended Development Areas (RDAs) are required to have an average gross area of 15,000-20,000 ha for the state-sponsored transmigration program. The extensive development of oil palm plantations in recent years further limits the possibility for agricultural extensification in the province.

[25] This paragraph largely depends on MacKinnon, et al., op. cit., pp. 531-533.

Table 4.4.1 Agricultural Land Potential

Zone	Legend	Characteristics	Original Vegetation	Current Use	West Kalimantan		Central Kalimantan	
					(km^2)	(%)	(km^2)	(%)
1	Arable land for all kinds of crops	Flat and fertile alluvial soil	Lowland dipterocarp	Annual crops (paddy, vege's)	1,705	1	3,349	2
2	Arable land except wetland paddy	Flat and fertile soil	Lowland dipterocarp	Perennial crops, HPH area	5,244	4	6,125	4
3	Arable land for tree crops	Rolling (9-25%)	Lowland dipterocarp	Perennial crops, HPH area	16,114	11	23,336	15
4	Arable land for tree crops except oil palm	Steep slope (16-40%)	Lowland dipterocarp	Perennial crops, HPH area	40,016	27	17,511	11
5	Arable land for wetland paddy	Fertile alluvial soil, poor drainage	Fresh water swamp forest	Paddy, coconut	6,312	4	8,802	6
6	Unarable land	Peat swamp	Peat swamp forest	HPH area, paddy, grass	22,616	15	45,536	30
7	Unarable land	Acid sulfate soil	Mangrove	Protection area	2,126	1	1,657	1
8	Unarable land	Sandstone	Heath forest	HPH area	11,402	8	18,769	12
9	Unarable land	Very steep slope (40%<)	Mountain forest	HPH area, national parks	39,208	27	22,908	15
10	Unarable land	Coastal sand		Coast	228	0	813	1
			Sub-total		144,743	99	147,993	96
			River		1,549	1	6,114	4
			Total		146,292	100	154,107	100

Source: Prepared by the study team by re-categorizing the land systems identified by the Regional Physical Planning Programme for Transmigration (RePPProT).

Central Kalimantan seems to have more potential for extensification. While arable land covers 38% of the total area (Table 4.4.1), the area under agricultural use was 12% in 1995 (Table 4.2.4), suggesting that there still remains some 4 million ha for extensification. However, the on-going land development for oil palm plantations, as well as the PLG project in the district of Kapuas, are rapidly taking up the remaining arable land. Furthermore, the RePPProT project has found that the province's land is generally characterized as "infertile, fragile and erodible soils, deep peat swamps, and steep slopes" and thus concluded that "the general arable/tree crop transmigration model is not appropriate" even in the interior plains and hills which are considered the most suitable for tree crop production.

(2) Potential for Intensification

As discussed in the previous sections, the existing agricultural land use is generally extensive in the two provinces and seems to offer some room for increasing agricultural production through intensification. In lowland areas, the irrigated wetland accounts only for 13% and 19% in West and Central Kalimantan, respectively and the rates of multiple cropping account for 16% in both provinces (Table 4.2.8). The construction of irrigation facilities and improvement of existing irrigation systems, together with their better operation and maintenance, will expand the planted area and raise the yields per hectare of wetland paddy.

The wetland developed in tidal swamps (*pasang surut*) and "other" wetland, a large part of which seems to be the wetland developed in inland swamps (*lebak* or *payo*), account for around 60% of the total wetland area in the respective provinces. However, these two types of wetlands may have a limited possibility of increasing the crop intensity and the yields even with some drainage and water control systems and the introduction of better planting materials. The farming systems approach will be necessary to improve cropping patterns with appropriate on-farm land development.

The dryland areas would seem to have a higher potential for agriculture as the Agricultural Survey indicates that there is more than 1 million ha of seemingly unutilized or underutilized lands such as "shifting cultivation" (*lahan ladang* or *huma*), "grass land," "swamps not cultivated," and "temporary fallow land" in the respective provinces. However, experts contend that agricultural production in Kalimantan has long been sustained by the systems developed to overcome the problems related to poor soils, e.g., swidden farming that maintains soil fertility through the practice of a short period of cultivation followed by a long period of fallow and the traditional Banjarese system that uses small-scale, distinct land reclamation and multiple cropping methods in tidal peat swamps to prevent the soils from turning into unproductive acid sulfate soils.[26] These agricultural systems have been supporting a major part of the study area's population through the careful utilization of lands that would be otherwise closed to agriculture.

Since a total area of some 1.5 million ha has been allocated for tree crop plantation in each province, it seems that most of the arable lands in upland areas that can become more productive under intensive crop care with extensive fertilizer treatment will be converted to such plantations soon or later. The remaining few million ha of upland areas may be better cultivated in some forms of the traditional extensive systems. However, there appears to be still some room for increasing productivity, especially for smallholder tree crops such as rubber, cocoa, and pepper, in those upland areas with the use of new, improved planting materials, better plant protection, and fertilizer application.

(3) Potential for Technological Innovation

Almost all of the modern technologies used in the study area, such as high-yielding planting materials (e.g., seeds, seedlings, semen, etc.), fertilizers and chemicals, agricultural machinery, designs for irrigation systems, farming systems, and so forth, have been developed and produced either in other regions of the country or foreign countries. For example, high-yielding clones of rubber and oil palm seeds come from some private estates in Sumatra and the high-yielding rice variety (IR66) cultivated in the PLG project area was bred in Bogor, Java, though

[26] MacKinnon, et al. discuss the ecological problems of Kalimantan agriculture and cite the agricultural systems evolved against those problems from previous research done by many other ecologists, agronomists, economists, etc. See ibid.

it is supposed to be suitable for the acid peat soils. The irrigation systems are based on the designs developed by the Bogor Institute of Agriculture or the Gadja Mada University in Yogyakarta. It is, however, crucial to apply technologies developed to meet the specific conditions of the study area in order to realize the maximum potential of the land.

Under the existing conditions, the public sector seems to function to only a limited extent as a provider of new technologies appropriate for agricultural production in the study area. There is an Assessment Institute for Agricultural Technology (LPTP) in Pontianak, West Kalimantan, which is under the Agency for Agricultural Research and Development (AARD) of the Ministry of Agriculture, but its activities are confined to evaluating technologies developed somewhere else, rather than developing varieties and farming systems suitable for the study area. The agricultural extension services of the two provinces are also not very effective in disseminating appropriate technologies due partly to insufficient activities in research and development and a weak linkage between research and extension.

Some on-farm research has been carried out in the joint effort of international research institutes and the private sector. One example is the Smallholder Rubber Agroforestry Project (SRAP) implemented in West Kalimantan by the International Center for Research on Agroforestry (ICRAF), the Center of International Cooperation in Agronomic Research for Development (CIRAD) of France, and the Rubber Association of Indonesia (GAPKINDO) and funded by GAPKINDO and the U.S. Agency for International Development (USAID). The project is conducting on-farm experimentation with a participatory approach for the purpose of improving the existing smallholder rubber cultivation systems by the introduction of high-yielding clones and a low to medium input while maintaining the relatively high level of return to labor. The preliminary results of the project indicate that there is a possibility of improving the labor productivity, as well as land productivity, of smallholder rubber cultivation.[27]

There is some room for enhancing the productivity of the study area's agriculture through technological innovations, but it requires government support, not only for strengthening the research activities of the public sector but also for facilitating the efforts of farmers and the private sector.

(4) Potential for Marketing

There appears to be high potential for marketing a variety of agricultural products within and outside the study area judging from the following conditions:

[27] Eric Penot and Gede Wibawa, "Complex Rubber Agroforestry Systems in Indonesia: An Alternative to Low Productivity of Jungle Rubber Conserving Agroforestry Practices and Benefits," a paper presented at IRRDB International Conference, Beruwala, Sri Lanka, November 1996.

1) The study area is deficient in food, rice in particular, and the demand is growing (Table 4.4.2).

2) Demand for other food products, such as vegetables, fruits, meat , eggs, and milk, is growing and expected to grow in the future along with income growth and urbanization.

3) There exist markets for fresh agricultural products (e.g., vegetables and fruits) in Java and surrounding countries, i.e., Singapore and Malaysia.

4) World demands for natural rubber and palm oil are steadily growing and some processing industries based on these products are either operating or planned to operate in the area.

5) New demand for food will be created on Natuna Island, though the feasibility study for its development is still in progress.

Table 4.4.2 Estimates of Supply and Demand for Rice in the Study Area in 2018
(Harvested Area based on the Trends of 1969-1995)

	West Kalimantan*		Central Kalimantan 1**		Central Kalimantan 2***	
	Wetland	Dryland	Wetland	Dryland	Wetland	Dryland
Area Harvested (ha)	240,000	107,500	136,000	72,000	286,000	72,000
Yield (ton/ha)	3.5	2.0	3.0	2.0	2.5	2.0
Production of Paddy (ton)	840,000	215,000	408,000	144,000	715,000	144,000
Supply of Rice (ton)	546,000	139,750	265,200	93,600	464,750	93,600
Total Supply of Rice (ton)	685,750		358,800		558,350	
Per Capita Rice Consumption (kg)	160		160		160	
Population (1,000)	5,500		2,400		3,100	
Demand for Rice (ton)	880,000		384,000		496,000	
Surplus/Deficit (ton)	-194,250		-25,200		62,350	
Rate of Self-sufficiency (%)	77.93		93.44		112.57	

Notes: *) The population growth of the province is assumed to follow the growth trend for 1980-1995.
**) The population growth of the province is assumed to follow the growth trend for 1980-1995 and the paddy area to be expanded by PLG is not taken into account.
***) The population growth of the province is estimated based on the Spatial Plan (RTRW) and the potential area to be expanded by PLG is included in the wetland paddy area harvested for 2018.
For the estimation, it is assumed:
1) Per capita rice consumption is 160 kg per annum in 2018.
2) The average rice milling rate is 65%.
3) The potential paddy harvested area of PLG (the one-million hectare project) is 150,000 ha.

4.4.2 Development Constraints

(1) Natural Constraints

Although the study area has a total area of 300,000 km^2, mostly lying below 100 m in altitude, and would seem to have enormous potential for agriculture, its agricultural production is largely constrained by the low fertility of soils, as well as the amount and distribution of rainfall. According to the land systems identified by the RePPProT, almost half of the total area is

unsuitable for agriculture in each province. Those unsuitable land systems consist of flooded alluvial plains, deep peat or tidal swamps, infertile sandy terraces, steep-sided hills, and mountains with easily eroded or rocky soils.[28] They are "too expensive or too difficult to develop" for the models of transmigration settlement, i.e., wetland paddy and tree crops under the PIR scheme or commercial management.[29] Even those lands found to be suitable for the transmigration models have low to moderate soil fertility and erodible slopes, require flood control and drainage, and are therefore of "marginal or at best moderate quality."

It should be specially noted that the PLG project site is located in tidal swamp lands which have potentially acid sulfate soils under the surface layer of peat or alluvial soils. These soils require substantial measures for improving their characteristics, the careful selection of suitable crops, and the development of appropriate farming systems, and some would even be better left untouched. The RePPProT has recommended that "no agricultural development of peat deeper than 50 cm should be permitted unless the economic costs can be fully justified."[30]

Attention must also be paid to climatic constraints on agricultural production. The study area has only a few months with rainfall of less than 200 mm. The short dry season is unfavorable for the cultivation of some crops, especially those which require a dry season for flowering and fruiting. On the other hand ,the wet conditions throughout the year, together with the relatively constant temperature around 30°C, are often favorable for the propagation of diseases and pests. The heavy rains during the rainy season tend to cause soil erosion in hilly, undulating, and rolling areas covered by less vegetation. Agricultural development in these areas require some measures against the acceleration of soil erosion, such as terracing, contour tillage, and permanent crop cover.

(2) Infrastructure Constraints

Another serious constraint to agricultural development in the study area is inadequate infrastructure, especially irrigation systems and road networks. As mentioned above, wet lands equipped with some form of irrigation are only 13% and 19% of the total wetland area in West and Central Kalimantan, respectively. Technical irrigation is almost non-existent in the former province. Although it will require considerably large investments, better water resources management is a key to increase paddy production to meet the growing demand for rice in the study area. However, locations for the development of irrigated agriculture must be carefully selected from such points of view as the effective and efficient use of budgets and

[28] The Regional Physical Planning Programme for Transmigration (RePPProT), Review of Phase 1B Results: Central Kalimantan, Direktorat Bina Program, Direktorat Jenderal Penyiapan Pemukiman, Departemen Transmigrasi, 1985; and (RePPProT), Review of Phase 1 Results: West Kalimantan, Direktorat Bina Program, Direktorat Jenderal Penyiapan Pemukiman, Departemen Transmigrasi, 1988.
[29] Ibid., p. 4 and p. 29, respectively.
[30] Ibid. (for Central Kalimantan), p. 7.

environmental and economic sustainability. While its objective is to serve the national goal of rice self-sufficiency, the PLG project, for which extensive irrigation systems are currently being constructed over deep peat soils, is unlikely to be sustained without continuous massive investment.

Road networks are poorly developed in the study area, reflecting its settlement patterns along rivers and the associated importance of river transport. The density of national and provincial roads in the study area is 0.031 km/km^2, far below the national average of 0.126 km/km^2.[31] The densities of district-level and subdistrict-level roads are also significantly low, indicating inadequate linkages between rural areas and urban centers. The traditional transport modes have been serving the marketing of output as the agricultural production for cash income has been oriented to particular markets (e.g., rubber, rattan, tengkawang, etc.) and the remaining part of agriculture is basically for subsistence. However, the on-going transformation of, as well as policy emphasis on, agriculture towards a commercial and market-oriented one necessitates the development of more dense road networks.

The limited availability of electricity and telecommunication services is also a constraint to the development of market-oriented agriculture in the study area. Together with the underdeveloped road transport, the shortage of infrastructure of these kinds hinders the acquisition of market information and new technologies and thus the expansion of market-oriented production by smallholder farmers. Although many private companies are already entering the plantation industry in the study area, the inadequacy of rural infrastructure raises the costs of production and marketing and has been a serious constraint to the promotion of private investment in large-scale plantation and agroindustry.

(3) Institutional Constraints

The inadequacy of institutional support, in terms of both quantity and quality, is a crucial constraint to the development of agriculture in the study area. Effective and efficient support services, such as agricultural research and extension, rural credit, market information, and quality and safety standardization for agricultural products, can help smallholder farmers to find and to grow the most suitable crops for their lands, to seize the growing market opportunities for their products, and thus to raise their income. Since the study area has many lands which are environmentally vulnerable, hilly and mountainous areas and peat swamp areas in particular, it is important to develop and provide sustainable farming technologies in order to maintain and/or increase the agricultural production.

[31] For the details of the existing conditions of roads and road transport in the study area, see Chapter 10 Transportation.

Furthermore, the study area lacks human resources that meet the new demand for labor force emerging in the study area. For example, many oil palm plantation companies are recruiting their managerial and technical staff mainly in Java and Sumatra. Most of the farmers are also poorly equipped with knowledge and techniques necessary for market-oriented agriculture. The inadequacy of human resources may be even worse in the public sector than in the private sector in that it is usually more difficult to hire workers with certain types of skills according to the need. Human resources development (i.e., education and training, including programs for farmers), as well as institutional capacity building, is probably the most important key to realizing the existing agricultural potential of the study area since the course of agricultural development is largely determined by the decisions and actions of the people involved therein.

The basic sectoral strategy for achieving such national and regional objectives as food self-sufficiency, economic growth, and social stability is to exploit the potential by increasing and diversifying the region's agricultural production while sustaining the existing systems which have evolved under the particular ecological and socio-economic conditions of the study area. Specific strategies for each area, i.e., upland areas with oil palm plantation development, upland areas without it, and lowland areas, are as discussed in 4.1 Sectoral Development Plan.

CHAPTER 5

FORESTRY

CHAPTER 5 FORESTRY

5.1 ISSUES

The Study Area is richly endowed with forest resources and one of the largest areas of tropical forests in Indonesia. The Area contributed about 30 % of the total log production of the whole country during 1991-1995 and its economy derives major benefits from this resource.

Forest resources, however, are being rapidly degraded in the study area, with rapid deforestation as a result of logging, land clearance for agriculture, plantations, human settlement and transmigration schemes and forest fires. The degradation has affected the regional economy through the stagnation of the plywood industry, which is the main industry in the area.

Especially, forest fires and illegal logging such as cutting in excess of the sustainable yield and immature trees have become immediate problems because they prevent future log production by natural regeneration.

The plywood industry is the greatest user of log materials from forests in the area. The study area produced 20 percent of the total national plywood production in 1990/91. The plywood production has been decreasing since 1991/92, decreasing by about 30 % in 1995/96. However, plywood production in the area is far below the installed capacity although log production is much more than the installed capacity of the industry because more than 50 % of the log production in Central Kalimantan is exported to other provinces

The Timber Estate Development and Industrial Forest Plantations (HTI) have been established since 1986 to enhance the productivity of unproductive forest land to produce raw materials for the wood industry. The total land actually planted by 1996 was 39 thousand hectors, which accounted for about 50 % of target area. The main spices are Acasia spp. for pulp. Therefore, it is impossible that the production from HTI is a substitute for HPH to sustain the existing wood based industry. HTIs in the study area, however, have not been harvested yet and most HTIs in West Kalimantan were burned by forest fires in 1997.

Although forests in the area are now mainly valued for their timber, they also provide many other goods and services of benefit to local communities. With deteriorating forest resources non-timber products have decreased and future business chances by extinction of biodiversity also are going to be lost.

5.2 OBJECTIVES

Main objectives are to sustain forest resources in the following aspects.

- Sustain forest products (timber and nontimber products).
- Sustain forest industries for regional economy.
- Protect local culture.

5.3 STRATEGIES

The main strategies to achieve the objectives are:

(1) Recover Logged Over Forest by Natural Regeneration

Natural timber resources are very important to the forest industry. Commercially valuable forest areas are changing to estates by clear cutting and timber resources for plywood industry is going to extinct. Therefore, less deteriorated logged over forests in the areas should be recovered by natural regeneration to sustain materials for the forest industry.

(2) Extension of the Existing Rotation Cycle

Longer logging cycles will result in sustainable forest regeneration and forest composition, with associated floral and faunal diversity, as it takes a long rotation cycle (more than fifty years) to allow forests to generate naturally. In fact, it is doubtful if the Indonesian rotation cycle is long enough to allow for the regeneration of commercially valuable trees. Therefore, it is recommended that the logged-over areas, especially in unsuitable areas for agriculture, should extended the 35 years rotation cycle (In Sabah and the Philippines the cutting cycle has been established at 40 years) before being logged again.

(3) Enforce Existing Regulations on Selective Logging

The following regulations on selective logging should be enforced.

- No more than 10 % of the timber should be taken from concession areas.
- Timber less than 50 cm in diameter should be left standing.

This should be strictly observed especially in the commercially valuable forest areas.

(4) Sustain Plywood Industry in the Study Area and Put a Trade Embargo on Unprocessed Logs to Other Provinces.

It is recommended that the wood based factories in Central Kalimantan should be given priority in the supply of materials logged in the province because the production of plywood industries in the area is below the installed capacity in spite of having enough production materials in the area.

However, more than 50 percent of the log production is exported to other provinces. Exportation of unprocessed plywood materials should be ban to other provinces to sustain the plywood industry in the study area.

(5) Transfer Property Rights of Forest

The property rights of logged over forest should be transferred from the ministry of forest to local government or local communities for conservation and effective use of forest resources and for conservation of the local culture.

(6) Prepare Comprehensive Countermeasures for Forest Fires

Comprehensive countermeasures for forest fires, fire prevention, prescribed fires and fire suppression, should be applied.

(7) Decrease Log Production to a Sustainable Level.

The government estimated the sustainable yield of log production by a province in Replita V as 1.4 million m3/year in West Kalimantan and 3.8 in Central Kalimantan. The production in both provinces are exceeded by about 1 million m3/year of the sustainable yield. These may largely contribute to the recent reduction of log production by HPH. Therefore, log production should be decreased to a sustainable level.

(8) Establish a Comprehensive Applied Institute

A comprehensive applied research institute should be established to study bio and forest resources for both conservation and utilization. Plantation and other development will create huge impacts on the ecosystem in the region. If development continues at the existing rate, many species and ecosystems will become extinct.

5.4 PRIORITY PROJECT FOR THE SECTOR PLAN

5.4.1 Natural Forest Resource Management Project

(1) Justification of the study

Forest production in the area has contributed much to not only the regional economy but also the national economy. The study area produced 155 million cubic meters of logs for the past 24 years, from 1973 to 1996, which accounts for 27 % of total log production in Indonesia for the same period.

However, the production has been decreasing sharply since the 1980's and has caused material shortages for the plywood industry in the area. The degradation of forest resources in the study area is caused by rapid deforestation as a result of illegal logging, land clearance for agriculture and forest fires etc.

Forests in the area play important roles not only in the regional economy but also in sustaining the biodiversity and regional environment.

(2) Objectives

The major objectives of the Study are to prepare a forest fire management plan as follows:

- To prepare forest resources management strategies.
- To evaluate existing forest resources to estimate timber production in the future.
- To identify legal logged over forests (less deteriorated logged over forest) for conservation of future forest resources.
- To prepare a natural regeneration plan of the forest.
- To prepare a timber production plan for the sustainable use of forest resources based on the economic, sociocultural and environmental points of view.

5.4.2 Forest Fire Disaster Management Project in West Kalimantan

(1) Justification of the study

Forest fires in Indonesia have caused an enormous economic loss: they evoke damage and loss of the timber and non-timber forest resources and crops such as rubber and oil palm.

Forest fires are also major ecological events with profound and lasting impacts on the environment, vegetation and wildlife.

During a forest fire, smoke covers the surrounding area and causes massive pollution problems with haze reducing visibility and damaging public health.

West Kalimantan shares 13 % of total area burned forest in Indonesia in 1997 and was the province suffering most from the fire in that area. The immediate cause of the fires was a combination of severe drought and land use change by logging and land reclamation for agriculture.

(2) Objectives

The major objectives of the Study are to prepare forest fire management plan as follows:

- To prepare forest fire management strategies.
- To prepare a fire tolerant land use plan in harmony with soil, economic and sociocultural conditions.
- To prepare hazard maps for forest fires including information on the danger of fires and previously burned areas etc.
- To identify economic, sociocultural and environmentally valuable areas to be protected against fires and to prepare countermeasures for preventing the area.

5.5 OTHER PROGRAMS AND PROJECTS FOR THE SECTOR PLAN

(1) Forest Rights Transfer Program

To conserve forest resources by the local government or by community property rights of logged over forest phased in transfer from the ministry of forest to the local government or communities.

(2) Forest Management Program

Improvement of forest organizations and personnel to be closely watched for illegal logging.

(3) Establish a Comprehensive Applied Institute

5.6 EXISTING CONDITIONS

5.6.1 Forest Production

(1) Role of Forest in the Regional Economy

The Study Area is richly endowed with forests resources and one of the largest areas of tropical forest in Indonesia. Its economy derives major benefits from this resource. Central Kalimantan especially depends on this sector with forest related industry shares at 35 % of the GRDP (see Table 5.6.1). Forestry products of West and Central Kalimantan also play important role in export sharing more than 70 % of the total export value.

Table 5.6.1 Role of Forestry in the Regional Economy

	West Kalimantan*	Central Kalimantan**
1. Share in GPP(%)		
Forestry	8	23
Wood Product and Other Forestry Product	13	12
2. Share in Export Value		
Timber	71	79***

Source: *:Kalimantan Barat Dalam Angka 1995
**:Pendapatan Regional Kalimantan Tangah 1993 - 1995
***:Kalimantan Tengah Dalam Angka 1995

(2) Log Production

Timber exploitation has a long history in the Study Area. Starting in 1904, a number of timber concessions were granted in the upper Barito. By 1914, eighty per cent of the timber floating down the Barito was from dipterocarps.

Large-scale cutting of timber in Kalimantan began in 1967 when all Indonesian Forests were declared the property of the state. Faced with severe economic problems, the government initiated new policies based heavily on foreign investment and awarded generous timber concessions to foreign companies eager to exploit the vast stands of tropical hardwoods.

As world demand for cheap tropical hardwood grew, log production in the Study Area was increased in the later half of 1980's, with the main additions in Central Kalimantan . This was accompanied by an important change in logging methods in the 1970's, with the outlawing of small-scale harvesting in favor of mechanization.

The Study Area contributed about 30 % of the total log production to the whole country during 1991- 1995(see table 5.6.2). With decreasing log production of the area in recent years, the

contribution has been decreased, showing 24 % in 1994 and 25 % in 1995. The reduction during the years is much more sever in West Kalimantan than in Central Kalimantan; the production of West Kalimantan in 1995 as almost half of the production of 1992.

The government estimated the sustainable yield of log production by province in Replita V as 1.4 million m3 /year in West Kalimantan and 3.8 in Central Kalimantan. The production in both provinces exceed about 1 million m3 /year of the sustainable yield.

The production declined in 1995 may be caused by excessive cutting.

In the Study Area, especially in West Kalimantan, extensive logging has occurred in the valuable lowland and hill dipterocarp forests, in large areas of peat and freshwater swamp forests. Limestone forests generally have less commercial value, as do most kerangas forests. According to our field survey in the north of Central Kalimantan, however, most limestone areas were exploited. Mangrove forests, designated as protected forests, have been decreasing because of being used for chipwood, low materials for rayon and local building materials. Montane forests are also designated as protected forests to conserve soils and protect hydrological function because of steep slope and weak soil structures.

Table 5.6.3 shows log production in the Study Area which is harvested from natural forests.

Table 5.6.2 Log Production

	Unit	1991/92	1992/93	1993/94	1994/95	1995/96
West Kalimantan	$1000m^3$	1,967	2,414	1,950	1,407	1,676
	%	8	9	7	6	7
Central Kalimantan	$1000m^3$	4,749	4,808	4,592	4,681	5,436
	%	20	18	17	19	22
Study Area	$1000m^3$	6,716	7,222	6,542	6,088	7,111
	%	28	28	24	25	29
Whole Kalimantan	$1000m^3$	12,413	13,481	11,478	11,143	12,073
	%	52	52	43	46	49
Whole Country	$1000m^3$	23,810	26,049	26,848	24,027	24,850
	%	100	100	100	100	100

Source : Directorate General of Forest Utilization

Table 5.6.3 Log Production by Source

	Unit	Natural Forest		Forest Plant.		Public Forest	Total
		PKT	IPK	Inhutani	HTI		
West Kalimantan	m^3	1,394,906	280,897	0	0	48	1,67,851
	%	83	17	0	0	0	100
Central Kalimantan	m^3	4,542,604	886,967	0	0	5,985	5,435,556
	%	84	16	0	0	0	100
Whole Kalimantan	m^3	9,725,675	2,340,952	0	0	6,033	12,072,661
	%	81	19	0	0	0	100
Whole Country	m^3	16,943,933	5,398,196	1,863,356	514,692	124,883	24,845,061
	%	68	22	7	2	1	100

Source: Natural Resource Statistics of Indonesia 1996

(3) Log Production by Spices

In Kalimantan the most valuable timber trees are ironwood *Eusideroxylon zwageri* and dipterocarps, including meranti *Shorea spp.*, merawan *Hopea spp.*, kapur *Dryobalanops spp.* and *kruing Dipterocarps spp.* The most valuable timber tree extract from swamp forests are ramin *Gonystylus bancanus* .

Log production by species is shown in Table 5.6.4 with the main species being Meranti, Kapur, and Keruing. They are all Dipterocarps. Of these species, Meranti is by far the most popular product, which shares more than 60 percent of the total log production in the study area with Dipterocarps, Meranti, Kapur, Keruing and Ramin, sharing more than 70 percent of the total production. The material is mostly utilized in the plywood industry. Generally, price of these logs produced in the area is lower than that of the national average.

(4) Log Import and Export

The log export from Central Kalimantan to other provinces is shown in Table 5.6.5 Central Kalimantan exports more than 50 percent of total production. Installed capacity of wood based industries in Central Kalimantan is about 1.6 million cubic meters per year (0.5 million cubic meters for plywood and 1.1 for sawn timber). Deducting the log utilization for the internal wood based industry from the log production, log production of the province is in excess and the log production should be exported. Main exporting provinces are South Kalimantan, West Kalimantan and East Kalimantan etc., which have the large installed capacity of the industry.

West Kalimantan imports logs from other provinces as shown in Table 5.6.6, mainly to satisfy the raw material requirements of the plywood industry because the installed capacity of the industry in the province is much higher than log production. The log import from the other provinces in 1996 is equivalent to the log production of the province. The main importing provinces are Central Kalimantan, East Kalimantan and Jambi.

Table 5.6.4 Log Production by Type in 1995

Type of Log	Baku	Bangkirai	Benuang	Bintangur	Indah	Jelutung	Kapur	Kruing	Meranti	Mersawa	Nyatoh	Ramin	Semantok	Rimba	Others	Total
1. Production (m^3)																
West Kalimantan	0	13,919	0	2,038	40,798	8,757	37,705	23,287	955,038	2,849	38	24,501	0	188,432	127,590	1,424,952
Central Kalimantan	0	20,462	71,162	976	132,553	97	17,262	312,077	2,025,372	580	8,969	359,830	0	317,932	505,877	3,773,149
Kalimantan	46,800	133,856	72,313	27,899	190,005	8,933	600,393	848,857	6,047,437	9,777	38,432	384,331	0	1,009,367	1,062,493	10,480,893
Whole Country	497,412	133,856	160,567	114,178	235,881	150,219	702,203	1,106,196	8,133,728	211,793	127,671	655,366	160,689	2,918,060	2,950,187	18,258,006
2.Ratio by type (%)																
West Kalimantan	0.0	1.0	0.0	0.1	2.9	0.6	2.6	1.6	67.0	0.2	0.0	1.7	0.0	13.2	9.0	100
Central Kalimantan	0.0	0.5	1.9	0.0	3.5	0.0	0.5	8.3	53.7	0.0	0.2	9.5	0.0	8.4	13.4	100
Kalimantan	0.4	1.3	0.7	0.3	1.8	0.1	5.7	8.1	57.7	0.1	0.4	3.7	0.0	9.6	10.1	100
Whole Country	2.7	0.7	0.9	0.6	1.3	0.8	3.8	6.1	44.5	1.2	0.7	3.6	0.9	16.0	16.2	100
3. Share in the Whole Country(%)																
West Kalimantan	0.0	10.4	0.0	1.8	17.3	5.8	5.4	2.1	11.7	1.3	0.0	3.7	0.0	6.5	4.3	7.8
Central Kalimantan	0.0	15.3	44.3	0.9	56.2	0.1	2.5	28.2	24.9	0.3	7.0	54.9	0.0	10.9	17.1	20.7
Kalimantan	9.4	100.0	45.0	24.4	80.6	5.9	85.5	76.7	74.4	4.6	30.1	58.6	0.0	34.6	36.0	57.4
Whole Country	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
4.Production (Million Rp)																
West Kalimantan	0	1,725	0	296	5,640	1,524	4,947	3,292	133,743	373	3	3,953	0	35,537	18,443	209,479
Central Kalimantan	0	3,280	6,808	108	14,618	15	2,419	41,063	293,428	73	1,330	42,846	0	39,052	73,075	518,116
Kalimantan	12,917	21,058	6,988	7,017	23,950	1,552	112,097	128,708	980,458	1,231	6,070	46,800	0	138,470	163,076	1,650,391
Whole Country	63,218	21,058	16,872	16,026	32,247	21,924	128,264	170,858	1,327,751	24,502	17,403	77,619	30,970	389,326	416,963	2,755,001
5.Share in the Whole Country(%)																
West Kalimantan	0.0	8.2	0.0	1.8	17.5	7.0	3.9	1.9	10.1	1.5	0.0	5.1	0.0	9.1	4.4	7.6
Central Kalimantan	0.0	15.6	40.4	0.7	45.3	0.1	1.9	24.0	22.1	0.3	7.6	55.2	0.0	10.0	17.5	18.8
Kalimantan	20.4	100.0	41.4	43.8	74.3	7.1	87.4	75.3	73.8	5.0	34.9	60.3	0.0	35.6	39.1	59.9
Whole Country	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
6.Production per m^3(000Rp)																
West Kalimantan		124		145	138	174	131	141	140	131	80	161	-	189	145	147
Central Kalimantan		160	96	111	110	159	140	132	145	126	148	119	-	123	144	137
Kalimantan	276	157	97	252	126	174	187	152	162	126	158	122	-	137	153	157
Whole Country	127	157	105	140	137	146	183	154	163	116	136	118	193	133	141	151

Table 5.6.5 Log Exportation of Central Kalimantan to other Provinces in 1995/96 and 1996/1997

Destination	1995/96		1996/97		Capacity 1)
	1000m3	%	1000m3	%	1000m3
South Kalimantan	1,600		1,708	49	332
West Kalimantan	167		631	18	1,277
East Kalimantan	85		115	3	2,960
South Sumatra	4		42	1	46
North Sumatra	17		3	0	221
East Java	199		249	7	-
West Java	30		68	2	-
Central Java	184		231	7	-
DKI Jakarta	11		14	0	-
Jambi	265		234	7	930
Maluku	56			0	-
South Sulawesi	22		52	2	-
Riau	108		122	4	1,002
West Sumatra	4		3	0	-
Total	2,753		3,473	100	
(%)	51		63		
Total log production 2)	5,436		5,481		

1) Plywood installed capacity(Source : Statistics of Forest Concession Estate)

2) Log production in Central Kalimantan (Source : Forest Statistics of Indonesia)

Source : Regional Forest Office of Central Kalimantan

Table 5.6.6 Log Importation of West Kalimantan from other Provinces in 1995/96 and 1996/97

Province	1995/96		1996/97	
	1000m3	%	1000m3	(%)
Central Kalimantan	812	55	739	62
East Kalimantan	150	10	113	9
Sauth Sumatera	57	4	69	6
Central Sulawesi	32	2	60	5
Jambi	374	25	55	5
Riau	18	1	45	4
Maluku	13	1	36	3
Southeast Sulawesi	-	-	24	2
Southeast Nusa B	-	-	19	2
Others	29	2	38	3
Total	1,485	100	1,198	100

Source : Regional Forest Office of West Kalimantan

(5) Forest Industry

During the 1970 – 80 period, Indonesia became the largest exporter of tropical hardwoods in the world and the countries importing logs from Indonesia became the world leaders in tropical hardwood products. The situation led to the awareness in Indonesia that considerable economic growth opportunities were being lost by permitting exports of unprocessed raw materials, i.e. logs.

In 1980, the Government of Indonesia introduced a policy for phasing out exports of logs, leading to a total ban on log exports by 1985. The log export bans have been generally successful in preventing log exports. The intention has been to build up forest products processing in Indonesia. Significant development of the forest based industry was registered only from 1985 onward.

Plywood production is therefore 90 percent based in Kalimantan and Sumatra; about half the mills are in the four provinces of Kalimantan. The reason that the industry is almost wholly dipterocarp-based is that the main log production in the area is dipterocarp such as meranti.

Forest industry has been playing an important role in the national economy. It has been contributing to the sizable foreign exchange earnings, 8.5 percent of total export value. The Indonesian forest industry was the dominant exporter in the world. However, the exports have declined in volume in the last few years, as shown in Table 5.6.7 and 5.6.8.

In the regional economy, the forest industry is the most important industry: sharing more than 60 % of the total industrial GRDP in 1995 in West Kalimantan.

The forest based industry in the Study Area consists of :

1) Plywood mill: plywood, boxes, profile timber, solid door, block board, particle board and fancy articles
2) Sawn mills: various type of sawn timber products.
3) Furniture and wood processing: processed wood, moulding. Dowel, components of furniture, dry kilnplaned timber, pallets, furniture.
4) Wood working: windows, doors, containers, truck boxes, coffins and name board.
5) Rattan works: various types of woven wares.
6) Rattan: half processed rattan
7) Mixed wood and bamboo works: tooth picks, sticks, wooden spoon and forks.

The main forest industrial productions of the area, plywood and sawntimber, are shown in Table 5.6.7 and 5.6.8 Plywood production is the greatest user of log materials from tropical rain forest.

Table 5.6.7 Plywood Production

		91/92	92/93	93/94	94/95	95/96
West Kalimantan	m3	1,431,692	1,357,961	1,364,430	1,140,013	1,417,840
Share	%	16	15	14	22	16
Central Kalimantan	m3	414,172	318,096	259,798	251,340	310,083
Share	%	5	3	3	5	3
Study Area	m3	1,845,864	1,676,057	1,624,228	1,391,353	1,727,923
Share	%	20	18	16	27	19
Whole Kalimantan	m3	4,888,746	4,999,841	5,182,060	3,388,042	4,752,869
Share	%	54	55	52	65	52
Whole Country	m3	9,123,451	9,149,059	9,924,438	5,195,282	9,122,401
Share	%	100	100	100	100	100
Export	m3	9,003,000	9,761,000	9,626,000	7,333,000	8,338,825
Share	%	99	107	97	141	91

Source: Directorate General of Forest Utilization

Table 5.6.8 Sawntimber Production

		91/92	92/93	93/94	94/95	95/96
West Kalimantan	m3	206,239	203,726	220,058	196,263	114,972
Share	%	7	5	8	10	6
Central Kalimantan	m3	262,013	259,939	151,873	142,794	196,588
Share	%	9	6	5	7	10
Study Area	m3	468,252	463,665	371,931	339,057	311,560
Share	%	16	11	13	17	15
Whole Country	m3	1,072,728	1,348,515	874,966	811,652	818,235
Share	%	36	32	30	40	41
Whole Country	m3	3,006,046	4,276,532	2,910,459	2,005,783	2,014,193
	%	100	100	100	100	100
Export	m3	939,000	9,450	5,040	2,370	800
Share	%	31	0	0	0	0

Source: Directorate General of Forest Utilization

The study area produced 20 percent of the total national plywood production in 1990/91. The amount of plywood production of the area has been decreasing since 1991/92 in proportion to the decreasing log production in the area. The production in West Kalimantan is much higher than that of Central Kalimantan because the total installed mill capacity in West Kalimantan is 2.6 times larger, although log production in Central Kalimantan is much higher than that of West Kalimantan. This means that most log production in Central Kalimantan is exported as raw material to other provinces as mentioned in Section 2.1.4.

According to the Indonesian Wood Panel Association, there are twenty-two plywood industries: 16 industries in West Kalimantan and 6 in Central Kalimantan, with a total plywood production capacity of 1.8 million cubic meters per year in 1996: 1.3 million in West Kalimantan and 0.5 million in Central Kalimantan. The production levels of both provinces are far below the installed capacity although the raw materials available are sufficient to sustain

operations at full capacity. Especially in Central Kalimantan, the production volume in 1994/95 accounts for only 50 % of the production capacity.

5.6.2 Forest Resource

(1) Landuse

The variety of data available on land use published in Indonesia differs so greatly that the Study has applied the data from the ReppproT source (Table 5.6.9) because it is based only on imagery interpretation and more reliable. According to the Table, West and Central Kalimantan cover an area of 147,510 Km2 and 153,564 Km2, respectively.

Characteristics by the main land use are:

Forest: Forest is covered predominantly in hilly and mountainous areas and is logged-over a large proportions of more accessible areas.

Shifting cultivation , Bush, Grass: Bush and grass shows land use resulting from shifting cultivation and over logging distributed over lowland forest areas.

Paddy, Estate, Settlement: These areas mainly lie on the fringe of the coastal swamplands or along the undulating and rolling plains where river and road transport are good.

As of 1987, the forest covers 59 % of West Kalimantan and 76 % of Central Kalimantan resulting from rapid deforestation. As log production has continued at the same level, the forest area has been decreased. With comparison of land use in West Kalimantan between 1987 and 1995, the main changes are that forests including bush has decreased from 78 % to 64 % and grass land has increased from 2 % to 17 %.(see Table 5.6.10)

Table 5.6.9 Land Use in 1987

		Forestry	Bush	Estate	Shifting Cultivation	Paddy	Grass Land	Others	Total
West	Km^2	87,010	28,460	4,250	20,850	1,460	3,400	2,080	147,510
Kalimantan	%	59	19	3	14	1	2	1	100
Central	Km^2	115,941	5,068	461	25,031	2,303	2,764	1,996	153,564
Kalimantan	%	76	3	0	16	1	2	1	100
Total	Km^2	202,951	33,528	4,711	45,881	3,763	6,164	4,076	301,074
	%	67	11	2	15	1	2	1	100

Source : RePPProT

Table 5.6.10 Land Use in 1995

		Forestry	Estate	Shifting Cultivation	Paddy	Grass Land	Others	Total
Waste Kalimantan	Km^2	93,925	9,417	6,670	3,188	24,770	8,837	146,806
	%	64	6	5	2	17	6	100

Source* BPN

(2) Forest Types

Forest in the area can be divided into the following 5 types :

1) Lowland Dipterocarp Forest

Lowland Dipterocarp Forest is by far the most widespread forest in the area and the most ecologically and commercially important. Distrocarps grow as very tall trees with canopy heights commonly reaching 45 m and sometimes over 60 m. The topmost or emergent layer is composed mostly of Dipterocarpaceae and Leguminoseae. Of the dipterocarps, *Dipterocarpus, Dryobalanops* and *Shorea* are emergents, while *Hopea* and *Vatica* are smaller trees of the lower layers. Among the legumes, *Dialium, Koompassia* and *Sindora* are common emergents; their fine, pinnate leaves offer little resistance to wind in these exposed situations. The tallest emergent of all is the distinctive *kempas* tree *Koompassia excelsa.*

2) Heath Forest

Heath forest is the second most widespread forest type in the area. The forest is found on soils derived from siliceous parent materials. These soils have inherently poor bases, highly acidic, commonly coarsely textured and free-draining, and are often described as white sand soils. It has distinctive structural and vegetation characteristics, with trees generally shorter and smaller than those of mixed rainforest. Trees of large girth and big , woody climbers, including rattans, are rare.

The forest has between 454 and 750 trees of 10 cm dbh per hectare.

3) Freshwater Swamp Forest

Freshwater swamp forests are widespread over alluvial soils that are flooded for long periods with mineral-rich river floodwaters of a fairly high pH. The conditions and greater nutrient input are reflected in greater productivity. They are associated with coastal swamps, inland lakes and huge low-lying river basins.

The forests are generally taller and more species-rich than those of peat swamps. Prime freshwater swamp forests have trees with an average height of 35 m, some lianas and many epiphytes.

4) Peat Swamp Forest

The large peat deposits are found behind coastal mangrove forests. Peat swamp forests receive moisture mainly from rainfall and are therefore nutrient-poor. It is reflected in vegetation composition, with peat swamp forests generally less species-rich than the adjacent freshwater swamp forests.

Peat swamp forests are characterized by ramin *Gonystylus bancanus*, Dyera, *Tetramerista, Palaquium, Campnosperma, Ganua, Mesua, Dactylocladus* and *Alstonia* trees. The dipterocarp *Shorea balangeran* is common on the edge of peat swamps and occurs in pure stands along the flooded margins of the reserve's rivers.

5) Mangrove Forest

Mangrove occurs only on shores where the vigor of the surf is broken by a sand bar, coral reefs or islands. There are three main types of mangrove ecosystem : the coastal/deltaic form, the estuarine/lagoonal form and island form. The mangrove association consists of a number of species tolerant of the saltwater-and-mud environment, together with the brackish-water forest at its inland edge, which consists of almost pure stands of nipa palm *Nypa fruticans*.

Area by forest type in wetland is shown in Table 5.6.11.

Table 5.6.11 Area by Forest Type in Wetland

		Freshwater swamp	Peat swamp	Mangrove	Sub-Total	Total
Waste Kalimantan	Km^2	13,050	22,010	4,250	39,310	147,510
	%	9	15	3	27	100
Central Kalimantan	Km^2	18,800	9,960	1,200	29,960	153,564
	%	12	6	1	20	100
Total	Km^2	31,850	31,970	5,450	69,270	301,074
	%	11	11	2	23	100

Source:RepporT

(2) Evaluation of Timber Resources

The study area produced 155 million cubic meters of log for the past 24 years, from 1973 to 1996, which accounts for 27% of total log production in Indonesia for the same period.(see Table 5.6.12) During that time, log productions and forest based industries contributed much to

not only the regional economy but also the national economy. However, the production has decreased in 1990's. The reduction had much affected to regional economy through degradation of forest based industry, especially in West Kalimantan.

Most wood is harvested from natural forest, HPH concession, rather than plantation. Table 5.6.13 and 5.6.14 shows the list of HPH concessions in the Study Area which still had logging license in 1995. Concessions are granted for a period of 35 years; the concession holder can cut timbers 1/35 of the granted area per year. From these data, log production in the future is estimated. (see Table 5.6.15 and Fig. 5.6.1) Results of the estimated log production in the area would decrease 50 % of the existing level after 10 years.

The forestry inventory study by FAO in 1996 and satellite image of NOAA in 1995 show almost the same results of the estimation. (see Fig. 5.6.2 and 5.6.3) The inventory study, based on satellite images in from 1990 to 1994, evaluates the resources of Melanti which is most important tree species for the plywood industry. Melanti of sufficient girth to be cut is distributed only in national parks and the mountain area of provincial boundary between West and Central Kalimantan. A satellite image of NOAA shows a more severe situation that forests in national park areas are also invaded.

Table 5.6.12 Total Log Production

(Unit : 1,000m3)

Year	West	Central	Total	Indonesia	Share(%)
1973	3,178	1,831	5,008	20,956	24
1974	2,724	2,395	5,118	21,753	24
1975	842	1,748	2,590	16,179	16
1976	999	3,212	4,211	21,399	20
1977	912	3,362	4,274	22,273	19
1978	1,406	3,981	5,388	24,641	22
1979	1,444	4,015	5,459	25,186	22
1980	1,087	4,256	5,343	24,657	22
1981	1,640	3,292	4,932	14,726	33
1982	1,248	3,359	4,607	13,980	33
1983	2,314	4,977	7,290	24,385	30
1984	3,161	5,843	9,004	27,817	32
1985	2,835	5,063	7,899	24,082	33
1986	3,168	6,245	9,413	27,610	34
1987	3,903	6,803	10,705	36,691	29
1988	4,088	3,736	7,824	32,202	24
1989	2,070	5,260	7,330	26,428	28
1990	2,185	4,894	7,078	22,165	32
1991	2,610	5,180	7,790	26,128	30
1992	1,967	4,749	6,716	23,810	28
1993	2,414	4,808	7,222	26,049	28
1994	1,950	4,592	6,542	26,848	24
1995	1,407	4,681	6,088	24,027	25
1996	1,676	5,436	7,111	24,850	29
Total	51,226	103,715	154,941	578,842	27

Source : Forest Statistic in Indonesia

Table 5.6.13 HPH Area in West Kalimantan

HPH	Year	FOREST	TOTAL Ha
ANURAGA	87	26,173	44,092
ARIA JAYA RAYA	79	67,216	73,342
BATASAN	80	45,309	132,470
BENUA INDAH	80	151,431	190,819
BULIND TRADING Co	73	58,349	77,575
BUMI RAYA UTAMA WOOD INDUSTRIES	73	166,234	221,635
DELAPAN DELAPAN	76	122,055	185,685
DUADJA CORPORATION	79	217,970	351,863
ERNA DJULIANAWATI	86	126,663	159,735
HALISA PONTIANAK	81	113,368	115,453
HARJON TIMBER	80	93,035	99,493
HARAPAN KITA UTAMA	92	167,036	230,886
HUTAN RAYA UTAMA	78	67,547	105,139
INHUTANI II	72	17,416	27,048
KARTIKA KAPUAS SARI	85	126,416	127,727
KAYU LAPIS INDONESIA	79	105,079	196,166
KAYU PESAGUAN	78	121,904	221,598
KURNIA KAPUAS PLAYWOOD	87	32,905	42,643
LANJAK DERAS JAYA RAYA	74	56,482	67,110
MARAGA DAYA WOOD WORKS	86	143,233	226,638
MARKITA BORNEO TIMBER	78	55,009	63,703
PAPA GUNA	79	98,702	155,125
PULAU MAYA	76	46,665	60,520
PUNCAK SAWMILL	76	60,479	102,688
RAJA RIMBA	79	51,398	102,107
RIMBA AGUNG UTAMA	88	83,651	121,659
RIMBA RAMIN	89	35,674	69,353
SARI BUMUKUSUMAH	86	41,424	53,678
SARITAMAH INDAH	90	5,599	39,731
SUKA JAYA MAKMUR	82	133,494	142,863
SUMBER BARU UTAMA	80	28,920	84,000
TAWANG MERANTI	79	63,720	133,660
TRI KAKA	77	66,484	103,250
TUNAS INDO	79	27,861	77,026
MANAWATI	79	103,583	111,696
Total HPH		2,928,484	4,318,176

Source : Kanwil Kehutanan,

Table 5.6.14 HPH Area in Central Kalimantan

HPH	Year	Forest Area Ha	Total Area Ha	HPH	Year	Forest Area Ha	Total Area Ha
Aji Ubaya	78	46,135	58,970	Palangka Nusantara	74	91,819	101,829
Angkasa Wana	77	75,208	79,583	Perkasa Wana	81	39,819	95,263
Antang	94	85,305	122,892	Prakantja Jaya Raya	73	78,102	89,163
Arjuna Wiwaha	78	92,783	99,791	Puruk Cahu Jaya	88	124,129	124,133
Astral Bina	69	21,345	40,467	Ratu Miri	88	44,887	44,887
Austral Byna	93	253,943	330,206	Rimba Karya	76	86,157	98,802
Baiambit	76	65,343	102,497	Safawati	85	91,247	191,189
Barito Baru	76	42,652	53,934	Sarang Sapta Putra	80	160,255	163,942
Barita P L	78	36,387	106,207	Sari Bumi Kusuma	79	212,578	245,862
Bina Smakhta	79	88,877	93,290	Sebangau Besar	79	158,625	216,625
Bina Smakhta	79	249,848	356,456	Setia Alam Jaya	90	21,051	56,403
Bintang Arit	81	49,525	67,888	Sikatan Wana Jaya	79	50,033	66,216
Bumi Indah Raya	91	63,782	102,966	Sindo Lumber	93	68,394	100,081
Carusindo	80	152,812	152,834	Suka Bumi Mulia	80	55,687	59,155
Dacridum I	73	61,433	134,636	Sumber Aman	73	71,337	76,576
Dacridum II	78	95,598	97,238	Tanjung Raya Timb	73	80,415	114,465
Danlian Timber	81	86,142	115,761	Tiga Badak Sanak	90	23,480	115,545
Daya Sakti	90	215,490	275,102	Tunggal Parnonang	74	77,291	80,515
Djayanti Djaya II	70	97,232	145,629	Akhetes Plywood	89	92,800	112,000
Djayanti Djaya	73	208,502	231,300	Barito P/Sinar Barat	80	30,857	54,000
Dwirna J U	77	147,918	171,907	Berkat Cahaya TBR	73	46,429	125,000
Fajar Khayan	80	47,974	56,455	Bina Daya Tetra	87	82,543	107,000
Gunung Meranti	76	116,241	122,148	Bina Samaktha	78	44,743	87,000
Hutan Domas Raya	79	248,974	266,891	Bina Sanaktha	88	136,000	170,000
Hutan Mulia	73	72,855	102,068	Biro Sketsa	89	38,943	47,000
Indexim Utama	91	73,524	74,301	Brata Jaya Utama	77	24,286	50,000
Indhosan A B	88	61,312	70,086	Brata Jaya Utama	79	32,571	60,000
Indo Kayu	77	176,051	230,559	Day Sakti Krida U.	89	53,857	65,000
Inhutani III	70	595,883	871,944	Erna Juliawati	87	142,714	185,000
Kahajan Lumber	73	48,579	62,165	Gajah Seno Sakti	90	45,429	53,000
Kayu Ara	79	170,279	170,689	Gunung Meranti	76	34,743	76,000
Kayu Lapis Indones	79	49,635	91,064	Indo Kayu	90	46,286	54,000
Kayu Mas Ratu	76	79,189	89,553	Inhut Ani III	78	50,914	99,000
Kayu Tribuana Ram	78	84,577	87,031	Karunia Wana Ika W	89	44,743	54,000
Kayu Waja	80	82,753	104,533	Manimbun Jaya	81	64,800	108,000
Lam Jaya utama	78	86,708	123,065	Maraga Daya Wood	92	48,457	53,000
Manimbun Jaya	81	137,308	137,957	Mentikei	78	20,571	40,000
Maruwei Timber	89	130,967	130,967	Sehati Barito	81	75,600	126,000
Mengkilip	77	41,064	53,657	Simanggang Hayu	73	49,400	133,000
Meranti Mustika	78	63,533	97,723	Tunggal Pamenang	79	67,857	125,000
Mountrado Jaya	72	94,535	118,955	Wira Saraya Tama	74	20,000	50,000
Mulung Basidi	80	59,535	89,833	Yahanes Arnold Pis	74	17,462	43,656
Nusantara	70	120,856	135,054	Total HPH		7,725,903	10,343,559

Source : Kanwil Kehutanan,

Table 5.6.15 Estimated Log Production

Unit : 1000 m3

Year	West Kalimantan			Central Kalimantan			Study Area		
	HPH*	Case 1**	Case 2**	HPH*	Case 1**	Case 2**	Production*	Case 1**	Case 2**
1973	3,178			1,831			5,009		
1974	2,724			2,395			5,119		
1975	842			1,748			2,590		
1976	999			3,212			4,211		
1977	912			3,362			4,274		
1978	1,406			3,981			5,387		
1979	1,444			4,015			5,459		
1980	1,087			4,256			5,343		
1981	1,640			3,292			4,932		
1982	1,248			3,359			4,607		
1983	2,314			4,977			7,291		
1984	3,161			5,843			9,004		
1985	2,835			5,063			7,898		
1986	3,168			6,245			9,413		
1987	3,903			6,803			10,706		
1988	4,088			3,736			7,824		
1989	2,070			5,237			7,307		
1990	2,185			4,851			7,036		
1991	2,610			5,072			7,682		
1992	1,789			4,703			6,492		
1993	2,199			4,295			6,494		
1994	1,845			3,911			5,756		
1995	1,171			3,839			5,010		
1996	1,551			3,908			5,459		
1997		2,043	1,459		4,355	3,815		6,398	5,274
1998		1,921	1,372		4,074	3,569		5,995	4,941
1999		1,651	1,179		4,041	3,541		5,692	4,720
2000		1,468	1,049		3,925	3,439		5,393	4,488
2001		1,226	876		3,793	3,323		5,019	4,199
2002		1,200	857		3,548	3,109		4,748	3,966
2003		1,143	816		3,281	2,874		4,424	3,690
2004		1,124	803		2,903	2,543		4,027	3,346
2005		1,124	803		2,680	2,348		3,804	3,151
2006		1,124	803		2,562	2,245		3,686	3,048
2007		1,051	751		2,272	1,990		3,323	2,741
2008		792	566		2,203	1,930		2,995	2,496
2009		768	548		2,149	1,883		2,917	2,431
2010		768	548		2,042	1,789		2,810	2,337
2011		691	493		1,960	1,717		2,651	2,210
2012		572	409		1,735	1,520		2,307	1,929
2013		468	334		1,544	1,352		2,012	1,686
2014		276	197		1,191	1,043		1,467	1,240
2015		215	154		1,078	944		1,293	1,098
2016		215	154		919	805		1,134	959
2017		121	86		783	686		904	772
2018		77	55		510	447		587	502
2019		49	35		452	396		501	431
2020		0	0		231	202		231	202
2021		0	0		231	202		231	202
2022		0	0		231	202		231	202
2023		0	0		139	122		139	122
2024		0	0		40	35		40	35
2025		0	0		25	22		25	22
Total	50,369	20,087	14,347	99,931	54,897	48,094	150,300	74,984	62,441

Case I calculated by average yield for the past 10 years and HPH area
Case 2 calucurated by average yield for past 5 years and HPH area
Source : *: Forestry Statistics in Indonesia
** : Estimated by Study team

Figure 5.6.1 Estimated Log Production in West Kalimantan

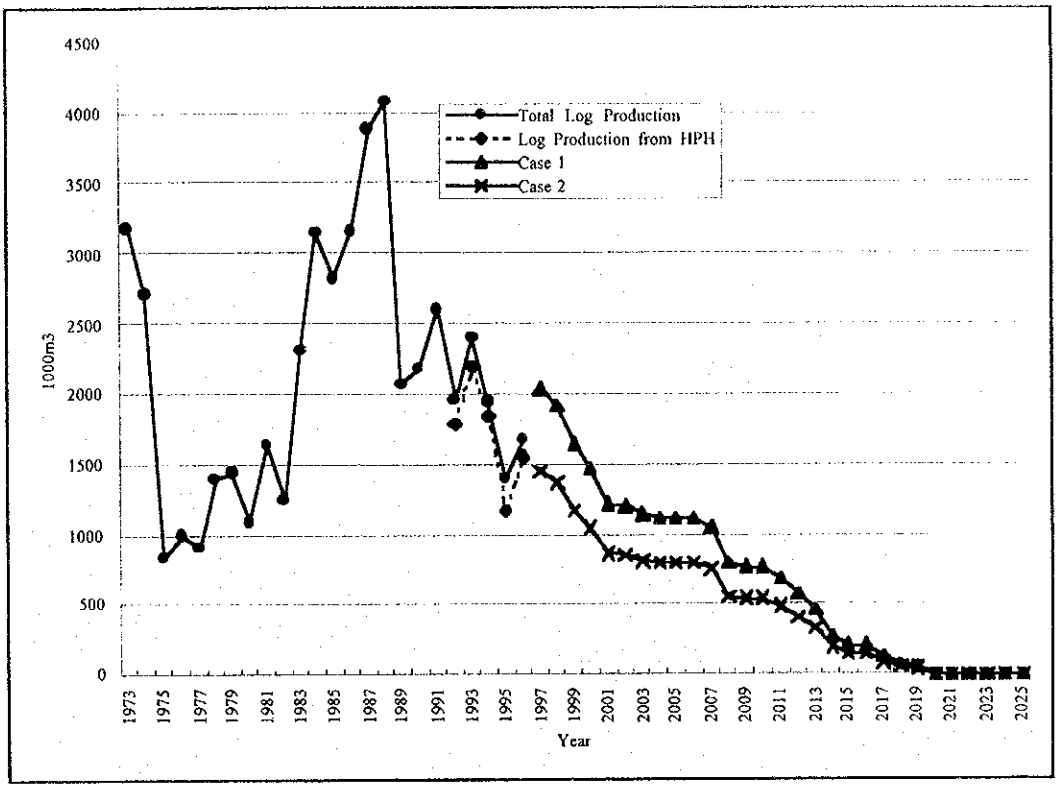


Figure 5.6.2 Estimated Log Production in Central Kalimantan

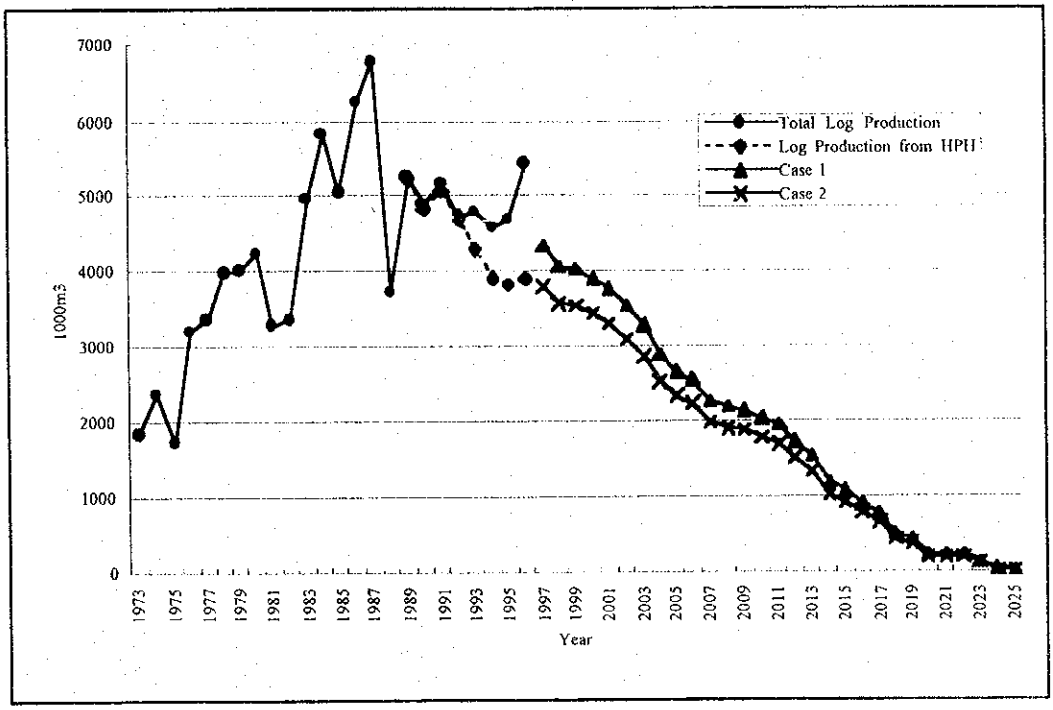


Figure 5.6.3 Exploitable Volume per Hectare

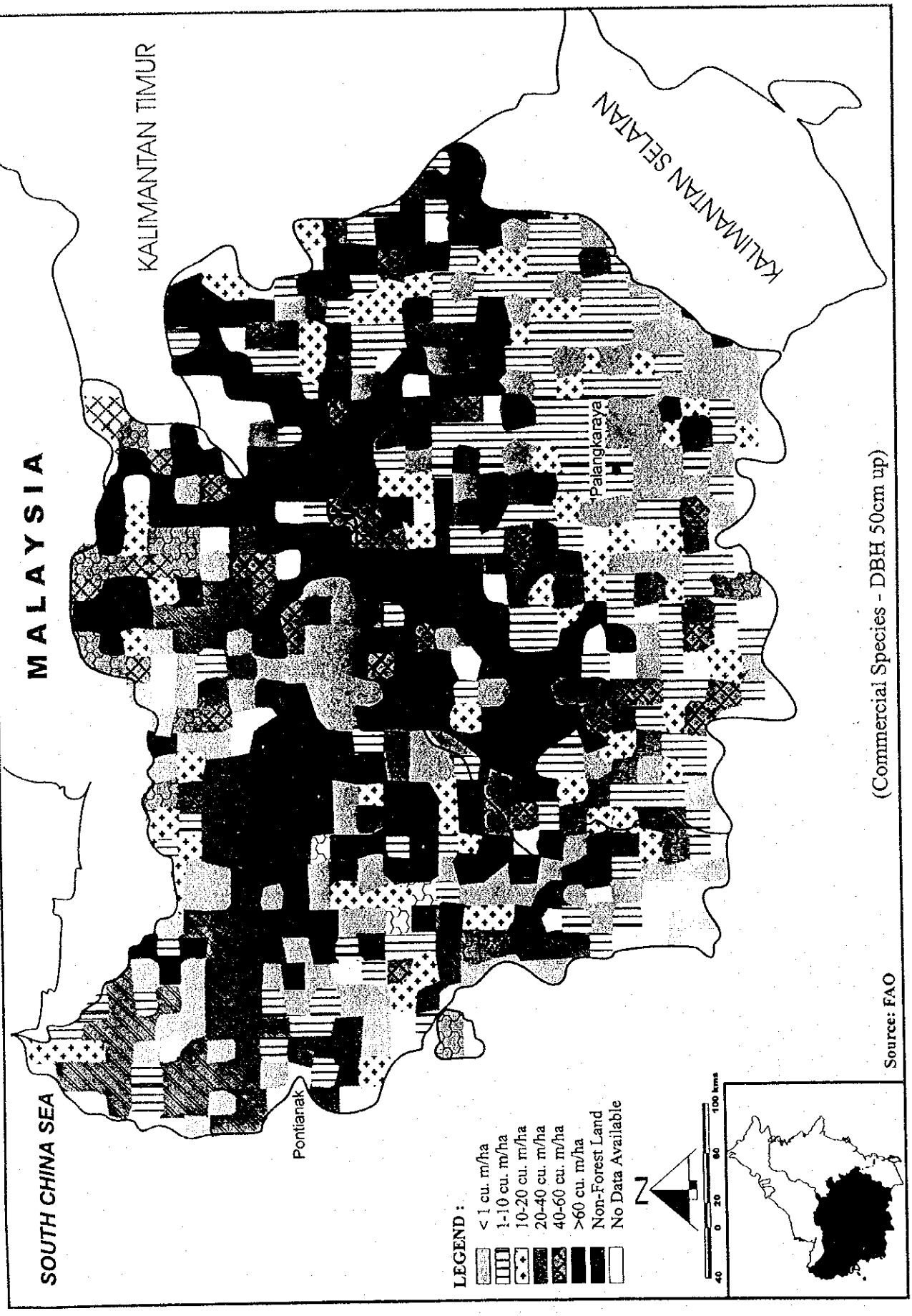
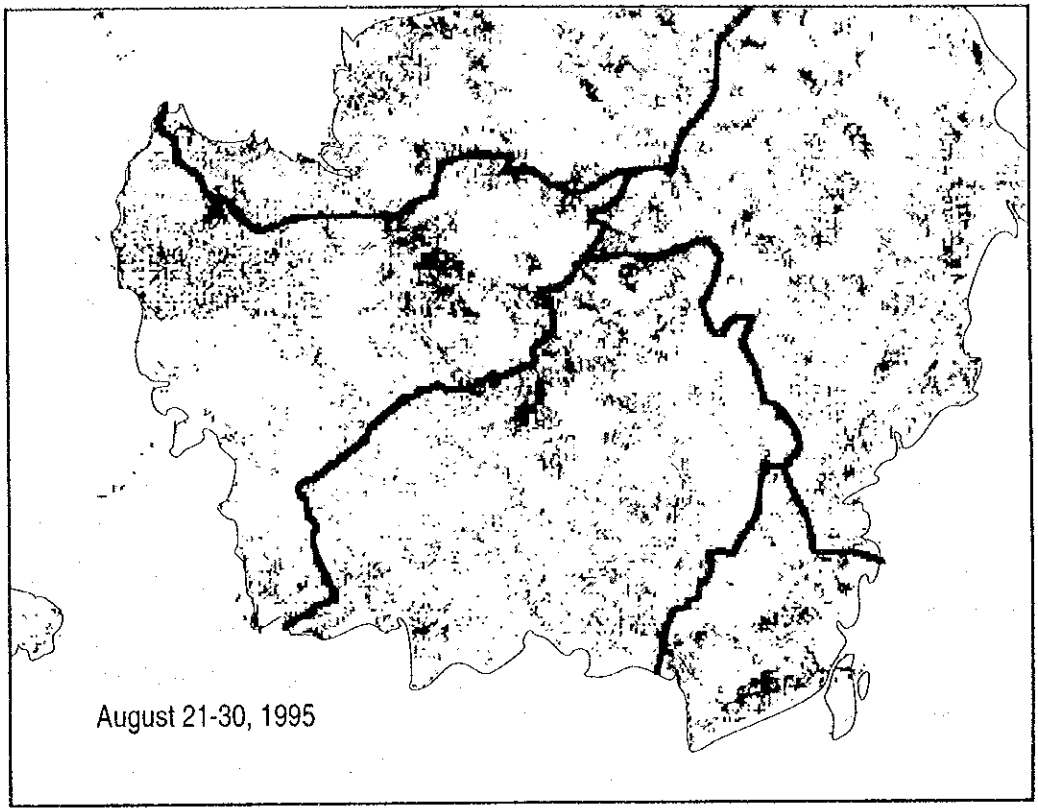


Figure 5.6.4 NOAA Satellite Image



(3) Industrial Tree Plantation Development

The Timber Estates Development Program and Industrial Forest Plantations or Hutan Tanaman Industri (HTI) have been established in 1986 by Ministrial Decree 320 Kpts-II/1986. According to the Decree, the purpose of establishing HTI is to enhance the productivity of unproductive forest land to produce raw materials for wood industries.

The Industrial Forest Plantations (HTI) are implemented on permanent production forest areas, either inside or outside forest concession areas and particularly on permanent unproductive forest areas. The forest plantation is undertaken by the private sector, state-owned forestry companies and joint ventures between the state-owned companies and the private sector. It also involves village-level Cooperatives.

A number of approaches have been used by the government to encourage the implementation of the industrial plantation forests, viz. Integration of industrial forest plantations system with the transmigration program. This system is aimed at accelerating the implementation of both industrial plantation forest and community resettlement program particularly for those who practice shifting cultivation.

Industrial Timber Plantation in the study area started in the early 1990s. The total land actually planted by 1996 was 22 thousand hectares in West Kalimantan, accounting for 50 percent of target area (Table 5.6.16) of which 53 percent is HTI-Murni for pulp and 44 percent HTI-Trans. The most common species used for HTI development in West Kalimantan are Acasia sp. for pulp HTI, Paraseriathes falcataris and Pinus merkushi for non pulp HTI and Hevea sp. for HTI trans.

HTI-Trans is dominant in Central Kalimantan, sharing more than 60 percent of the implemented area. Main tree species for Trans HTI in Central Kalimantan are Meranti, Sungkai, Sengon and Acacia etc.

HTIs in the area, however, have not been harvested yet because the average rotation of the species for pulp is 8 years. As shown in section 5.6.1 forest resources in the study area have been degraded and the wood based industry has stagnated in proportion to decreasing log production. It is impossible that the production from HTI is a substitute for HPH (Forest Concession Rights) to sustain the existing wood based industry, mainly the plywood industry in the study area because the implemented HTI area is too small compared with the HPH area and the tree species are different from those which are used for plywood.

Figure 5.6.5 shows the distribution of HTI on the Land Potential Map and Table 5.1.17 shows HTI area by the land potentiality. The total HTI area is 2.3 million ha and 83 thousand ha in West and Central Kalimantan, which shares 16 percent and 0.5 percent of the total provincial area, respectively. HTI occupies more than 20 percent of the oil palm suitable area in West Kalimantan.

Recently, oil palm development has attracted a great deal of attention as the main industry in substitution for the existing wood based industry in the study area because the natural conditions are suitable for crop growth. Oil palm is also more remunerative than pulp, 1,050 US$/ha/year for pulp and 1,600 US$/ha/year for oil palm(Dinas Perkebunan Kalteng). It is well known that arable soils in the study area are limited. Considering the land use effectiveness, the land use plan on oil palm and HTI areas should be adjusted.

The pulp industry is expected to be a promising industry in the study area with the expansion of the HTI pulp area. However, increasing demands of the materials may lead to new pressures on natural forest, clear cutting of logged over forest etc.

Table 5.6.16 Industrial Timber Plantation by 1996

(unit:ha)

	Target Area	Implemented Area	(%)
West Kalimantan			
HTI-Trans	23,141	9,703	42
HTI-Murni(Pulp)	20,521	11,705	57
HTI-Murni(Non-Pulp)	435	807	185
Sub-total	44,097	22,214	50
Central Kalimantan			
HTI-Trans	24,152	10,354	43
HTI-Murni	10,000	6,500	65
Sub-total	34,152	16,854	49
Total	78,249	39,068	50

Source: Laporan Bulanan, West Kalimantan,1997. Laporan Tahunan, Central Kalimantan, 1995/1997

Table 5.6.17 Distribution of Industrial Timber Plantation (HTI) by Soil Potentiality

		Suitable Area1)	Less Suitable Area2)	Suitable for Rice	Sub-total	Unsuitable Area3)	Total
West Kalimantan	ha	489,446	816,778	74,644	1,380,868	923,029	2,303,897
	%	21	35	3	60	40	100
Central Kalimantan	ha	18,727	26,265	0	44,992	37,707	82,699
	%	23	32	0	54	46	100

1) Suitable area for oil palm(Zone 1,2,3)
2) Less suitable area for oil palm(Zone 4)
3) Unsuitalbe for agriculture(Zone 6,7,8,9,10)
Source : ReppproT, Regional Forestry Office, West and Central Kalimantan, 1997

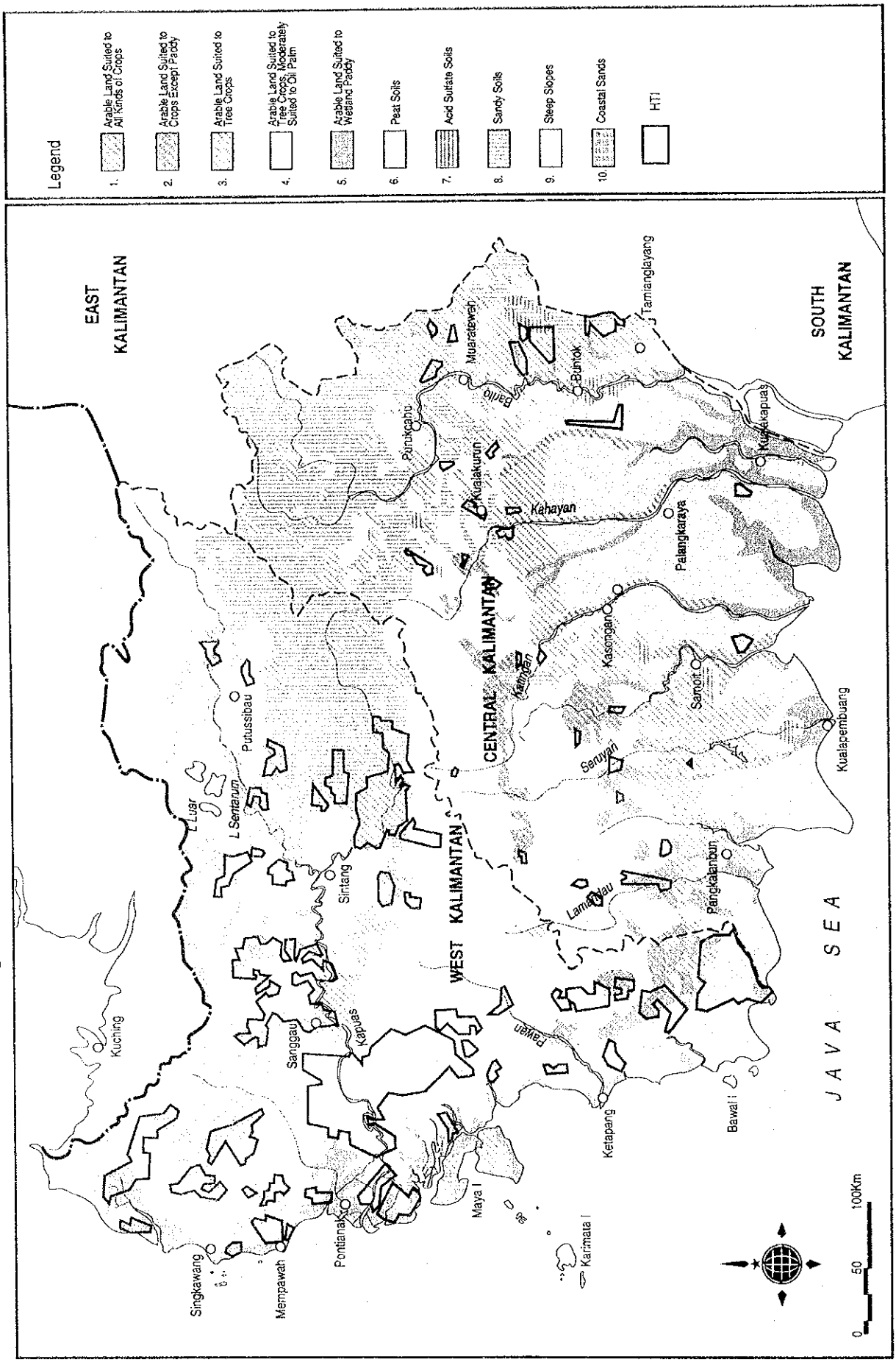


Figure 5.6.5 Distribution of Industrial Timber Estate (HTI)

5.6.3 Forest Fire

Forest fires in Indonesia have caused an enormous economical and ecological loss and increased air pollution. Economically, forest fires have evoked damage and loss of the timber and non timber forest resources and together have caused the damage of crops such as rubber and oil palm etc. It was also reported that the harvest of most blackfish species fell in 1983, when history recorded the biggest fire in Indonesia.

Forest fire is a major ecological event with profound and lasting impact on the environment. Large numbers of animals die during a fire, especially less mobile creatures such as nestling and forest floor reptiles and amphibians. Surviving animals have had to contend with decreased food resources due to the death of fruits trees during the extensive forest destruction by fire.

Soil, an important factor to sustain the ecosystem, is also affected by fire. Soil quality at burned sites has deteriorated due to the death of soil organisms and increased nutrient leaching. When the rains return, soil erosion from exposed areas increase the sediment load of rivers and threaten the important inland fisheries. Especially the lack of peat soil, which has acted as a giant sponge regulating water flow, leads to increased flooding in downstream riverside villages.

After burning, the forest is converted to agriculture, alang-alang or secondary forest. The ecosystem , therefore, becomes simpler and is regenerated as less-species-rich.

During a forest fire, smoke covers the surrounding area, as far afield as in Singapore, more than 1500 km to the west and causes airport closures in Kalimantan and other areas. Smoke from forest fires has caused massive pollution problems with haze reducing visibility over Singapore and parts of the Malaysian peninsula. The low visibility affects sea and air traffic. The smoke haze is also damaging to health.

The immediate cause of the fire is a combination of severe drought, destructive logging practices and slash-and-burn agriculture. Droughts occurred in 1983, 1987, 1991 and 1997, with fires causing big damage especially in 1982 and 1997 in Kalimantan. The drought was related to the El Nino climatic events.

In 1997 a big forest fire occurred in Indonesia and caused great damage for forest, burning 177 thousand hectares of forest in Indonesia (shown in Table 5.6.18).

The Study Area, West Kalimantan and Central Kalimantan, shares 22 % of total area of burned forest in Indonesia in 1997. West Kalimantan, especially, was the province suffering most from the fire in 1997, shearing 13 per cent of the total burned forest.

The most damaged area by land use was HTI(see Table 5.6.19): plantation for timber production, mainly by forest concessions. The main activity is the replantation of industrial timber trees after clear cutting.

In the case of West Kalimantan, HTI area (Industrial Plantation) was severely affected by the fire(see Table 5.6.20 and Fig. 5.6.6). 5.6.21 and Fig. 5.6.7 shows the number of hot spot by land use. It also shows that the hot spots were distributed mainly in industrial plantations (HTI) and oil palm estates. This land needed to be clear cut to plant industrial timber and oil palm. Therefore, the main cause of the forest fires can be estimated that most timber companies burned the forest to clear land in order to reduce their costs.

West Kalimantan has planned to expand oil palm estates and industrial timber plantation in the future and forest land is changing from forest to land use such as grass, agricultural land and secondary forest has suffered comparatively more damage. With the expansion, land will be increasingly prone to fire damage in the future.

Table 5.6.19 Area of Fired Forest in 1997

(Unit: Ha)

	Before	Jun	July	Aug.	Sept.	Oct.	Total
West Kalimantan	0	0	16	18,469	4,651	0	23,136
Share(%)	0	0	0	30	5	0	13
Central Kalimantan	0	47	425	11,654	3,058	0	15,184
Share(%)	0	2	6	19	3	0	9
Study Area	0	47	441	30,123	7,709	0	38,320
Share(%)	0	2	6	49	8	0	22
Whole Kalimantan	46	505	491	36,927	21,569	125	59,663
Share(%)	1	16	7	60	22	2	34
Whole Country	3,165	3,078	7,380	61,629	96,457	5,575	177,285
Share(%)	100	100	100	100	100	100	100

Source : Ministry of Forest

Table 5.6.20 Area of Fired Forest in 1997(As of Oct.) by Land Use

(Unit:Ha)

Type of forest	Plantation forest	Secondary forest	Scrub	Total
Protection forest	-	-	-	-
Production forest				
HTI	18,299	5,160	-	23,459
Reforestation	2,807	-	-	2,807
Concession	-	2	-	2
Sanctuary reserve	-	795	200	995
Tourism	-	70	174	244
National Park	-	1,060	-	1,060
Total	21,106	7,087	374	28,567

Source: Regional Forest Office of West Kalimantan

Table 5.6.21 Area of Fired Forest in West Kalimantan (July-August, 1997)

Name	Type of land use	Area(Ha)
1. PT. Finantara Intiga	HPH	7
2. PT. Multi Dayap	HPH	291
3. PT. Inhutani II	HPH	140
4. PT. Antar Mustika (Kegun)	HPH	500
5. PT. Lembah Jati Mutiara	HPH	252
6. Tanaman (OECF)	Plantation	3,715
7. PT. Inhut. III	HTI	1,405
8. PT. Lahan Cakra Wala	HTI	100
9. PT. Meranti Laksana	HTI	20
10.PT. Rimba Egvator Permai	HTI	650
11.PT.Inhutani III	HTI	25
12.TN. Gunun Palung	National park	10
13.SM. Danau Sentarum	Wild life sanctuary	45
14.HW. Baning	Recreation forest	9
15.Lahan Transmigrasi	Transmigration	550
16.Bukit Seha	Htan alain	4
Total		6,785

Source: Regional Forest Office of West Kalimantan

Table 5.6.22 Number of Hot Spot by Land Use in West Kalimantan in 1997

Land use	July	August	Total
Oil palm estate			
Implemented area	0	1	1
Approved area	7	5	12
Proposed area	5	3	8
Industrial plantation forest	17	11	28
Transmigration	5	2	7
Other	9	8	17
Total	43	30	73

Source: Regional Forest Office of West Kalimantan

Figure 5.6.6 Distribution of Forest Fired Area

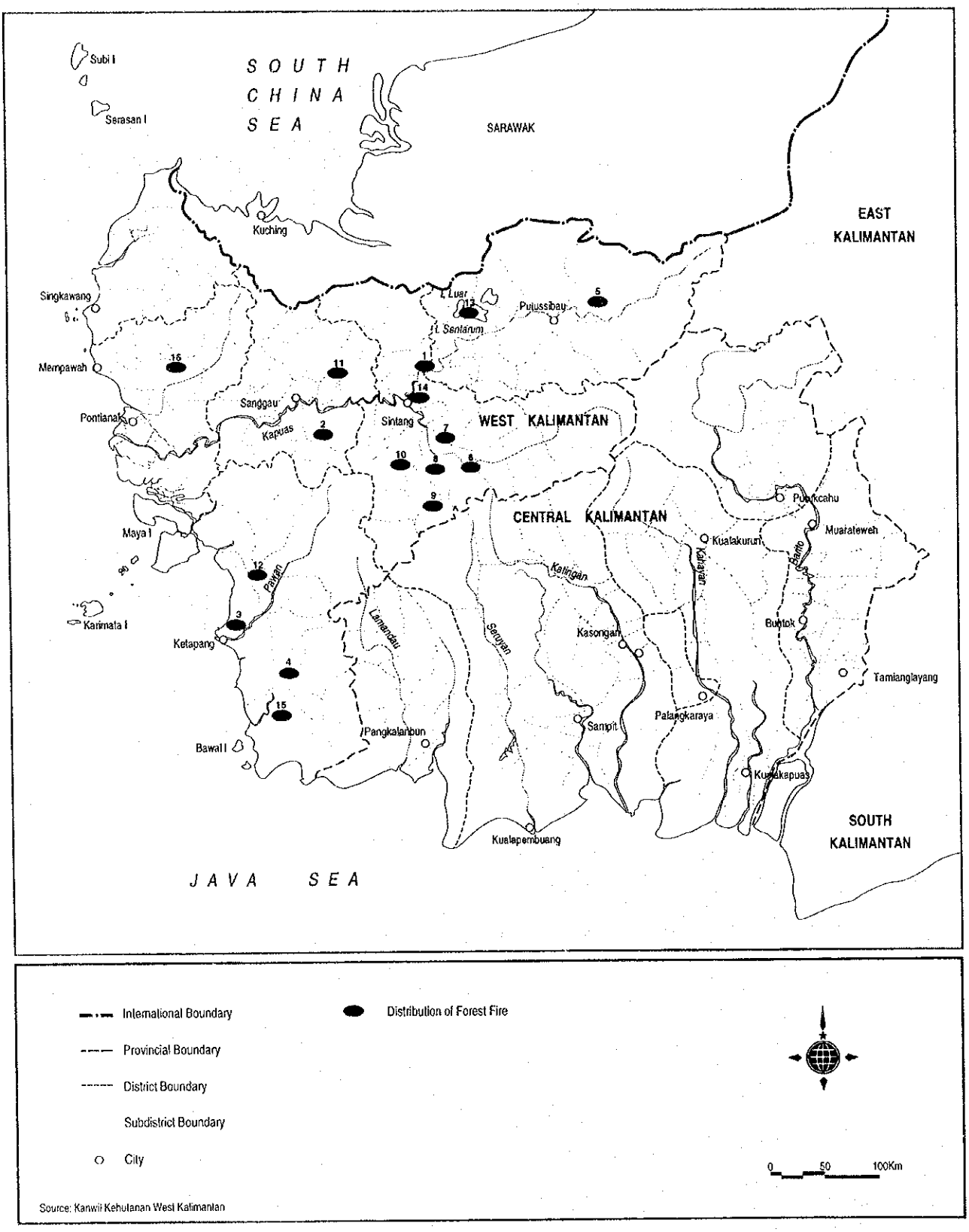
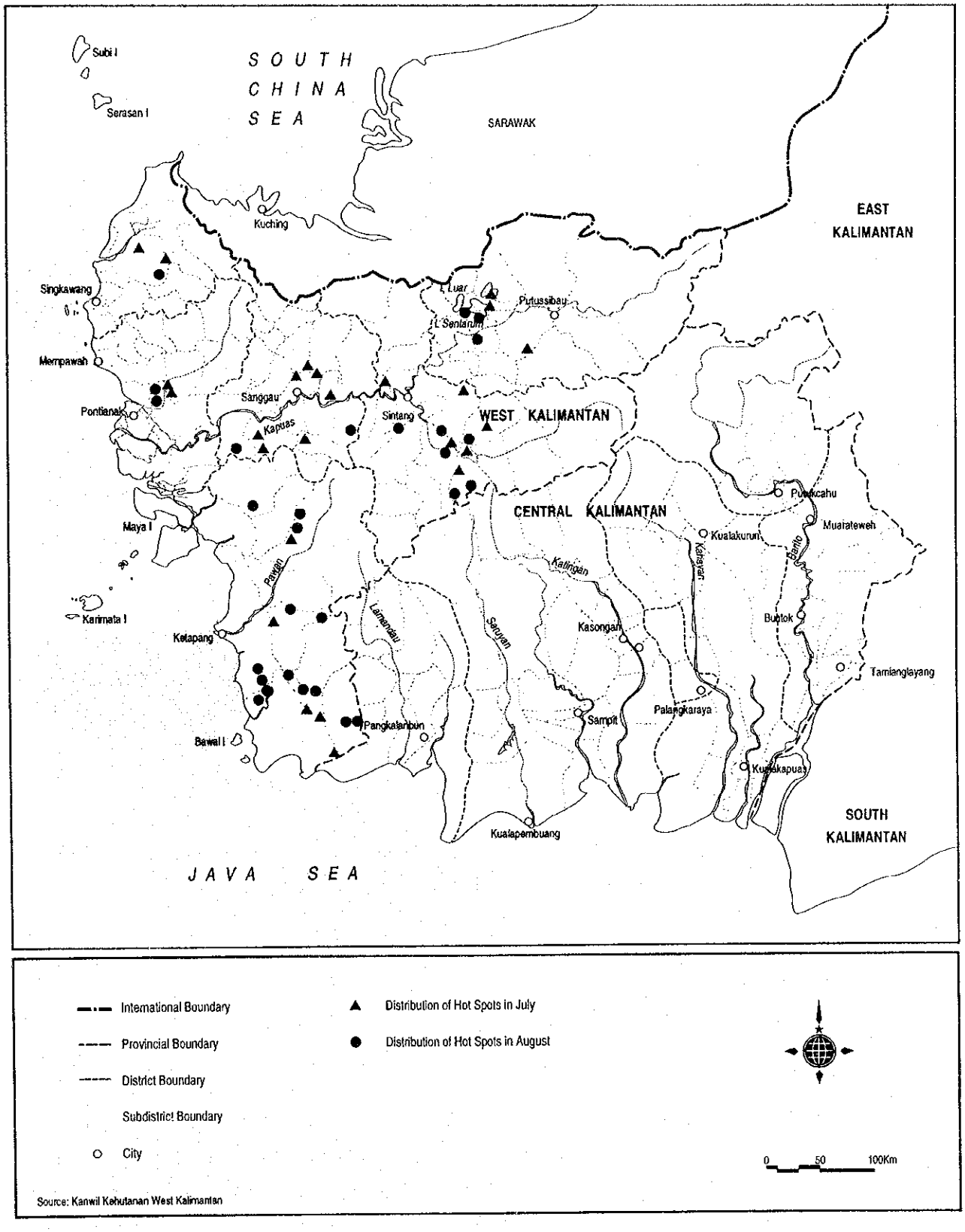


Figure 5.6.7 Distribution of Hot Spot



5.7 ON-GOING PROJECTS AND PROGRAMS

On-going projects and programs are as follows:

(1) Tropical Forest Management Program

This project has been working to improve practical forest management including the PKHP system and the conservation network since 1991. The project had sample works in Danau and Sentaum Wildlife Reserve in West Kalimantan and three HPHS in Central Kalimantan and proposed various aspects of forest management assisting to establish the KPHP system in Central Kalimantan. The main part of the project terminated at the end of June 1997.

(2) Social Forestry Development Project

The project has been implemented in Sanggau, West Kalimantan since 1987. The project is currently under the implementation stage (1993-1997) operating a Community Forest Training and Information Center(Balai Latihan dan Informasi Hutan Kemasyarakatan: BLI-HK) under technical assistance by GTZ. The management of the center has been transferred to a local NGO established by local farmers in 1997.

The area of the project is 102,250 ha of ex-HPH in the Sanggau district and it is covered by 44 % in UTHM(Usaha Tani Hutan Menetap), 34 % in HPT(Hutan Producsi Terbatas) and 22 % of HL(Hutan Lindung).

(3) HTI by INHUTANI III

INHUTANI has been trying local participation in their HTI in Sintang district. The land is basically divided into 40 % for local communities and 60 % for HTI. Timber species such as pine and acacia were planted for HTI and rubber (30 %) and fruits trees(rambutans, durian etc.:10 %) were planted for local community use. Ex-OECF funds (Hutan Kemasyarakatan) are used for the project.

(4) Regreening Programs

The district forestry and soil conservation service (Dinas PKTs Tingkat II (Dinas Kehutanan in districts)) at district level has been implementing regreening and hutan rakyat programs specially to address local involvement in tree planting activities outside of state forest land. The programs include development of nurseryiesby villagers, demonstration unit of sedentary cultivation, seed distribution, etc. However, it is pointed out that the present regreening and hutan rayat

programs are not accessible to the majority of the local communities because the implementation is on a limited scale.

CHAPTER 6

FISHERIES

CHAPTER 6 FISHERIES

6.1 ISSUES OF FISHERIES SECTOR

6.1.1 Fish Resources

In both provinces under the current study, the marine fishery of the archipelagic are not open to deep sea exploitation. Moreover, the resources in the target fishing area have long been exploited by fishing fleets not only from the two provinces but also from the outer provinces that adjoin this archipelagic sea. The local fishing fleets are exposed to competition with more competitive and capable fishing fleets from other provinces and even from foreign neighboring. In actual fact, the efforts rendered by the fishing fleets from outside the provinces, as well as the efforts of the foreign-registered fishing vessels, are far greater than those by the local fishing fleets of the two provinces under study, serving as the determining elements to affect the resource potential in this area of the sea.

(1) Development and the Environment

The development in industrialization now taking place in the provinces of West Kalimantan and Central Kalimantan is also affecting the fisheries resource potential of the provinces and certain counter measures for protecting the fisheries resources from damaging effects of industrialization should be considered.

(2) Petroleum Industry

The long term effects to the marine fishery resources, resulting from activities of prospecting for petroleum and other mineral resources now carried on in the waters adjacent to the Natuna Islands, should not be under-estimated, as the drilling of the sea-bed for oil prospecting is one of the most destructive activities of fishery resources.

(3) Forestry Industry

The logging which has almost reached its maximum exploitation limit should cause a greater destructive effect to the fisheries resources in coastal waters through accumulation of silt and water contamination. The volume of soil carried by river waters into the sea is increasing with the progress of deforestation, thus intensifying the effects of accumulation of silt in changes of

sea-bed conditions and the total environment of the coastal waters that are serving as spawning and nursing grounds for inhabitants therein. The increasing use of chemical preservatives for the stocking of logs in river waters now contaminates river waters and is feared to affect the infant and juvenile components of river fish.

(4) Pollution

The peculiar nature of both provincial inland open water systems, which have served for creation of very diverse ecological systems, is now being exposed to the risk of extinction. Deforestation changes the inland water-flow systems and the original water characteristics. Opening up of plantations also changes the original water characteristics and original eco-systems existing in the inland open water areas by heavy use of lime ashes, chemical fertilizers and agricultural pesticides. The inland water fish and crustaceans resources of diverse nature may also be affected by these new changes. Minor fish species that live in waters or in areas of specific conditions may not sustain their living longer when their peculiar optimum living conditions are lost. Only those fish species that are strong and capable of surviving changing conditions or acclimatizing themselves to unfavorable conditions may remain and dominate the ecosystem, thus resulting in the loss of original nature of Kalimantan.

After all, the fisheries resources, in both the sea and the inland open water, of the two provinces are being exposed to destructive elements and are very vulnerable. The fisheries of the two provinces, both marine and inland open water, are established on the footing of resources of such vulnerable nature.

Therefore, the most important and essential requirement for ensuring the regional sustainability of the activities in the fisheries sector will be conservation and maintenance of the resources and the specific ecological systems and conditions in which the present resources sustain life.

6.1.2 Increase in Production and Creation of Marketing Outlets

In the preceding paragraphs, it was pointed out that the uneven fish consumption patterns for the two provinces of Kalimantan under study maybe interpreted as an absence of or limited access to, marketing outlets. The cases of two kabupatens, namely Kabupaten Kapuas Hulu and East Kabupaten Kotawaringin, were explained.

The Kabupaten Kapuas Hulu in the West Kalimantan Province has the highest inland open water fishery production (60% of the province's total inland open water production) but the smallest population. The East Kabupaten Kotawaringin is noted with the highest production in the province (nearly one half of the provincial total) and quite a large population. It may be said that an excessive supply of fish will have to be turned over to the consumers in the production

area, probably at reduced prices to induce repeated purchases, when there is no other outlets for out-of-boundary marketing.

The fish consumption in the Kabupaten Pontianak and Kotamadya Pontianak and in the Kabupaten Kuala Kapuas is very low although fish production in these two kabupatens is quite high. This is probably because these two urban kabupatens have good marketing outlets with the convenience of good transport infrastructure, by sea or by air and the prices do not have to be discounted. This would mean that the local consumers are not so induced to purchase more fish and the consumption stands just at a moderate level.

In planning development of an industrial sector with the expansion of commercial activities, the increase in production is always an essential objective to achieve. In the case of the fisheries development for the two provinces, the production increase is set as one of the major objectives to achieve. However, random increase in production in such districts like the Kabupaten Kapuas Hulu or the East Kabupaten Kotawaringin without ensuring the possibilities of creating marketing outlets may result in upsetting the fish pricing structure and marketing activities. In other words, any increase in production over and above the current consumption level will have to be sold at great discounts to induce additional purchases, thus upsetting the existing pricing structure and the order in the existing market.

In the last several years, the fisheries production has remained at a consistent level an increase in production will have to be prepared and planned with preferred species of a high value that have good outlets and market acceptance or have the assurance of off take in good volumes for processing purposes at assured prices. Of course, domestic consumer markets would accept and absorb additional supplies in reasonable volumes, but the producers have to endeavor to offer increased supplies in better quality and in more presentable forms which would stimulate the purchasing interest of the consumers.

Particularly for West Kalimantan, the production increase could be directed to both the domestic markets the inter-insular and export trading. However, for Central Kalimantan, the production increase will have to be aimed at inter-insular trading and export marketing and efforts will be necessary to divert the current production from both the marine and the inland open water fisheries for inter-district (within the province) or inter-provincial trading by extending a water range of fish marketing distribution. This will be useful to ease the pressure of fish supply concentration in a rather restricted area for improvement in fish pricing.

The marine fishery may not have good prospects for further development. The inland open water fishery may further develop but only in existing traditional manners, produces out additional production that comprises same dominant species in same quality.

6.1.3 Aquaculture Development

Aquaculture in both provinces is believed to hold very substantial prospects for future development. As mentioned, it is important to plan the development in fisheries production to meet specific needs of the marketing outlets. In aquaculture, the production could be planned and controlled, if properly and efficiently managed, as to how much to produce and what items to produce to meet specific demand or liking of the target market. The sizes of fish could be planned so that the most attractive fish will be offered to the consumers. This would ensure higher return to the producers.

Tambak culture, if properly planned with due care for export marketing, will be highly viable operations for development along the marshy brackish-water areas. Of course, it would be most ideal to develop poly-culture in both semi-intensive and extensive manners.

Kolam and Karamba culture will also be highly feasible, provided that production volume will be carefully studied and contained within a level of meeting assured or planned off take. Here again, the advantages will be that the producers will have the choice of species, could present to the market the fish in most preferred sizes, at a time when the fishery harvest is scarce.

Finally, the development of aquaculture operations, either on a commercial scale or smaller, should be encouraged. Particularly the small-holder, family or household-base aquaculture should receive more encouragement and material support from the public sector.

The development of aquaculture by commercial entities will certainly be realized but the commercial operators tend to concentrate on the development of most viable items. By encouraging and assisting the small-holder household or cooperative-type operators, particularly with financial and technological support, the development could be diversified and strengthened.

6.2 OBJECTIVES

- To increase fish production and to increase the values of fish produced
- To conserve fisheries resources for future utilization
- To diversify and increase rural incomes

6.3 STRATEGIES

6.3.1 Strategies of Fisheries Sector Plan

- To enhance values and quality of fishing catch by providing small-scale hygienic fish handling areas at fish unloading facilities along rivers
- To conserve fisheries resources in inland waters and coastal areas for future development of more high value added fisheries production, as well as for supply basic protein food to local markets
- To improve selected hatchery/nursery/technology demonstration operations for aquaculture
- Not to disturb the existing fish pricing structure and marketing activities by careless efforts at increasing fish production

6.3.2 Assistance Recommended for Development

(1) For Support of Most Fundamental Activities for Conservation and Utilization of Inland Water Surface

It is strongly believed that maintenance of the current inland open water surface and conservation of the existing inland-water ecological systems are most essentially required for sustainable utilization of the resources therein. The tasks for achieving these objectives will include: (1) survey and research of peculiar inland water surface areas specific to the two provinces, (2) close and thorough monitoring of fisheries and other human activities utilizing the inland open water surface, (3) removal and prevention of any such activity as detrimental to conservation, (4) planning and initiating the most sustainable and most appropriate manners of inland water resource utilization; and (5) any other activities in management and control of inland water resource in specific areas. It is recommended that a station or center be established under a special agency that will be authorized to conduct these activities.

(2) For Support of Hatchery/Nursery/Technology Demonstration Operations for Aquaculture Development

Throughout the provinces, there are a number of hatcheries and nursery ponds in operation confronted with a number of difficulties arising from lack of facilities and materials. The

technological personnel at these stations were found doing difficult tasks through hand labor. The services extended to fish farmers are essentially required and desired by the operators.

These stations should be improved and upgraded in infrastructure and facilities. In the first place, one or two stations/hatcheries in the most active district should be upgraded as centralized station/stations, and, other respective local stations be provided with improved facilities, particularly with laboratory equipment.

It is also recommended that one station/hatchery in the coastal district where tambak operations are developing be specialized in brackish-water and marine culture fields with an objective of diversification of aquaculture along the coastal areas. This coastal station will also study environmental conservation of coastal areas. The establishment and operation of such hatchery/research station centers has been pushed forward as a part of a project, called "LOKA," prepared and being implemented by the Directorate-General of Fisheries and such facilities will definitely help aquaculture development on which the future of the fisheries sector in the two provinces rely.

One other matter for recommendation is the encouragement for the technological personnel attached to those hatchery stations and personnel for development planning at district offices of Dinas Perikanan. Up-dating and expanding of technological knowledge and experience of these personnel will definitely serve for improving and expanding the activities of such technological stations. An arrangement for attending certain training/familiarization courses in Japan by a group of technological personnel for one or two months every year, as well as for inviting one or two aquaculture experts (particularly those experts in hatchery technology and operations) from Japan to assist the operations in the provinces, is strongly recommended.

(3) For Support in Improvement of TPI Facilities

Other than for the East Kabupaten Kotawaringin in Central Kalimantan, where upgrading of an existing TPI or establishment of a new TPI is recommended, no medium to large-scale improvement in the facilities at fish landing centers is suggested as the volume of fish being handled at landing centers does not warrant any such investment. However, improvement particularly to create reasonably spacious fish handling areas that will ensure sound and hygienic conditions for fish handling at TPIs along the river banks is strongly desired. Such improvement will be realized with minimal investment but will greatly improve hygiene standards in fish trading activities.