CHAPTER 2.

FORESTS/FORESTRY AND SOCIAL FORESTRY IN INDONESIA

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2.1 Policies and Current Conditions Regarding Forests and Forestry

(1) Forestry Policies

1) Launch of 2nd Long-Term Forestry Development Programme

Indonesia has a vast area of tropical rain forests and the total forest land area is 144 million ha. Such a vast forest area attracts worldwide attention from the viewpoint of global environmental conservation. The timber produced by these forests generates a large number of domestic jobs in such fields as felling, logging and processing. Timber is Indonesia's second-most important export commodity after oil/natural gas and accounts for some 14% of the country's total export earnings. As such, Indonesian timber has a strong influence on the international market price.

Many people live in and around forests and their lives are largely dependent on forests in terms of clothing, food and housing. Consequently, forests and forestry policies in Indonesia play a significant role in improving people's lives and also ensuring soil, water and environmental conservation.

The Government of Indonesia is currently implementing the Second Long-Term Forestry Development Plan for the period from 1994 to 2018. The overall objective of the Plan is "to create forestry resources which can perform multiple functions in a maximum fashion". The identified targets and tasks of the Plan include forest management in accordance with such designated land use as production forest, protection forest and natural reserve, etc., the fostering and recruitment of capable manpower and the introduction of advanced technologies/techniques to suit the local conditions.

2) Formulation of Sixth 5-Year Forestry Development Plan

In accordance with the objective, targets and tasks of the 2nd Long-Term Forestry Development Plan, the Sixth 5-Year Forestry Development Plan for 1994 through 1998 is in progress. While inheriting several issues from the Fifth Plan, including the establishment of land use categories and their boundaries and the maintenance/development of protection forests with excellent soil and water conservation functions, the Sixth Plan intends to encourage social forestry which aims at achieving sustainable and environment-friendly forest management through the

provision of employment opportunities for people living in and around forests and the promotion of local communities.

3) Regional Forestry Administrative System

The regional forestry administrative system for Propinsi Bengkulu as of March 1997 is shown in Fig. 2-1.

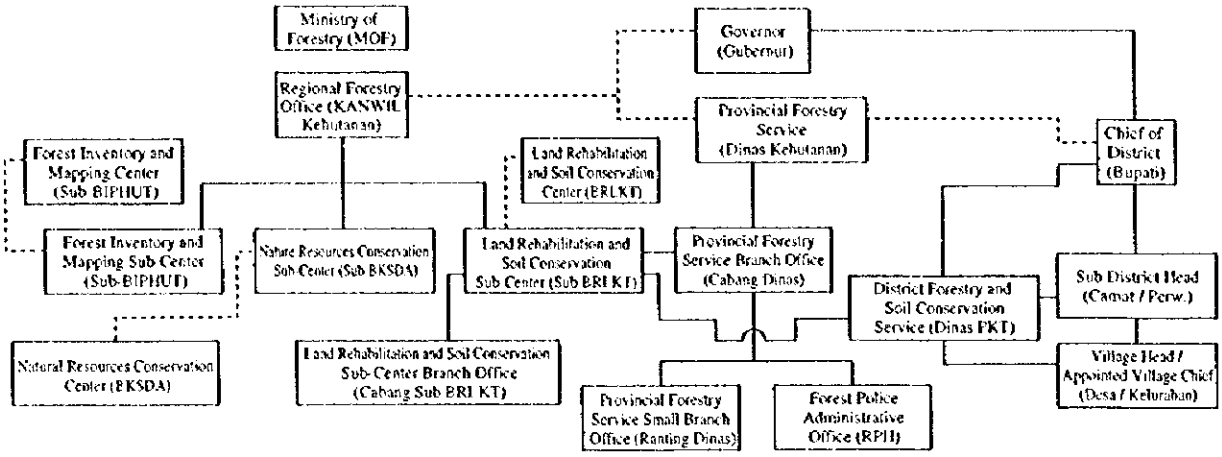

Fig. 2-1 Organization Chart of Regional Forestry Administration

Notes:
- Regional Forestry Office (KANWIL Kehutanan) : an extended body of the Ministry of Forestry and the governmental office in charge of overseeing all forestry-related planning and implementations.
- Provincial Forestry Service (Dinas Kehutanan): a forestry body under the state governor's jurisdiction; in charge of implementation and corrective measures.
- Land Rehabilitation and Soil Conservation Subcentre (Sub-Balai Rehabilitasi Lahan dan Konservasi Tanah): In Bengkulu, the Ketahun Land Rehabilitation and Soil Conservation Subcentre functions as the subcentre to the Third Land Rehabilitation and Soil Conservation Centre at Palembang. Formerly concerned with planning and evaluation (Dinas Kehutanan in charge of implementation) related to forest and soil conservation, and land reclamation under the auspices of the Regional Forest Service. Beginning in March 1994, "District Forestry and Soil Conservation Service" (Dinas Perhutanan dan Konservasi Tanah) was established in every prefecture as a part of the decentralization process; these were allocated funds directly from the Ministry of Forestry, and conservation subcentres currently implement their projects.
- Forest Inventory Research Subcentre (Sub BIPHUT): forest inventory and map research station.
- Natural Resources Conservation Subcentre (Sub BKSDA): conducts operations related to nature conservation.
- Provincial Forestry Service Branch Office (Cabang Dinas Kehutanan): the implementation body for forestry projects, along with the Provincial Forestry Service Small Branch Office (Ranting Dinas).
- Forest Police Administrative Office (RPH): A station for forest rangers under the jurisdiction of the state forestry office, and for forestry extension staff.

(2) Forests in Indonesia

Forest classification in Indonesia is finalised by the TGSK, Forest Land Use by Consensus issued in 1984 pursuant to the Basic Forestry Law enforced in 1967 and there are five forest categories, i.e. nature reserve forest, protection forest, ordinary production

forest, restricted production forest and conversion forest. The forest area by category in Indonesia in 1994 is shown in Table 2-1.

Table 2-1 Forest Area by Category in Indonesia

(Unit: million ha)

Forest Category		Forest Land	Bare Land	Total
National Forest Land	Nature Reserve Forest	15.8	3.0	18.8
	Protection Forest	24.9	5.8	30.7
	Restricted Production Forest	25.3	6.0	31.3
	Production Forest	26.4	6.6	33.0
	Conversion Forest	20.	6.6	26.6
	Sub-Total	112.4	28.0	140.4
Private Forest Land		6.6	46.0	52.6
Total		119.0	74.0	193.0

Source: Indonesia Forestry Action Programme (Ministry of Forestry), November, 1995

(3) Forests in Project Area

All national forests in the Project Area are protection forests and the land use and vegetation survey puts the total forest area at 13,305 ha. While commercial cutting, clearing and food production, etc. are prohibited inside national forests, the planting of food trees and collection of firewood and/or rattan are permitted.

(4) Reforestation Work

Reforestation work is conducted at critical land in national forests and at protection forests/nature reserve forests/abandoned former slash-and-burn cultivation sites in important watersheds as well selected sub-watersheds for the purposes of achieving forest rehabilitation, providing new employment opportunities for local farmers, reducing soil loss, flood control and conserving natural resources. During the 5th 5-Year Forestry Development Plan (1989 - 1993), 4,350 ha of land were reforested in Kab. Rejang Lebong. The main species planted were meranti (*Shorea* spp.), merkussi pine (*Pinus merkusii*), mahogany (*Swietenia macrophylla*), segon (*Albizia falcataria*), acacia mangium (*Acacia mangium*) and kemiri (*Aleurites moluccana*), etc. The planned annual reforestation and the actual result are shown in Table 2-2.

Table 2-2 Planned Reforestation and Actual Result in Kab. Rejang Lebong

(Unit: ha)

Kecamatan	Reforestation								Forest Roads (km)	
	1989		1990		1991		1992		1993	
	Planned	Result	Planned	Result	Planned	Result	Planned	Result	Planned	Result
Kepahiang	250	250	800	800	250	250	600	600	6	0
Curup	400	400	100	100	–	–	–	–	–	–
Muara Aman	850	850	600	600	–	–	500	500	–	–
Total	1,500	1,500	1,500	1,500	250	250	1,100	1,100	6	0

Note: Kec. Muara Aman is located in Kab. Lebong Utara.
Source: Statistik Rehabilitasi Lahan Dan Konservasi Tanah, Propinsi Bengkulu, 1993/94

(5) Regreening Work

Regreening work is conducted at privately owned critical land and selected sub-watersheds of important watersheds, etc. for the purposes of improving the commitment of farmers to the conservation of natural resources, rehabilitating forests on critical land, improving soil fertility, increasing soil productivity, increasing the income of farmers, reducing soil loo and flood control. Regreening work can more specifically be classified as demonstration plots, check dams, community forest and nurseries.

1) Demonstration Plots

A demonstration plot can be either a natural resources conservation model unit (UP-UPSA) or a settled agriculture model unit (UP-UPM). In the case of a UP-UPSA, agricultural methods aiming at soil conservation are demonstrated. Each plot covers an area of 10 ha, involving 10 families as the basic unit. Such civil engineering works as terracing and channel works are also conducted. In the case of a UP-UPM, the benefits of adopting settled agriculture rather than slash-and-burn cultivation are demonstrated. Each plot covers an area of 20 ha involving 20 families as the basic unit. Terracing work is also conducted. The implementation of demonstration plots during the 5th Forestry Development Plan period in Kab. Rejang Lebong is shown in Table 2-3.

2) Community forest (Hutan/Kebun Rakyat)

Community forest comprises regreening efforts to provide farmers with new employment opportunities, to improve soil fertility and to achieve soil conservation through the mixed planting of fruit trees and other trees in degraded areas. Community forest is conducted in areas with a gradient of 40% or more, areas

unsuitable for the cultivation of annual crops, abandoned sites due to degradation, unproductive areas, conservation areas in view of the existence of such water sources as springs and ponds, landslide areas and areas with shallow top soil. Farmers with a small plot of land are organized with a view to covering a combined wider area with various types of trees. Community forest in Kab. Rejang Lebong covered 3,100 ha of land during the 5th Forestry Development Plan period as shown in Table 2-3.

3) Village Nurseries (Kebun Bibit Desa)

A village nursery has a size of at least 0.25 ha and produces the types of seedlings required for local regreening work. The seedlings for community forest and demonstration plots, etc. are supplied by village nurseries. A village nursery project officially lasts for one year and its management responsibility is then transferred to a local farmers' group. A total of 21 village nurseries were established in Kab. Rejang Lebong during the 5th Forestry Development Plan period as shown in Table 2-3.

Table 2-3 Regreening Work in Kab. Rejang Lebong

(Unit: ha)

Type of Regreening Work	1989	1990	1991	1992	1993	Total
UP-UPSA	30	50	100	100	100	380
UP-UPM	20	40	60	–	–	120
Community forest	–	500	1,000	1,000	600	3,100
Village Nursery (Number of Nurseries)	–	–	9	4	8	21

Source: Statistik Rehabilitasi Lahan Dan Konservasi Tanah, Propinsi Bengkulu, 1993/94

(6) Finance

As regreening work and afforestation work has been gaining momentum at private land, the Ministry of Forestry has introduced a low interest loan of upto two million Rp/ha and a maximum repayment period of five years (or 10 years in the case of tree planting for forestry purposes) to further promote such work. Funding is also available from the Presidential special budget for various work requiring a large sum.

2.2 Social Forestry

(1) History of Social Forestry in Indonesia

Many forestry approaches resembling social forestry have been adopted in Indonesia in the past. The most organized attempt in this regard was a project which commenced in 1986 of

the Indonesian Forestry Corporation with the assistance of the Ford Foundation on Java Island where the population pressure was very strong. This project had covered a total area of some 37,000 by 1993 and employed agroforestry, agroforestry through the planting of mangrove trees and silvopasture. The project is said to have contributed to improving the income of the participants. In implementing the project, NGOs listened to the local opinions and these were then reflected on the project management by the Corporation. The commitment of NGOs is regarded as having been a vital contributory factor in the project's success.

Meanwhile, projects in line with the spirit of social forestry have been implemented in West Kalimantan and other regions to enhance the relationship between local life and forestry. These projects aiming at enhancing the relationship between inhabitants and forests have provided great stimulation for forestry officials, who are traditionally blind to issues other than forestry, and comprise important trials for the preparation of proper social forestry practices in the future.

The only conventional type of social forestry confirmed in the Study Area is apiculture involving some 300 beehives. However, greening work involving the conservation of farmland, fodder fields for sericulture and the planting of some 30 ha of land are presumed to have provided valuable experience for the future implementation of social forestry. No social forestry pursuant to the New Decree of the Minister of Forestry has been yet put into practice in the Study Area as the relevant guidelines on the application form and species to be planted are still at the preparation stage.

(2) Social Forestry Programme of Sixth 5-Year Forestry Development Plan

The Social Forestry Programme planned as part of the Sixth 5-Year Forestry Development Plan has the following objectives and components.

1) Objectives of Social Forestry Programme

The objectives of social forestry are (i) promotion of public participation in afforestation efforts, (ii) enhancement of forest functions by means of the restoration and reforestation of communal land, traditional common land and converted forest land and (iii) improvement of public health.

2) Programme Components

a) Intensification of Community Forest Development

Community forest development is a new type of major forestry development and is important for local development.

- Confirmation of the locations and configuration of community forests: 250,000 ha
- Confirmation of the locations and configuration of utilisable community forests: 460,000 ha
- Preparation of a community forest management plan: 830 ha
- Establishment of community forest management units: 830 units
- Confirmation of (or decision on) forest products (including non-timber products) of community forests
- Confirmation of the timber volume of community forests: 27 provinces
- Mapping of community forest timber resources

b) Strengthening of Community Forest Management Organization

- Creation of cooperative-type farmers' groups: 830 units
- Social forestry practice extension work for and training of farmers: 4,750 persons
- Legal certification of community forest area
- Development of a system to promote the sale of forest products (joint work between farmers and forest products industry)

c) Community Forest Development

Community forest development is designed to encourage the voluntary planting of trees by local farmers on their own land and strong guidance is required if the farmers have no previous experience.

- Establishment of nurseries: 830 units

– Social forestry extension work for and the training of farmers without previous experience: 830 key farmers

– Meetings between farmers and the forest products industry

– Finance for farmers: 830 units

– Development of community forests (13 provinces; 9 watersheds): 250,000 ha

d) Development of Social Forestry

The practice of social forestry can be developed in the form of agroforestry, silvopasture and silvofishery, etc. In addition, the planting of bamboo and/or cinnamon is considered because of their high economic value together with apiculture and/or sericulture.

– Decision on the location and configuration of social forestry: 25,000 ha

– Establishment of social forestry practices (24 provinces; 24 waterbasins): 250,000 ha

– Apiculture (3 provinces): 46 units

– Sericulture (approximately 1,000 tons) in West Java: one unit

– Establishment of an apiculture pilot project

– Establishment of a cinnamon nursery

(3) Enforcement of Decree of Minister of Forestry

Having examined the possible uniform implementation standards for social forestry, particularly social forestry in national forests, in view of the various relevant past experience, the Decree of the Minister of Forestry was enforced in November, 1995. The key points of this Decree are described below (See Attached Appendix M.).

1) Social forestry is implemented to improve the welfare of people living in and around forests and also to qualitatively improve and preserve the sustainable benefits of forests.

2) The subject area of social forestry is an area of a protection or production forest where no felling rights or reforestation rights are recognised and which has become critical land due to forest deterioration.

3) Social forestry activities include all processes from planting to the processing and sale of products (non-timber).

4) A participating member can be an individual person, group or community and all the participants conclude an agreement with the forest authority. This agreement must be accompanied by all activity plans, drawings/maps and copies of the identification cards of the participants.

5) A person having signed the agreement is responsible for the management of upto 4 ha of forest.

6) A participant must protect the forest with honest management and must pay a royalty.

7) The central government bears the project cost.

8) The agreement may be cancelled if the performance is considered to be unsatisfactory.

9) Related organizations provide guidance, control or advice, whichever is deemed appropriate.

10) Social forestry practices which commenced in the past can continue as long as the objectives and performance are appropriate vis-a-vis the spirit of social forestry.

Preparations are currently in progress to issue the related enforcement notifications regarding issues entrusted to the Directorate General of Reforestation, decision on utilisable forest area, approved species for planting and agreement form, etc.

CHAPTER 3.

NATURAL ENVIRONMENT

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3.1 Climate

The Project Area fits the tropical rain forest climate in the Keppen climate classification and much of the region corresponds to submountain rain forest in terms of the forest type (see Fig. 3-1).

(1) Temperature

Observation data at the Geofisika Kepahiang Station located near the southern part of the Project Area (at Desa Pasar Ujung; El. approximately 520 m) for the period from 1987 to 1995 shows a mean annual temperature of 23.9℃ and a mean monthly temperature range of 23.5℃ – 24.4℃, indicating a small temperature fluctuation throughout the year with an annual temperature fluctuation range of as small as 0.9℃ (see Attached Appendix C-1). The mean monthly maximum temperature varies between 28.8℃ and 30.9℃ with April through June recording a slightly higher temperature than the rest of the year. Meanwhile, the mean monthly minimum temperature varies between 19.0℃ and 21.4℃ with July and August recording a slightly lower temperature than the rest of the year. The warmth index is 226 which falls into the semi-tropical zone according to Kira's climatic zoning method.

The relative humidity is high throughout the year at 82 – 87%. On a monthly basis, July and August have relatively low humidity of 82% while December and January have relatively high humidity of 87%.

(2) Rainfall

Rainfall observation data at the BBH Air Dingin Station (at Desa Air Bening; El. approximately 1,000 m) and BPP Pal VIII Station (at Desa Pal VIII, El. approximately 940 m), both of which are located in the northern part of the Project Area, and the BBI Padi Kelobak Station (at Desa Kelobak; El. approximately 560 m) and the afore-mentioned Geofisika Kepahiang Station, both of which are located in the southern part of the Project Area, show high mean annual rainfall of 2,490 – 3,695 mm for the period from 1986 to 1995 (see Fig. 3-2, Fig. 3-3 and Appendix C-2). As these observation stations are located at the piedmont and as areas near the summit of Bt. Daun (El. 2,595 m) are often covered by clouds, forming a cloud belt, the rainfall level is even higher along the ridge on the western border of the Project Area. In fact, it is guessed that the annual rainfall may well be more than 4,000 mm in some areas along the ridge. The mean annual rainfall for the 10 year period from 1986 to 1995 (actual data is available for only six years) at the Diperta TK

II Curup Station (at Curup, El. approximately 650 m) was 2,019 mm, suggesting relatively low rainfall at the flat land around Curup compared to other parts of the Project Area.

The annual rainfall largely fluctuates from one year to another. Annual rainfall data for four stations, i.e. BBH Air Dingin, BPP Pal VIII, BBI Padi Kelobak and Geofisika Kepahiang, indicate repeated ups and downs in the range of 2,319 - 4,525 mm for the BBH Air Dingin Station (data for 1987 is missing). A similar fluctuation in the range of 1,954 - 2,896 mm is observed for the BPP Pal VIII Station which recorded the lowest annual rainfall level (data for 1986 is missing) among these four stations. The fluctuation range for the BBI Padi Kelobak Station is 3,186 - 4,126 mm, showing the highest annual rainfall level (data for 1994 is missing) among the four stations. The annual rainfall fluctuation range for the Geofisika Kepahiang Station is 2,451 - 3,845 mm which is almost the average of the four stations.

Average monthly rainfall data for these four stations in the period from 1986 to 1995 show that high monthly rainfall is generally observed in November through January and March at 252 - 476 mm but is low in June through August at 92 - 173 mm. Forests in the tropics are said to show signs of drought when the monthly rainfall level drops below 100 mm. Such a low monthly rainfall level is recorded in the Project Area in June at the BPP Pal VIII Station (96 mm) and in August at the Geofisika Kepahiang Station (92 mm). It must be remembered here, however, that the monthly rainfall significantly differs from one year to another. The monthly rainfall recorded at the four stations in the above 10 year period from 1986 to 1995 shows that low monthly rainfall of less than 50 mm has occurred in some years. Low monthly rainfall of less than 100 mm tends to occur from June to September.

The observation records of the BBI Padi Kelobak Station for the period from 1987 to 1994 show maximum 24 hour rainfall of 89 - 162 mm, maximum one hour rainfall of 52 - 82 mm and maximum half hour rainfall of 40 - 62 mm.

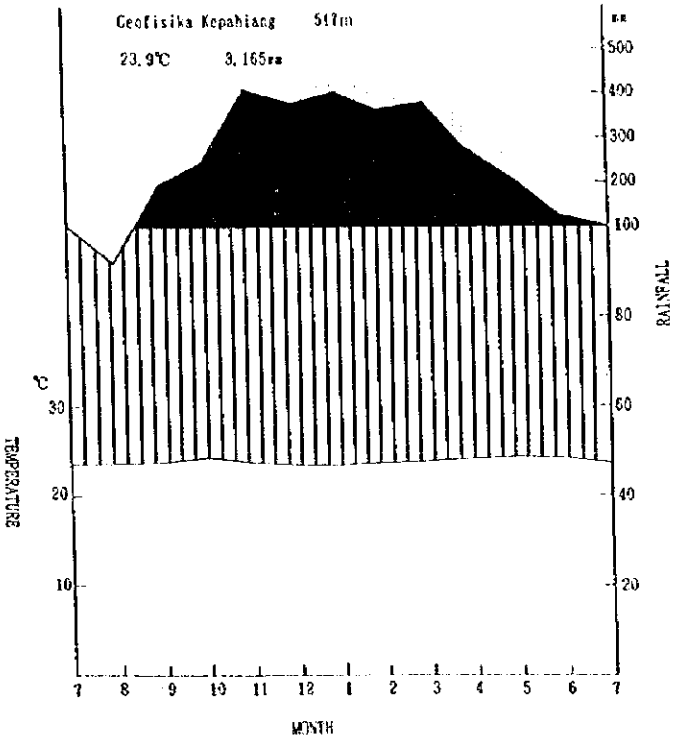


Fig. 3-1 Climate of the Project Area

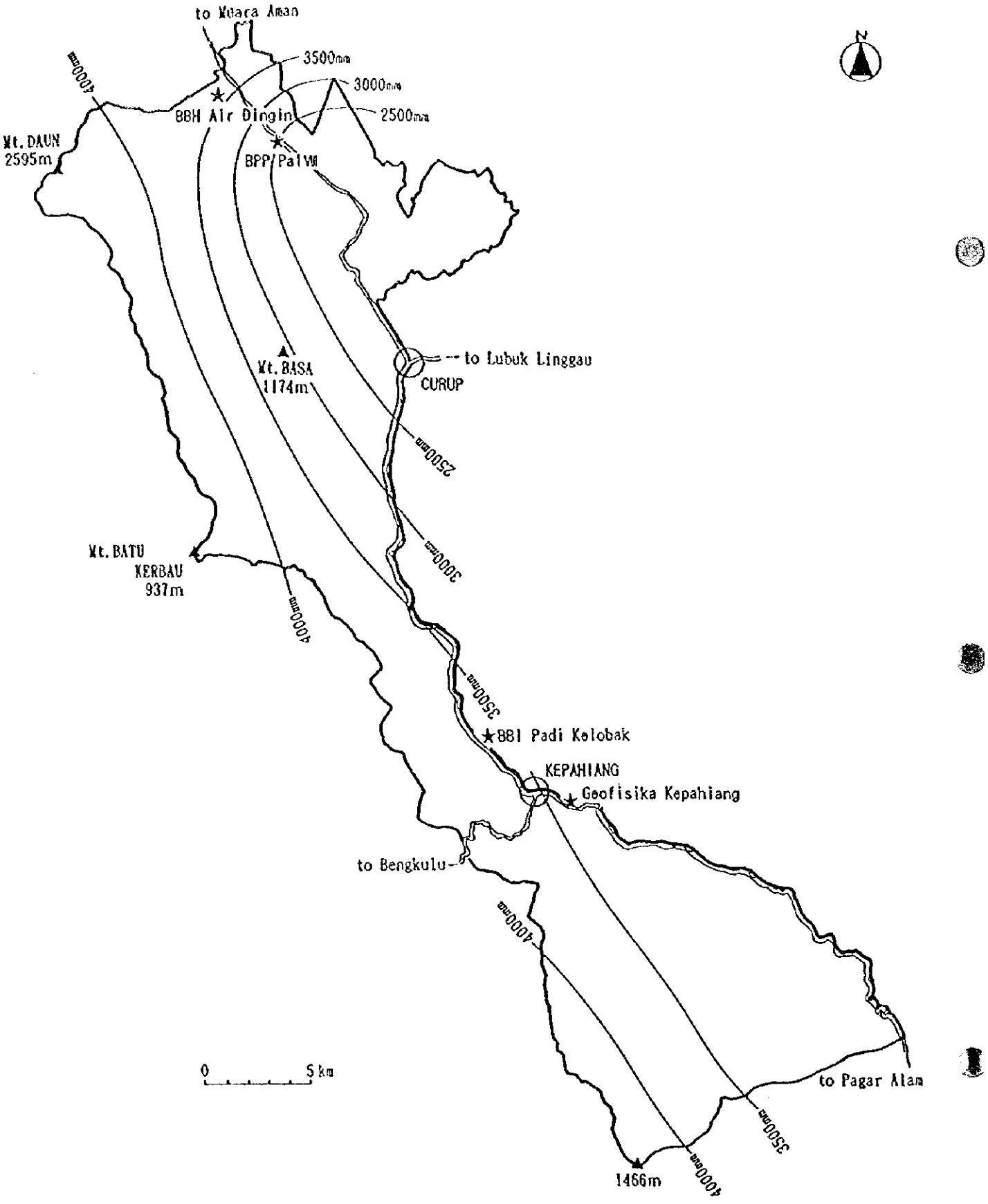


Fig. 3-2 Isohyetal Map of the Project Area
(★ denotes meteorological observation station)

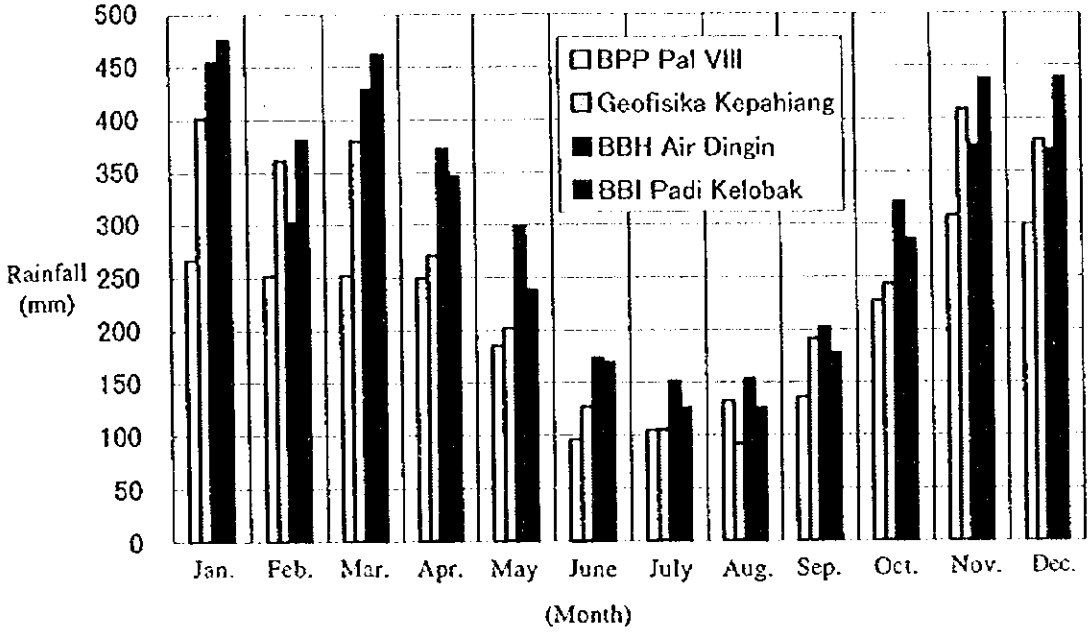


Fig. 3-3 Monthly Rainfall in the Project Area

3.2 Topography and Geology

(1) Outline of the Study Area

① Topography

The Study Area is located in the Southeastern region of the Barisan mountain range, the central range of the Sumatra island. The highest point is at 2,456 m above sea level (Mt. Daun of Kec. Curup), and the lowest at approximately 83m (eastern Kota Padang area). In general, the Study Area dips lower in elevation to both the south and east.

The topography of the Study Area can be roughly classified into the volcanic (upper: steep slopes, piedmont: gentle slopes) and mountainous (generally steep) zones and hilly areas are distributed between the volcanic and mountainous zones. The transitional zone to the lower hillsides and sedimentation sites can be found in the northwestern part of the Study Area and along southern Musi River respectively.

② Geology

Volcanic rock is distributed in most of the Study Area. The volcanic zone mostly comprises of comparatively new pyroclastic materials (volcanic ejecta) consisting mainly of Quaternary lava, tuff and breccia. The mountainous zone mostly comprises of Quaternary - Pleistocene pyroclastic materials and resembles the volcanic zone in geological composition. There is a distribution of a Hulusimpang layer (altered volcanic rock) of the Tertiary – Oligocene in the transitional zone between the mountainous and volcanic zones. A Lingsing layer (clay mineral, siltstone, dolomitic limestone) and intrusive rocks are distributed in certain areas of the mountainous zone. In addition, a sedimentary rock layer is found in the transitional zone between the mountainous zone and lower hillsides.

In the transitional zone between the mountainous and volcanic zones, the Ketahun and Kuluh-Musi faults are found and there are many lineaments distributed along these faults.

(2) Characteristics of the Project Area

The Project Area is located in the western part of the Study Area. The highest point above sea level is at approximately 2,456m (Mt. Daun in Kec. Curup), and the lowest at approximately 275m (the southernmost point within the Musi River Project Area in Kec. Kepahiang), showing a significant change of altitude. Accordingly, such microclimatic conditions as the air temperature are expected to considerably vary between locations at different elevations (see Fig. 3-4).

The Project Area is made up with the volcanic and mountainous zones (see Fig. 3-5).

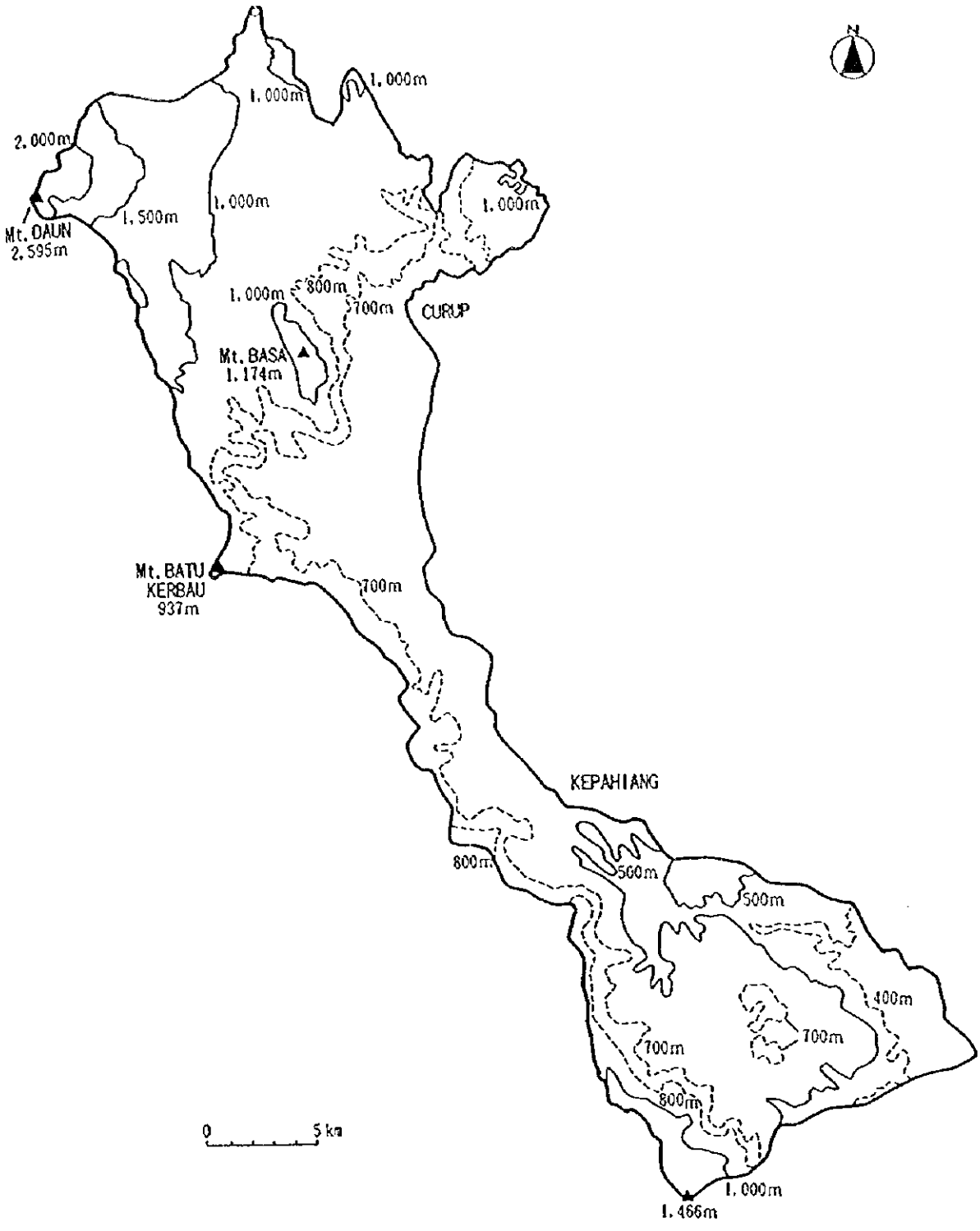
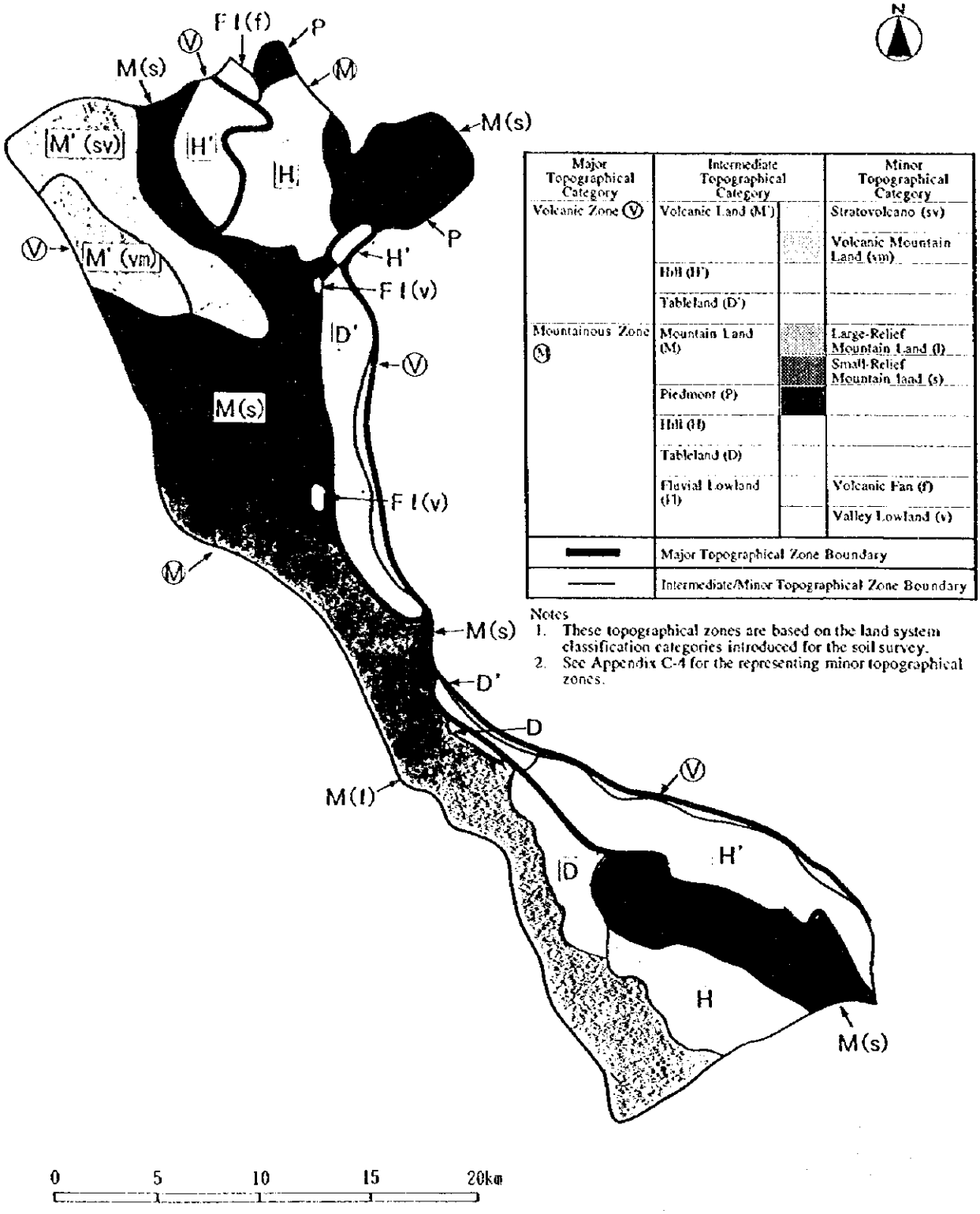


Fig. 3-4 Elevational Changes in Project Area

Note 1) The elevation is important in terms of non-timber forest products and agricultural production in that it is related to temperature, which in turn influences the pollination and fruit-bearing seasons.

Ex.: 700m: zone suitable for cultivation of fruit trees (tropical fruit trees: low temperature adversely affects pollination and fruit-bearing, subtropical fruit trees: low temperature positively affects pollination and fruit-bearing)
800m: zone suitable for cultivation of coffee (*arabica*: over 800m, *robusta*: under 800m)



Major Topographical Category	Intermediate Topographical Category		Minor Topographical Category
Volcanic Zone Ⓥ	Volcanic Land (M')		Stratovolcano (sv)
			Volcanic Mountain Land (vm)
	Hill (H')		
	Tableland (D')		
Mountainous Zone Ⓜ	Mountain Land (M)		Large-Relief Mountain Land (l)
			Small-Relief Mountain land (s)
	Piedmont (P)		
	Hill (H)		
	Tableland (D)		
	Fluvial Lowland (fl)		Volcanic Fan (f)
			Valley Lowland (v)
	Major Topographical Zone Boundary		
	Intermediate/Minor Topographical Zone Boundary		

Notes
1. These topographical zones are based on the land system classification categories introduced for the soil survey.
2. See Appendix C-4 for the representing minor topographical zones.

Fig. 3-5 Rough Distribution of Topographical Categories in Project Area

① Volcanic Zone

Composed of stratovolcanoes, mountainous regions affected by the volcanic activity, volcanic hillsides, and volcanic tablelands. Much of the zone is rich in black basalt lava and other volcanic sediments such as coarse-grained volcanic breccia. Located in the northern part of the Project Area as well as in the central to the southern region to the east of the Musi River.

② Mountainous Zone

Much of the Project Area outside the volcanic zone can be placed in the mountainous zone. Composed of tuff breccia layer, acidic tuff and a layer of their eroded materials[1] produced as a consequence of Mt. Daun's ancient volcanic activities, certain areas also contain basalt. This zone is classified into mountain land, piedmonts, hillsides, tableland and fluvial lowland according to undulation and surface characteristics. The zone is distributed to the west of the Musi River in the central to southern part of the Project Area.

National forests in the Project Area are mainly composed of volcanic land of the volcanic zone and mountain land of the mountainous zone and tend to be formed on steep slopes. Based on this topographical characteristic, sites suitable for paddy rice cultivation are quite limited in villages located near national forests. In contrast, private land tends to be flat or gently sloping.

3.3 Soil

(1) Current Conditions of the Study Area

Two distinct types of soil[2], i.e. Andepts (corresponding to the Andosols group in the FAO-Unesco method[3]) and Ultisols (corresponding to the Acrisols/Nitosols group in the FAO-Unesco method) are said to be distributed in the Study Area. Andepts originate from volcanic deposits and are characterized by a thick, brown-black surface horizon. The surface horizon is rich in organic materials and provides an excellent physical base for farming, promising a high yield. In Indonesia, Andepts are more likely to be found in the volcanic region in the Study Area. In comparison, Ultisols are acidic with poor base conditions and, in general, contain a concentrated layer of clay as a result of movement of

[1] Eroded tuff breccia layer: coarse-grained and dark brownish in color
Acidic tuff breccia: fine-grained and pale (reddish-brown if andesitic) in color

[2] Based on USDA Soil Taxonomy (7th) [PUSAT PENELITIAN TANAH DAN AGROKLIMAT (1990): PETA SATUAN LAHAN DAN TANAH LEMBAR BENGKULU, SUMATERA 1:250,000]

[3] FAO-Unesco (1974)

clay to the lower horizon. The agricultural productivity is quite low as this soil is both physically and chemically poor. Utisols are likely to be found in the eastern part of the Study Area and the mountainous region of northern and western Curup.

Inceptisols (corresponding to the Cambisols group in the FAO-Unesco method) other than Andepts are likely to be found in areas in which the probability of finding Andepts and Ultisols is low. In addition, thin-layered soil is thought to be distributed over rocky, denuded terrain, man-made soil around settlements and soil affected by paddy farming in pockets of alluvial deposits along rivers and at flat land.

(2) Properties and Distribution of Soil Groups in Project Area

1) Type and Distribution[1] of Soil Groups

According to the newly prepared soil map (scale: 1: 25,000, see Attached Appendix L.), the following soil groups are dominant in the Project Area: (i) soil group composed mainly of Acrisols (Acrisols group) and primarily distributed on hillsides, (ii) soil group composed mainly of Cambisols (Cambisols group) and primarily distributed at mountain land and steep terrain and (iii) soil group composed mainly of Andosols (Andosols group) and primarily distributed at volcanic land and gentle slopes. In addition, there are layers composed mainly of tuff breccia and acidic tuff, soil groups composed primarily of immature soil (Leptosols-Regosols complex group and immature soil group) resulting from weathering of the tuff layers and found at steep terrain, wettish/swampy soil group along the rivers and flat lands, and immature man-made soil group around settlements.

The soil units and properties of the Acrisols, Cambisols and Andosols groups vary according to the extent of the volcanic ash coverage, parent material and topographical location and can each be subdivided into 3, 4, and 3 subgroups respectively (see Attached Appendix C-3 ~ 4)

2) General Soil Properties (see Attached Appendix C-5 ~ 6)

Most soil in the Project Area soil is generally deep (1 m or more) with a brownish lower horizon of medium to fine grain. The volume of organic content in the surface layer is comparatively high (approximately 3~10%). Due to the effects of the volcanic ash, the level of the cationic exchange capacity (CEC: indicates the maximum capacity of the soil to absorb basic constituents) is high (around 30 meq/100g). However, the soil is somewhat acidic (pH: 4-5) and the level of base saturation (indicates the volume

[1] Based on FAO-Unesco (1990)

of absorbed base constituents) is low (10~20%). For this reason, the base content, including the quantity of suppliable phosphoric acid and exchangeable magnesium and potassium, is low. The overall nitrogen content is also low and the quantity of inorganic nitrogen usable by plants is also assumed to be low. Possibly due to the effects of volcanic ash, the quantity of exchangeable aluminium, which acts as a harmful substance, does not exceed 1ppm. Aluminium saturation is also low (approximately 10%), and is not expected to pose any problems.

Much of the soil in the Project Area can be classified into soil types with relatively short formation and maturation periods. For this reason, it is unclear what variations in the process of soil formation and maturation result due to differences in temperature and precipitation caused by altitude change in most Project Areas. A thick layer of humus or thick surface layer is observed in the same soil groups in areas with a higher altitude, presumably reflecting the dry or wet water environment.

3) Soil Properties by Groups

① Acrisols Group (AC, ACC I ~ II Soil Classes)

In this group, mainly Acrisols with a brownish fine-grained lower horizon rich in clay and poor in gravel (argic B) are found and Cambisols (refer to ② for properties) are also found. Leptosols (refer to ④ for properties) which are partially rich in volcanic ejecta can also be found in certain localities. Possibly due to the lack of a distinctive dry season, the clay sedimentation process is slow, the soil depth is good and the physical properties are also relatively good. The chemical properties are poor, with a high acidity and paucity of base properties. However, the Acrisols found in many parts of the Project Area have a higher CEC level (Alisols) compared to typical Acrisols. This is most likely the effect of past volcanic ash coverage and of the downward movement of humus. This group can be subdivided into the low-fertility soil group and high-fertility soil group.

② Soil Classes Mainly Consisting of Cambisols (CM I ~ IV Soil Classes)

Soils with a brownish, middle to fine grained lower horizon with a sand (unweathered but easily decomposable primary mineral materials) content (cambic B) can mainly be found. The soil has not yet reached a stage where other characteristic horizons and properties have formed. The soil tends to be deep and the physical properties are generally good. The chemical properties are thought to vary according to the parent material and the stage of soil formation. The supply

of inorganic material through the chemical decomposition of the sand content is taking place albeit at an extremely slow rate and the potential fertility is better than that of the Acrisols group.

③ Soil Classes Mainly Consisting of Andosols (ANC, AN I ~ II Soil Classes)

In most parts, soil rich in shiny volcanic glass with a coarse to medium grained horizon (andic properties) can be found. Typical Andosols have a thick, black surface horizon and a massive lower horizon of indeterminate structure (ped). Reddish-brown Cambisols (see ② for properties) and Leptosols (see ④ for properties) rich in coarse-grained volcanic ejecta (scoriaceous and basaltic, etc.) can be found in some localities. Compared to Acrisols and Cambisols, the physical and chemical properties of Andosols are good. In general, the fertility level is high and the water permeability is good but the surface horizon is easily erodable should the area be denuded. Areas where Leptosols are distributed are low in fertility.

④ Soil Classes Mainly Consisting of Immature Soils (LPR Soil Classes)

The parent materials of this group lie near the surface. Consolidated layers (tuff breccia and acidic tuff, etc.) can sometimes be found close to the surface and the soil is mainly composed of Leptosols (with a mainly gravel content of lava, basalt and scoria) and Regosols consisting of an unconsolidated middle-grained layer (layer of weathered consolidated materials). The soil has almost no depth and structural development within the horizons is weak. The physical and chemical properties are poor. The exchangeable aluminium content is markedly high. The high level of aluminium, suggested by the growth of *Melastoma malabathricum* and *Nepenthes* spp. which were considered to be an indicator plant for aluminium in Indonesia, is expected to produce harmful results. Leptosols are distributed at steep slopes found in the volcanic zone and at low-relief mountain land in the mountainous zone while Regosols are found at steep slopes other than those at low-relief mountain land in the mountainous zone.

⑤ Wettish Soil and Swampy Soil (WS)

Soil with reddish brown to black speckles and concretions are found. A high groundwater table at certain times of the year is another distinctive indicator of the presence of WS soil. The main soil types found are paddy soils and Gleysols (soil affected by groundwater and standing water). The soil properties vary according to the types of parent materials and the thickness of the surface horizon

and the depth of the groundwater table are determined by the topography. These soils are distributed along rivers, as are Fluvisols which mainly consist of alluvial deposits. At higher elevations, swamps tend to be formed and Histosols (consisting mainly of accumulated organic layers) can be found. The chemical properties vary according to the types of parent materials but the physical properties are poor.

⑥ Immature Man-made Soil (m Soil Class)

This type of soil is found at land near settlements, the Musi River Hydroelectric Power Station construction site, and along trunk roads where cutting and banking has taken place.

(3) Evaluation of Soil Conditions[1] in the Project Area (see Table 3-1)

1) Outline of Soil Conditions in the Project Area

The soil classes with the highest soil productivity are believed to be ACC I of the Acrisols group and AN I and AN II of the Andosols group as they are rich in lava and/or coarse-grained volcanic ejecta. In contrast, soil groups with low soil productivity include AC and ACC II of the Acrisols with a high clay content and CM I and CM II of the Cambisols group with a low gravel content in addition to the immature soil group and the wettish soil and swampy soil group.

The soil classes with low productivity have a thin surface horizon and a hard lower horizon and show a high acidity level. Both the physical and chemical properties are poor. Due to the little presence of an organically rich surface horizon which provides a potential source of nutrients and the low sand content level, these soil types presumably do not offer high productivity.

The highest elevation for the distribution of degraded forests which are believed to be the subject sites of the Social Forestry Project in national forests, including those at a high altitude, is approximately 1,700 m and the conditions for podzolization are not ripe at these sites because of the slow decomposition of deposited organic matters. In the case of those soil classes (LPR, AC, ACCII, CMI, CMII and CMIV) at sites with a high level of acidity, it is desirable to keep the planting of needle-leaved trees to a

[1] The values obtained by the physical and chemical surveys vary according to spot-specific conditions even within a single soil unit and are also easily influenced by analytical errors. However, the surveyed values are assumed to be representative of the soil class or soil unit for the purpose of this Study. It is preferable that detailed soil study and cultivation tests be conducted and the in-situ soil conditions be evaluated for the preparation and implementation of the Social Forestry Project.

minimum level to prevent the process of increasing the soil acidity, particularly at sites with a high altitude and high rainfall, due to the slow decomposition of the fallen leaves.

The soil classes in the greatest danger of erosion are the immature soil and Acrisols groups, followed by the Andosols and then the Cambisols groups with wettish/swampy soils in very little danger of erosion. However, in addition to the immature soil group, soil classes with low saturated permeability, high clay content and hard, impermeable lower horizons such as AC, ACC II, CMIV, ANC, AN II are erodable and require attention.

It is of some importance to consider the suitability factors when selecting the crops or tree species to be cultivated on these low productivity, high-erodibility soil classes and also to carefully examine the cultivation and management methods at some length. Moreover, measures to prevent soil degradation must be introduced for sites with these soil groups as the soil constituents are liable to erode.

2) Soil Productivity Potential by Land Use Type

a. Agricultural Land (Herbal Crops)

- While ACC I shows high soil productivity potential, most other soil classes have medium soil productivity potential. LPR shows low soil productivity potential.

- Areas along river courses and at valley bottoms suitable for paddy rice cultivation are classified in the soil class of WS where the soil productivity potential is medium. The distribution of WS is very limited except at plateaus and volcanic fans. Paddy field soil originating from volcanic ejecta is believed to have conspicuous water loss due to excessively good permeability, presumably making it difficult to conduct double-cropping.

b. Agricultural/Forest Land (Tree Crops and Non-Timber Forest Products)

- While ACC I shows high soil productivity potential, most other soil classes have medium soil productivity potential. AC shows low soil productivity potential.

- Even though the soil productivity potential is judged to be medium, the CM I, CM II, CM IV, ACC II, LPR and WS soil classes distributed in the national

forest-dominated western part of the Project Area are assumed to have unsuitable physical and/or chemical properties for certain types of crops and tree species. In areas with these soil classes, as a decline of the resistance to diseases and adverse impacts of the soil properties on flowering and fruit bearing are assumed, it is inferred that the actual yield of conventional methods of cultivation and management may be low.

c. Forest Land (Timber Production)

- The AC, ACC I, AN I and AN II soil classes show low soil productivity potential while the soil productivity potential of the other soil classes is medium.

- Most places have suitable soil conditions for the planting of *Acacia mangium* and Mahogany (*Swietenia macrophylla*), the species currently used for reforestation, except those classified as LPR or WS. The planting of Merkussi pine *(Pinus merkussi)* is believed to be unsuitable at sites with poor drainage.

Table 3-1 Outline of Soil Conditions Classification in the Project Area

Group of Dominant Soil Class	Soil Class	Erosion Hazard Potential			Soil Productivity Potential (3)		
		Indonesian Soil Type (Equivalent) (1)	DEPHUT Class	Erosion Hazard (2) Score	Agricultural Land Annual Crop	Agricultural/ Forest Land Tree Crop/ Non-timber Forest Products	Forest Land Timber
Acrisols	AC	Podsolics	4	60	II	III	I
	ACC I				I	I	I
	ACC II				II	II	II
Cambisols	CM I	Latosols	2	30	II	II	II
	CM II				II	II	II
	CM III				II	II	II
	CM IV				II	II	II
Andosols	ANC	Andosols	4	60	II	II	II
	AN I				II	II	I
	AN II				II	II	I
Immature Soil	LPR	Litosols, Regosols	5	75	III	II	II
Wetlish/ Swampy Soil	WS	Alluvial, Tanah glei	1	15	III	II	II

Notes:

(1) Using the survey findings on the typical soil profile of the dominant soil, the soil types suggested by Dudal, R. & Soehuraptoharojo, M. (1978) are applied.

(2) The erosion hazard potential is determined in reference to the soil conditions using Direktoral Jenderal Reboisasi dan Rehabilitasi Lahan, Departemen Kehutanan (1986): Pedoman Penyusunana Pola Rehabilitasi Lahan dan Konservasi Tanah. When applying the score to the soil classes in the Project Area in the future during both the preparatory and the application periods, more detailed categories will be introduced and the soil condition will be evaluated by taking into consideration such soil factors affecting soil erosion as the soil texture of the surface horizon, the saturated coefficient of permeability and the soil unit composition, etc.

(3) The soil productivity potential is roughly judged based on the degree of restriction posed by each factor's demand for a different type of land use and the number of such factors as incorporated by the basic concept of the FAO's land evaluation or USDA's land capability classification (see Attached Appendix L). Of the possible restrictive conditions, the climatic conditions, topographical factors, disaster potential and erodability, etc. are not considered this time.

I:	High soil productivity potential (hardly any special attention is required in terms of the selection of crops and tree species to be cultivated and the cultivation and management practices)
II:	Medium soil productivity potential (some attention is required in terms of the selection of crops and tree species to be cultivated and the cultivation and management practices)
III:	Low soil productivity potential (extensive cultivation and management practices are required to maintain the soil productivity and there is limited scope for the cultivation of suitable crops and tree species

3.4 Rare Wildlife and Ecosystems

(1) Current Conditions of the Study Area

Out of all wildlife species subject to protection by Indonesian laws, those which may inhabit Kec. Rejang Lebong and which fall in the category of endangered species designated by the IUCN are four species of mammals (Sumatra Rhinoceros, Malay Bear, Sumatra Elephant, Sumatra Tiger) and one bird species (Rhinoceros Hornbill: *Buceros rhino*). Among plants, Rafflesia falls in this category.

Rare ecosystems can be found in the forms of the Kerinci Seblat National Park (1,368,000 ha. spanning Propinsi Sumatera Barat, Propinsi Jambi, Propinsi Sumatera Selatan and Propinsi Bengkulu corresponding to the old protection forest area included in the Park following the local demarcation practice in the 1990's in north Kab. Rejang Lebong) and the nature reserve established for the protection of Rafflesia; both areas are designated for protection. In addition, high altitude areas in those forests designated as protection forests or recreation forests are thought to retain their original conditions.

(2) Rare Flora and Fauna in the Project Area

1) Wild Flora

Out of all wild plant species subject to protection by the Indonesian government, those species with a high likelihood of appearance in the Project Area (see Table 3-2) were monitored. Fig. 3-6 shows the estimated distribution area and confirmed sightings of these species, among which, Rafflesia, with a shortage of information regarding its cultivation and propagation methods, demands careful attention.

Rafflesia (*Rafflesia* spp.)

It is said that there are some 12 species of Rafflesia in Indonesia, of which at least four are found in Sumatera. *Rafflesia arnoldi*, supposedly the largest flower in the world, is believed to be found in Propinsi Bengkulu. Within the Project Area, Rafflesia is likely to be found in the western mountainous area spanning Desa Das Petah and Desa Pagar Gunung - where the Cagar Alam nature reserve lies - and Desa Kelilik. There have also been two confirmed sightings in the wooded area remaining around the coffee fields distributed along the Mundu river banks near Desa Taba Renah.

Rafflesia is a parasitic plant which uses such woody climbers as *Tetrastigma lenceolanum* and *Cissus angusifolia*, etc. of the grape family as its host. A single unit of the plant mostly consists of the flower section which takes approximately 1.5 - 2 years to grow. It also takes approximately one month for the bud to bloom. Flowering lasts for approximately one week. While there are female and male plants, no detailed report has so far been made on how the seeds found in the flower section are dispersed and there is no confirmed theory as to the method of propagation. Ground surface disturbance by such animals as wild boars and field mice, etc. may contribute to the germination or rooting process.[1]

Table 3-2 Wild Flora Subject to Protection with Potential Growth in the Project Area

Family	Local name [1]	Scientific name	Japanese name	Protection area [1]	Possibility of cultivation and propagation [2]	Red Data Book [3]	CITES [4]
Plant Kingdom							
Orchid family	Anggrek Pensil	*Vanda hookeriana*	(-/ a type of wild orchid species)		O	×	×
	Bunga Bangkai Raksasa	*Amorphophallus titawa*	(-/-)		O	×	×
Rafflesia family	Rafflesia	*Rafflesia* spp.	(Rafflesia/Rafflesia)	CA. Daspetah Less than 1ha/site, 2 sites (designated 1932) CA. Pagargenung Less than 1ha/site, 3 sites (designated 1932)	×	V/E	×

Notes:

1) Sources: KANWIL KEHUTANAN PROPINSI BENGKULU (1994): Daftar Nama Flora/Fauna yang dilindungi di Propinsi Bengkulu s/d T. A. 1992/1993 berdasarkan SK. Gubernur KDH TK.I No.4 Tahun 1985/Kawasan Konservasi Sumber Daya Alam di Propinsi Bengkulu T.A. 1992/1993 (STATISTIK KEHUTANAN PROPINSI BENGKULU TAHUN 1992/1993).
2) Based on the following documents:
K. Heyne/Badan Litbang. Departemen Kehutananan: TUMBUHAN BERGUNA INDONESIA
Simon & Schuster Inc. (1989) : Guide to orchids
3) IUCN (1978): From the IUCN Plant Red Data Book
4) Convention on International Trade in Endangered Species of Wild Fauna and Flora (The Washington Convention)
In addition to the above, *Nepenthes* spp. (Pitcher Plants genus), designated species under Annex II, were confirmed in areas of Anggrek pensil distribution.

[1] Anthony J. Whitten, Sengli J. Damanik, Jazanul Anwar & Nazaruddin Hisyam (1984): The Ecology of Sumatra

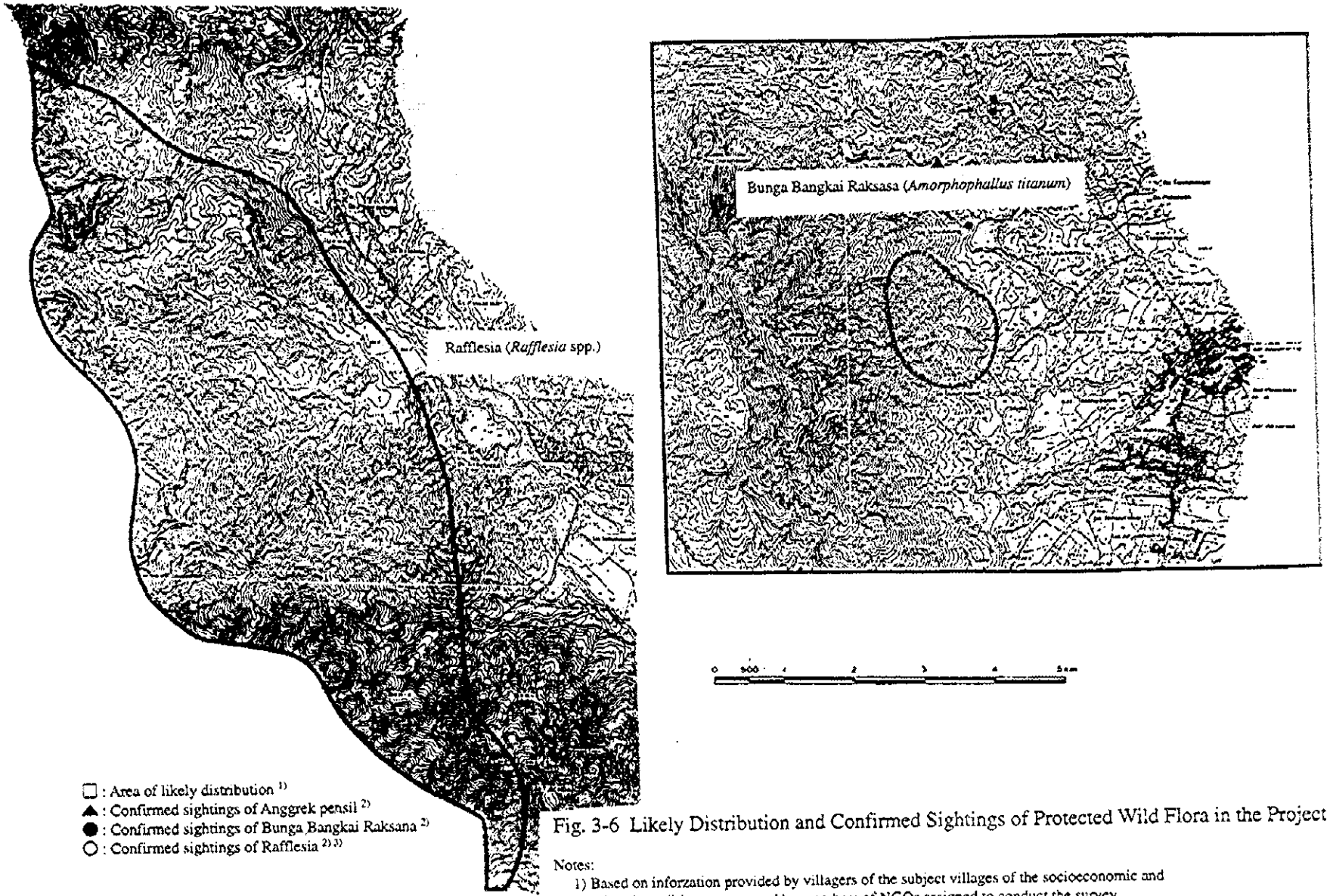


Fig. 3-6 Likely Distribution and Confirmed Sightings of Protected Wild Flora in the Project Area

Notes:
1) Based on inforzation provided by villagers of the subject villages of the socioeconomic and cultural conditions survey and by members of NGOs assigned to conduct the survey.
2) Confirmed by members of a field team for environmental impact evaluation study.
3) Areas not designated as a nature sanctuary (Cagar Alam) as of July 1997.

2) Wild Fauna

Many species likely to be found in the Project Area of those animals subject to protection by the Indonesian government (see Attached Appendix C-7) are believed to inhabit forest areas (or use them as a sphere of activity) and many of them feed on other animals/small animals and plants/fruits. Within the Project Area, there have been confirmed sightings or evidence of existence of the Malayan honey bear and sparrowhawks in Desa Petah and Desa Suka Datang, ounce in Desa Tebat Laut and siamang in several villages in the southern part of the Project Area, mainly in natural forests/secondary forests and around settlements. National forest areas with large tracts of natural and secondary forests, areas immediately around settlements and farmland are thought to provide habitat or a part of the sphere of activity for these species.

(3) Rare Ecosystems

Evaluation of the natural conditions based on the degree of human interference using the newly prepared land use and vegetation map indicates that "natural forests", which show the state of natural vegetation in the form of forests, and "wetland" which shows the state of natural grassland, can be treated as rare ecosystems.

There are clusters of natural forests with high natural contents on Bt. Daun in the northern part of the Project Area and also on mountain land in the central and southern parts of the Project Area (where there is a highly likelihood of sighting Rafflesia); there are also scattered sites of these forests in other areas (see Fig. 3-8). Natural wetland is scattered in the upper parts of Bt. Daun.

According to the findings of the vegetation survey (at seven sites) conducted in the course of the environmental impacts assessment survey (Chapter 9), the Shannon factor for natural forests or secondary forests in the adjacent areas of natural forests (El: 580 - 990 m) is approximately 3 – 4. Compared to a Shannon factor of 2 – 3 for wetland forests, there appears to be a low diversity of species for tropical forests and this can be considered a characteristic of mountainous rain forests. However, the lowest value was obtained for the low-elevation secondary forest at Benuanggaling, and the highest for Mt. Dendan with an elevation of 800m or so. Areas where coffee trees can be observed among immature trees also exist. It is likely that human influence and not elevation differences affect the diversity of species (see Attached Appendix I-5).

Natural forests and secondary forests in the adjacent areas have special importance in their capacity as a habitat and sphere of activity for earlier mentioned wild fauna. Due to past or

present human influence, many of these areas are thought to have reached a point where they are no longer able to sustain an environment which meets the demand for food, etc. by these animals.

(4) Damage to Local People by Birds and Animals

The villagers of all the subject villages of the socioeconomic and cultural conditions survey expressed a desire for the introduction of measures to combat damage to their farming products due to wild boars (Babi Hutan), monkeys, birds and field mice. Some villagers are of the opinion that the number of wild boars is increasing while others believe that coffee trees are less likely to be damaged by wild boar than annual crops. The field investigation results for areas near forests suggest that some villagers hunt birds for cash income or food and are little bothered by harmful animals. In regard to wild boars in particular, as many villagers are Muslims, they do not hunt wild boars for food. Consequently, wild boars are hunted by specialist hunting groups.

The following aspects of ecosystem deterioration are considered to be likely causes of the damage by birds and animals.

- The decrease of the number of large mammals which usually have a large sphere of activity has led to an increase of the number of those species of which large mammals are natural enemies, thereby destabilising the balance of the ecosystem.

- Natural vegetation zones high in natural features formerly provided an ideal habitat for wild fauna. Their diminishment and compartmentation have resulted in the shrinking of habitats or spheres of activity as well as a food shortage, reducing the prospect of sustaining individuals (herds) in the natural environment, in turn leading to the increased appearance of wild fauna at farmland.

- Farmland is increasingly invading the sphere of activity of wild fauna as the natural vegetation zone with a low natural feature (secondary and man-made forests, etc.) acting as a buffer zone and lying between farmland and the natural vegetation zone with a high natural feature is narrow.

One solution suggested is the introduction of protective perimeter fencing to surround the core habitat to prevent animals from wandering outside the core habitat[1] but this idea is not very practical because of its extremely high cost. Widening of the buffer zone appears to be

[1] Economic Development Institute of the World Bank (1989): People and Trees The role of Social Forestry in Sustainable Development

a more realistic option as it can conserve rare species as well as the ecosystem. Due to the considerable length of time required to conserve natural and secondary forests and to improve the habitat environment for wild fauna, plans to install protective fencing around farmlands or crops as an emergency measure are under consideration.

3.5 Hydrology and Water Quality

(1) Current Conditions of the Study Area

Rivers flowing in the Study Area can be roughly divided into the main channel of Musi River (which flows into the Bangka Strait) and its tributaries (which converge in Musirawas, South Sumatra). The main channel of Musi River has its source in Kec. Curup and flows down Kec. Kepahiang. The tributaries originate in Kec. Padang Ulak Tanding and Kec. Kota Padang. Part of Kec. Curup also includes the river systems of the Ketahun watershed which empties into the Indian Ocean.

According to the observation results[1] at Desa Cawang Lama in Kec. Curup, located at a point before the entry of Musi River into the Project Area, the flow rate increases to 2.9 - 3.7 m³/sec during the December-May rainy season and decreases to 1.8 - 2.2 m³/sec during the July-October dry season. The maximum flow rate is 5.56 m³/sec, the minimum discharge is 1.33 m³/sec and the annual average is 2.67 m³/sec. The coefficient of the flow regime is 4.18 and the flow rate fluctuation is judged to be rather small. Water turbidity is not apparent to the naked eye.

(2) River Systems in the Project Area

Most of the Project Area is located in the main watershed of the Musi River and part is located in the Ketahun watershed (1,400 ha of Dingin River). There are six main tributaries listed below and shown in Fig. 3-7. These make up much of the main watershed of the Musi River:

- Mundu River (watershed area: approx. 8,100 ha, drainage density: 1.89 km/km²)
- Dendan River (watershed area: approx. 13,300 ha, drainage density: 2.30 km/km²)
- Pikat Kering River (watershed area: approx. 4,900 ha, drainage density: 1.34 km/km²)
- Lanang River (watershed area: approx. 5,700 ha, drainage density: 1.90 km/km²)
- Teretik River (watershed area: approx. 5,300 ha, drainage density: 1.66 km/km²)

There is also Ketapan River with a watershed area of approximately 1,400 ha.

[1] Ministry of Public Works, General Directorate of Irrigations Survey Station (1994)

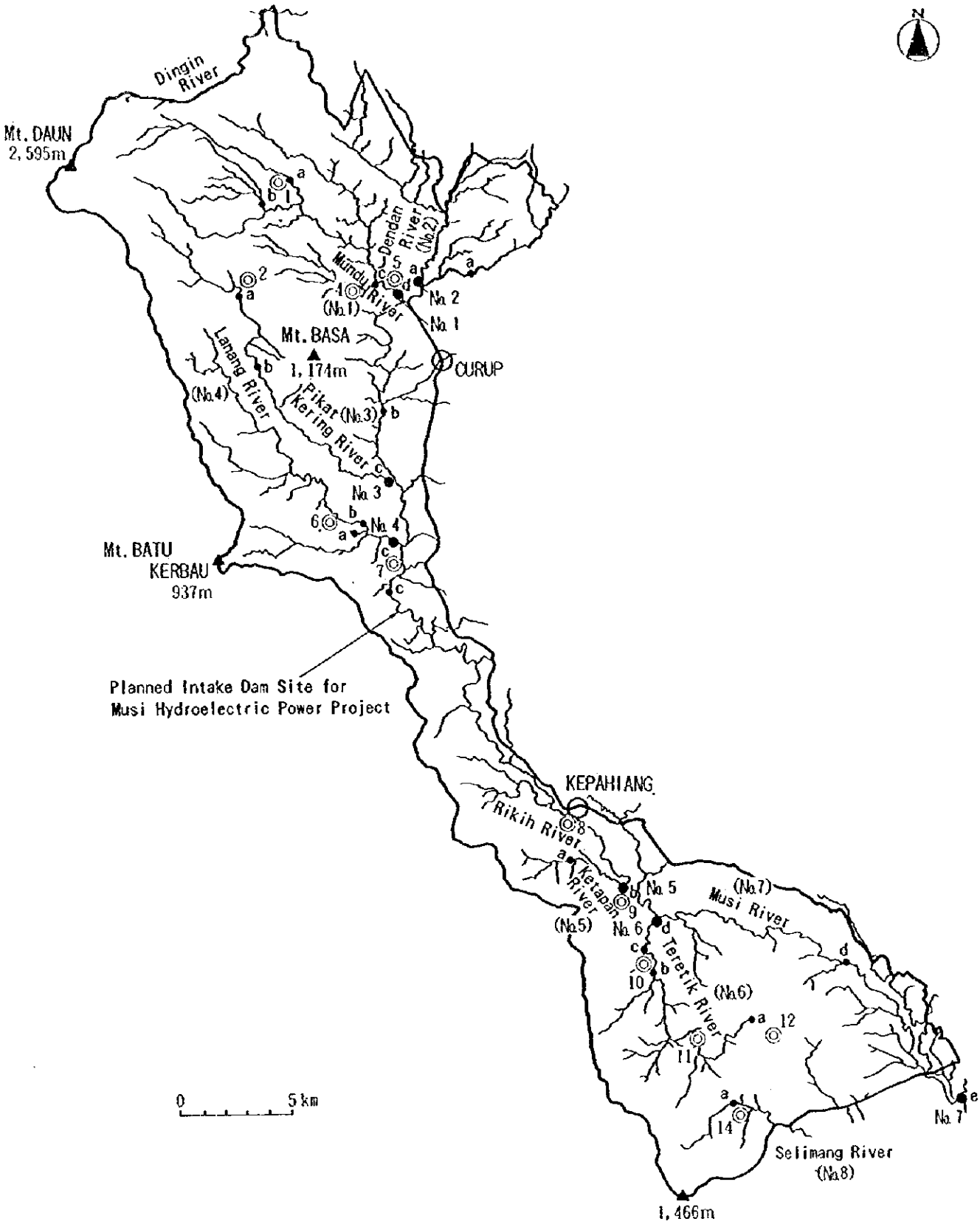


Fig. 3-7 River Systems in the Project Area

Notes:

1) Sites of surveys related to hydrology, water quality and aquatic life. ●: Rivers and streams ●: shallow wells and springs
2) See Attached Appendix C-8-9 for a comparison with survey site numbers of the environmental impact assessment survey.

The headwaters of Musi River are at Mt. Kelam in the Kerinci Seblat National Park outside the Project Area and the headwaters of Dendan River can be found in the same park. Other tributaries of Musi River, excepting Dendan River, have their headwaters in the protection forest zones dispersed within the Project Area.

(3) Surface Runoffs In the Project Area

According to the results of observation[1] conducted at Musi River near Desa Ujan Mas Atas, located in the central part of the Project Area, the mean annual flow rate is 42.3 m³/sec.

According to the October-November (corresponds to the rainy season), 1996 and July, 1997 discharge survey results (see Attached Appendix C-8), the flow rate of Musi River at Desa Kunduran Baru in Kec. Ulunusi (Propinsi Sumatera Selatan), adjacent to the south of the Project Area, was 116.7 m³/sec in the rainy season and 31.24 m³/sec in the dry season, and the ratio of 3.73 almost matched the river regime coefficient at the entry point to the Project Area [(see (1)].

Out of the six primary tributaries surveyed, the rivers with the greatest flow rate were Lanang River (14.8 m³/sec) and Dendan River (14.6 m³/sec) during the rainy season and Pikat Kering (2.15 m³/sec) and Dendan Rivers (1.97 m³/sec) during the dry season. In the case of such rivers as Lanang and Dendan, of which the rainy season to dry season flow rate ratios are greater than 4 (approximately), Musi River's river regime coefficient, the water yield capability is judged to be comparably low due to the large outflow volume per unit of watershed area in the rainy season and the low outflow volume per unit of watershed area in the dry season. These phenomena can be attributed to differences in the geographical conditions and land management conditions in comparison to the other tributary areas. In the upper watersheds of these two tributaries, the water level drops in the dry season and, depending on the settlement population and the total area of paddy fields, the supply of domestic and irrigation water may become inadequate.

(4) Condition of Groundwater in the Project Area

According to the survey results (see Attached Appendix C-9) on shallow wells (non-pressurized groundwater), the non-pressurized groundwater flow rate is 8×10^{-6} - 120×10^{-6} m³/sec. The groundwater level ranges from approximately 1m to 11m and tends to become deeper as the relative height from small rivers increases.

[1] P.T. Perusahaan Listrik Negara (Jan. 1996): Monthly Progress Report No.16, Musi Hydroelectric Power Project

Based on the survey results at several springs, the spring flow rate (68×10^{-6} – $6,825 \times 10^{-6}$ m³/sec) was found to differ greatly according to location. For example, a range of difference from 68 – 150×10^{-6} m³/sec was found for four springs around Desa Air Lanang. This is presumably caused by the difference in the catchment area in the upperstream of each spring.

(5) Water Quality in the Project Area

① Outline of River Water and Non-pressurized Groundwater

Of the analysed water quality values obtained for river water of Musi River and its six primary tributaries (Environmental Impact Assessment Survey [refer to Chapter 9]; see Attached Appendix C-9) sampled during the dry season, the following substances were found to be in excess of the threshold values stipulated in Category B "Can Be Used as Primary Source of Drinking Water" of the Cabinet Ordinance Regarding Water Pollution Control (No. 20 of 1990) [1] in some locations: hardness $CaCO_3$: (all rivers excepting Dendan River), chemical oxygen demand (COD): (all rivers excepting Dendan River), sodium ammonite level ($N\text{-}NH_3$): (Pikat Kering and Ketapang Rivers), and total pesticides (Teretik River). Teretik River water showed an especially high concentration of pesticides which are said to have carcinogenic properties (total organic chloride value Dieldrin and Aldrin). Similarly, shallow well water (see Attached Appendix C-9) was proven to have above-threshold values of $CaCO_3$, COD, and $N\text{-}NH_3$ at many locations and above-threshold values of CO_2, DO and Mn, Fe at some sites. With regard to pesticides of the organic chloride type, Desa Sukaramai, Desa Tanjung Dalam, and Desa Kampung Meayu showed high levels of concentration. According to existing data (surveyed in 1997, see Attached Appendix I-6) on the extent of the *e.coli* presence in shallow well water, wells in 9 out of 14 villages in the Project Area show an above-threshold value.

In general, river water and non-pressurized groundwater in the Project Area score high in terms of hardness. The biochemical oxygen demand (BOD) is low at all of the sampling points but the COD and $N\text{-}NH_3$ tend to be high. This tendency suggests that water bodies in the Project Area are subject to pollution by organic matters or experiencing eutrophication. The difference between the concentration values of the surveyed sites at the above rivers was small and the self-purification ability by dilution, precipitation and dispersion is low. Consequently, the recovery process appears to be slow once pollution has taken place.

[1] Peraturan Pemerintah Republik Indonesia Nomor 20 Tahun 1990 tentang Pengendalian Pencemaran Air

The Project Area includes a number of coffee fields and, therefore, the liberal use of pesticides and herbicides is common. There is a report showing concern in regard to the length of time required for the full decomposition of paraquat agents (see Attached Appendix C-10).

The results of the fact-finding survey as part of the environmental impacts assessment survey indicate the use of Thiodan (an endosulphanic pesticide) at paddy fields and of Potas Sangkalim (potassium cyanide) for river fishing by local people, creating concern in regard to adverse impacts on aquatic life by the use of pesticides, herbicides and chemical agents for fishing.

② Characteristics of River Water

The level of suspended solids (SS) in the rainy season exceeds the threshold value of 100 mg/litre or 50 mg/litre stipulated by the "Decision of the Minister of Population and Environment Regarding Waste Water Control Vis-a-Vis Existing Plants (No.3 of 1991) [1] " for the main Musi River and its six primary tributaries. Although this turbidity level is not the result of industrial waste water, it suggests an increasing level of river water turbidity during the rainy season or simply after each rain. The dissolved solids (DS) values for Lanang, Pikat Kering and Mudu Rivers are comparatively higher than those for other rivers. In the case of Lanang and Pikat Kering Rivers, the DS level is high despite the low SS level, indicating a continuing deterioration of water quality with respect to chemical properties (see Table 6-7).

In addition, an oil slick believed to originate from land surface materials was found in Desa Air Lanang. Concerned with the possible effects of oil slicks on the human body, local people do not use Lanang River as a source of drinking water. The results of a survey on aquatic life (part of the Environmental Impacts Assessment Survey, see Attached Appendix I-9) in terms of the dominant species and size of colonies, etc. suggest that the habitat for plankton, benethic organisms and nectons (particularly fish) is poor, presumably because of the adverse impacts of the river water's chemical properties (COD, $CaCO_3$ and $N\text{-}NH_3$) and/or the use of pesticides and toxic materials.

The aquaenvironment of local people (in particular the chemical properties of river water) has deteriorated in many areas. In these areas, it may be that the load from farmland and settlements is too great for the self-purification ability of rivers to cope with. In order to decrease the unit load from farmland and settlement areas, the

[1] Keputusan Menteri Negara Kependudukan Dan Lingkungan Hidup Nomor: KEP-03/MENKLH/II/1991 Tentang Baku Mutu Limbah Cair Bagi Kegiatan yang Sudah Beroperasi

strengthening of extension and public relation activities (on agriculture, environment-friendly forestry and hygiene) is desirable to facilitate a shift towards agriculture and forestry practices. In addition, in implementing the Social Forestry Project, it is desirable to continuously conduct the fixed point monitoring of water quality and soil and water body deposits (in terms of COD and pesticide concentration, etc.)

3.6 Landscape

(1) Current Conditions of the Study Area

The prominent feature of the natural landscape is mountainous landscape. Forests with preserved tracts of unspoiled original growth in areas such as the Kerinci Seblat National Park are particularly important. Such rivers and valleys as Musi River and Lake Mas in Kec. Curup and other lakes/marshland make up the aquatic scenery. In addition, man-made landscape consisting of farmland and houses is observed along main roads.

The primary viewing points are located along main roads. The viewing points for local people are mainly found in areas of settlements and such man-made landscape as farmland is mainly observed in the field of vision. Mountainous landscape tends to be located in the field of vision in the perspective of local people and constitutes one of the elements which make up the distant view. With an increase in elevation, the everyday viewing points of local inhabitants decrease in number due to the drop in the intensity of land use.

(2) Landscape Elements in the Project Area

① Preconditions

The approach to landscape elements is determined by the relationship between environmental elements constituting the landscape and people viewing such elements. There are many landscape elements, and value judgement of the landscape varies depending on the social conditions and personal background. In the present Study, the landscape elements are examined based on the following preconditions in view of the objectives of the Social Forestry Project.

- The subjects (persons viewing the local landscape) are mainly local people.
- The object (object to be viewed) is the natural landscape which is difficult to replace.
- Changes of landscape are judged in terms of those characteristics for which objective judgement is feasible (for example, quantitative change of view).

② Notable Landscape Resources

Based on the field investigation findings and data contained in the newly prepared land use and vegetation map as well as topographical map, the landscape resources which should be considered as notable objects are likely to be the "natural forests" with their high degree of natural growth. The distribution of notable landscape resources is limited to partial areas in the national forest zone (see Fig. 3-8).

③ Notable Viewpoint Points

Based on the findings of the socioeconomic and cultural conditions survey, local people's viewing points of the landscape in the course of everyday activities are mainly the residential part of the village, farmland and paths between these two areas. As farmland is scattered the number of people using particular farmland as a viewing point is limited. Accordingly, village centres with frequent entries and exits and the main road (Bengkulu ~ Curup) with heavy traffic volume can reasonably be considered the main viewing points in the Project Area (see Fig. 3-8).

The summit of Mt. Kaba located in the recreation forest region of the eastern Project Area affords an excellent view over the Project Area. However, the number of visitors to this summit is small and periods of good visibility are limited by fog, clouds and mist.

④ Notable Area of Visibility

The farther the distance from the national forest zone, the more difficult it becomes to clearly distinguish the presence of a forest in the landscape. Therefore, the point from which notable landscape resources are visible can be limited to those villages through which the demarcation line of the national forest zone runs and villages adjacent to such villages. In particular, Desa Tebat Pulau, Desa Air Lanang, Desa Pagar Gunung, Desa Kelilik and neighbouring villages should be considered notable viewing points.

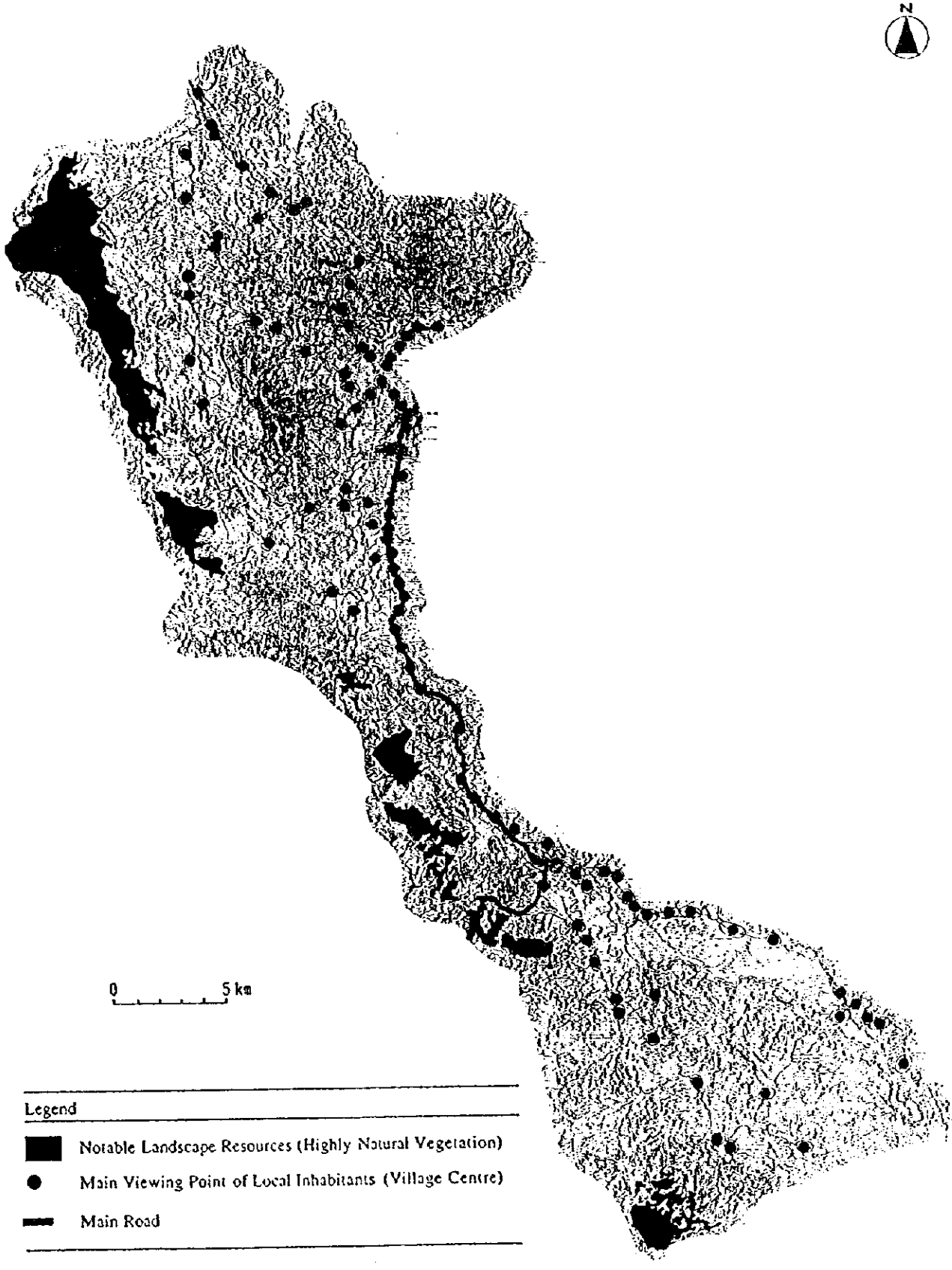


Fig. 3-8 Distribution of Notable Landscape Resources and Main Viewing Points of Local People in the Project Area

3.7 Land Use and Vegetation

Based on the results of the field survey and the interpretation results of the aerial photographs newly taken in April - May, 1996, the current conditions of land use and vegetation in the Study Area are described below (also see Attached Appendices J. and K.).

The total area of the Project Area is 52,833 ha, of which forests account for 15,201 ha (28.8%) and non-forests account for 37,632 ha (71.2%). (see Table 3-3).

(1) Forest Areas

① Natural Forests

Natural forests occupy 4,815 ha (9.1 %) and form a north-south belt along a ridge in the western part of the highlands with an elevation of 1,000 m or more. They consist of various tropical broad-leafed trees.

② Secondary Forests

Secondary forests occupy 5,157 ha (9.8 %) and are located in the elevational range of 500 – 1,500 m. These also consist of tropical broad-leafed trees.

③ Man-Made Forests

Man-made forests occupy 1,039 ha (2.0 %) and are located in the elevation range of 500 – 800 m. The planted trees are mainly Acacia mangium, Merkussi pine and Mahogany.

④ Shrub Land and Bamboo Forests

Shrub land covers a total area of 4,136 ha and includes shrub land on private land and left-over forests (secondary forests) on steep slopes and river banks. Bamboo forests are scattered along rivers and around settlements. Due to the smallness of the area of each unit (less than the minimum area for interpretation of 1 ha), the area in the category of "bamboo forest" totals only 54 ha.

Table 3-3 Area by Land Use and Vegetation Category in the Project Area

(Unit: ha)

Classification Category [1]		Symbol	National Forest			Private Land			Total			Ratio (%)
			Upstream of Dam [2]	Down-stream of Dam	Total	Upstream of Dam	Down-stream of Dam	Total	Upstream of Dam	Down-stream of Dam	Total	
Forest	Natural Forest (Total) [3]	Ha	3,182.42	1,632.97	4,815.37	-	-	-	3,182.42	1,632.97	4,815.39	9.12
	- upto 30%	Ha1	193.14	28.20	221.34	-	-	-	193.14	28.20	221.34	0.42
	- 31 - 70%	Ha2	647.11	584.57	1,231.68	-	-	-	647.11	584.57	1,231.68	2.33
	- 71% or more	Ha3	2,342.15	1,020.20	3,362.35	-	-	-	2,342.15	1,020.20	3,362.35	6.37
	Secondary Forest	Hs	1,477.02	3,679.99	5,157.01	-	-	-	1,477.02	3,679.99	5,157.01	9.76
	Man-Made Forest (Total)	Ht	3.16	1,035.58	1,038.74	-	-	-	3.16	1,035.58	1,038.74	1.96
	- acacia mangium	Hta	3.16	717.77	720.93	-	-	-	3.16	717.77	720.93	1.36
	- markusi pine	Htp	-	317.81	317.81	-	-	-	-	317.81	317.81	0.60
	- Mahogany	Hts	-	-	-	-	-	-	-	-	-	-
	Shrub Land [4]	Sb	72.78	487.85	560.63	3,146.91	428.57	3,575.48	3,219.69	916.42	4,136.11	7.83
	Bamboo Forest	Bb	8.61	-	8.61	36.19	9.38	45.57	44.80	9.38	54.18	0.10
Non-Forest	Irrigated Paddy Field	Sp	0.95	10.03	10.98	3,059.64	565.22	3,624.86	3,060.59	575.25	3,635.84	6.88
	Rainwater Paddy Field	Sh	-	-	-	-	38.72	38.72	-	38.72	38.72	0.07
	Dry Crops Field without Terrace	Ldg	41.45	24.15	65.60	3,412.49	800.75	4,213.24	3,453.94	824.90	4,278.84	8.10
	Dry Crops Field with Terrace	Ldt	-	-	-	172.55	2.78	175.33	172.55	2.78	175.33	0.33
	Coffee Field (Total) [5]	Lk	958.50	637.87	1,596.37	13,120.90	12,079.82	25,200.72	14,079.40	12,717.69	26,797.09	50.72
	- Upper Trees upto 10%	Lkt	248.04	76.04	324.08	3,832.06	856.32	4,688.38	4,080.10	932.36	5,012.46	9.49
	- Upper Trees 11% or More	Lkb11	49.92	26.96	76.88	593.74	557.57	1,151.31	643.66	584.53	1,228.19	2.32
	- "	Lkb12	3.01	3.03	6.04	134.19	-	134.19	137.20	3.03	140.23	0.27
	- "	Lkb13	-	-	-	-	-	-	-	-	-	-
	- "	Lkb21	293.11	101.54	394.65	976.44	594.39	1,570.83	1,269.55	695.93	1,965.48	3.72
	- "	Lkb22	364.42	430.30	794.72	7,577.96	10,015.64	17,593.60	7,942.38	10,445.94	18,388.32	34.80
	- "	Lkb23	-	-	-	6.51	55.90	62.41	6.51	55.90	62.41	0.12
	Orchard	Kb	-	-	-	24.25	-	24.25	24.25	-	24.25	0.05
	Mixed Garden	Kc	-	-	-	412.99	136.48	549.47	412.99	136.48	549.47	1.04
	Cinnamon Plantation	Lm	-	-	-	33.98	4.07	38.05	33.98	4.07	38.05	0.07
	Estate (Coffee)	Pk	-	-	-	277.88	-	277.88	277.88	-	277.88	0.53
	Grassland	Pr	-	3.49	3.49	29.09	61.79	90.88	29.09	65.28	94.37	0.18

Classification Category [1]		Symbol	National Forest			Private Land			Total			Ratio (%)
			Upstream of Dam [2]	Down-stream of Dam	Total	Upstream of Dam	Down-stream of Dam	Total	Upstream of Dam	Down-stream of Dam	Total	
Non-Forest	Bare Land	Lt	35.77	–	35.77	0.89	–	0.89	36.66	–	36.66	0.07
	Settlement	Pm	–	0.51	0.51	590.59	307.46	898.05	590.59	307.97	898.56	1.70
	Wet Land	Rw	–	–	–	12.13	–	12.13	12.13	–	12.13	0.02
	Water Body	W	–	–	–	21.39	9.30	30.69	21.39	9.30	30.69	0.06
	Industrial Facility	Bi	–	–	–	26.64	–	26.64	26.64	–	26.64	0.05
	River	Si	–	–	–	224.16	287.93	512.09	224.16	287.93	512.09	0.97
	Road	Jl	3.47	8.37	11.84	96.69	95.99	192.68	100.16	104.36	204.52	0.39
Total			5,784.11	7,520.81	13,304.92	24,699.36	14,828.26	39,527.62	30,483.47	22,349.07	52,832.54	100.00

Notes: (1) See Appendix K. for details of the classification categories. The area is totalled using the land use and vegetation map (scale: 1/25,000).

(2) The subject areas are divided into two using the dam under construction by the Musi Hydropower Generation Project in Desa Ujan Mas Atas.

(3) Natural forests are further classified in terms of the crown density. (Example) Ha1: crown density of upto 30%.

(4) The area of shrub land (Sb) under the heading of Private Land includes secondary forest (Hs) sites.

(5) Coffee field (Lk) categories:

Lkt : the coverage by upper trees (shelter trees, etc.) is upto 10%

Lkb : the coverage by upper trees is 11% or more. This is further classified in terms of the tree height class of upper trees (1: upto 5 m, 2: 5.1 m or more) and the crown density class of upper trees (1: 11 - 30%, 2: 31 - 70%, 3: 71% or more)
(Example) Lkb 11: tree height class 1 (upto 5 m) and crown density class 1 (11 - 30%)

(2) Non-Forest Areas

① Coffee Fields

Coffee fields cover a total area of 26,797 ha (50.7 %), extending from flat land to mountainous land. Coffee fields show a distinct expansionary trend, resulting in the invasion of state land and the conversion of farmland and shrub land. Within the coffee field area, those sites where the upper trees have been left uncut or planted (coverage ratio of 11 % or higher) occupy 21,785 ha while those without such trees (coverage ratio upto 10 %) occupy 5,012 ha.

② Paddy Fields

Paddy fields of 3,675 ha (7.0 %) are distributed in the flat, alluvial fan-like lowland along Musi River and its tributaries and are mostly irrigated.

③ Dry Crops Fields

Dry crops fields are mainly scattered around settlement sites and occupy 4,454 ha (8.4 %). Few dry crops fields have bench terraces and the main cultivated crops are maize, soybeans, chili and vegetables.

④ Mixed Gardens

At mixed gardens, trees, including fruit trees, are planted as upper trees and some form of farming is conducted. These mixed gardens are found near settlement sites and occupy 549 ha.

⑤ Coffee Estates

A coffee estate covering approximately 278 ha is found next to state land in the upper part of Desa Kampung Sajad.

⑥ Settlements

There is a total of 93 settlements covering a total area of 899 ha.

⑦ Miscellaneous

The combined area of orchards, cinnamon plantations, rivers and roads, etc. is 980 ha.

CHAPTER 4.

SOCIOECONOMIC ENVIRONMENT

CHAPTER 4. SOCIOECONOMIC ENVIRONMENT

4.1 Characteristics of Local Community

(1) Characteristics of Local People in Study Area

The Study Area covers four entire kecamatans, i.e. Kec. Kepahiang, Kec. Padang Ulak Tanding, Kec. Kota Padang and Kec. Curup, in the eastern part of Kab. Rejang Lebong of the six kecamatans of Kab. Rejang Lebong. The total land area of the Study Area is approximately 220,000 ha. Table 4-1 shows the population and administrative structure of these four kecamatans.

The population of the Study Area is some 320,000, consisting of some 67,000 households and population density of an average of 145 persons/km^2. In regard to the administrative structure, the Bupati (Governor in charge of the Kabupaten) supervises the heads of the four kecamatan induks (which include six kecamatan pembantu) and the heads (some are appointed) of 225 villages (including 20 administrative villages).

Table 4-1 Outline of Study Area (Four Kecamatans in Kab. Rejang Lebong)

Kecamatan (including Kecamatan Pembantu	No. of Desa A	Area (km^2) B	Population C	Households D	Population Density (persons/km^2) C/B	Family Size per Household (persons/household) C/D	Remarks
Curup	85	525.76	150,175	31,426	286	4.8	inclusive 2 kec. pembantu and 16 administrative villages
Kepahiang	81	664.80	96,400	20,425	145	4.7	inclusive 3 kec. pembantu and 3 administrative villages
Padang Ulak Tanding	42	624.17	52,378	10,732	84	4.9	inclusive 1 kec. pembantu and 1 administrative village
Kota Padang	17	364.83	19,366	4,221	53	4.6	
Study Area	225	2,197.39	318,319	66,807	145	4.8	inclusive 6 kec. pembantu and 20 administrative villages
Kab. Rejang Lebong	302	4,109.80	404,063	86,211	98	4.7	inclusive 9 kec. pembantu and 25 administrative villages

Source: Rejang Lebong Dalam Angka 1995

(2) Characteristics of Local People in Project Area

The Project Area covers part of two kecamatans of six kecamatans in Kab. Rejang Lebong, i.e. Kec. Curup and Kec. Kepahiang with 93 villages. Table 4-2 shows the population and administrative structure of this area. The total land area of the Project Area is about 50,000 ha with a population of some 120,000 (which share about 42% and 49%

of the total area and population of the two kecamatans respectively). The average population density in 1995 was 226 persons/km^2 in the Project Area (286 persons/km^2 in Kec. Curup and 145 persons/km^2 in Kec. Kepahiang) which is above average for Kab. Rejang Lebong of 98 persons/km^2 and the population density of Kec. Curup is especially high.

Table 4-2 Characteristics of Local People in the Project Area

Kabupaten	Kecamatan	No. of Desa	Area (km^2)	Population*			Population Density (persons/km^2)	Main Ethnic Group
				Total	Male	Female		
Rejang Lebong	Curup	85 (37)*	525.76	52,535	26,230 (49.9%)	26,305 (50.1%)	226**	Rejang
	Kepahiang	87 (56)*	664.80	66,641	32,730 (49.1%)	33,911 (50.1%)		Rejang

Notes:
1. * denotes data for areas included in the Project Area established by the 1996 survey.
2. ** denotes data for the entire Project Area established by the same 1996 survey.
Source: Kepahiang Dalam Angka 1995; Curup Dalam Angka 1995

The natural population growth rate was an average of 2.3% in the period between 1990-94. In addition, social growth through transmigration assisted by the central government and voluntary migration is high. The total number of settlers in Kab. Rejang Lebong from 1974 to 1994 was 14,090 with 3,448 households. Settlers other than those due to the transmigrasion policy have come from not only neighboring villages but also from Kab. Bengkulu Selatan to obtain new land. The reasons for the many settlers from Kab. Bengkulu Selatan are ① as a pulling factor, prospective settlers assume the existence of fertile and vast land in Kab. Rejang Lebong, especially areas designated for development (*kawasan budidaya*) because of the TGHK (*Tata Guna Hutan Kesepaksan*) and RUTR (*Rencana Umum Tata Ruang*) and ② as a pushing factor, the population density in Kab. Bengkulu Selatan is high.

The average number of family members per household is 4.8 persons in Kec. Curup and 4.7 persons in Kec. Kepahiang, both of which resemble the national average. The ratio of males and females is almost same and the number of people in the 0-20 year old age bracket of 42% in Kec. Curup and 51% in Kec. Kepahiang is large.

In regard to the population distribution, villages with more than 2,000 people are located collectively along national roads (to the east of Musi River) in the centre and suburbs of Kec. Curup and Kec. Kepahiang. In contrast, villages near national forests in the lower

reaches of Musi River, located far from main roads, have a population of 400 to 1,000. There are 28 villages adjacent to or near forests in the Project Area. Of these, 18 villages have population of less than 1,000. Desa Air Mundu has the smallest population of 280 while Desa Das Petah has the largest population of 3,237, showing a large population discrepancy between villages.

In terms of ethnic background, the Project Area consists of the Rejang, Serawai and Lemba as indigenous groups and the Pasmah, Jawa, and Bali, etc. as exogenous groups. The Project Area is dominated by the Rejang.

In regard to religion, 96% of local population in Kec. Curup and 99% in Kec. Kepahiang are Muslims, followed by Christians and Hindus in both kecamatans (Table 4-3).

Table 4-3 Religious Background

(Unit: %)

Kecamatan	Muslims	Christians	Hindus	Buddhists
Curup	95.7	3.83	0.27	0.20
Kepahiang	99.5	0.21	0.19	0.10

Source: Kepahiang Dalam Angka 1995, Curup Dalam Angka 1995

(3) Economic Conditions

The regional gross domestic product (RGDP) for Kab. Rejang Lebong in 1994 was 1,495,000 Rp per capita. 54.7% of the RGDP is generated by the agricultural sector. The number of farming households is some 16,200 in Kec. Curup and some 15,200 in Kec. Kepahiang, accounting for 54.5% and 76.6% respectively of all households in these kecamatan. The combined figure corresponds to 73.5% of the total farming households of 42,700 in the whole of Kab. Rejang Lebong, indicating the heavy dependence of the economy of the Project Area on agriculture (Table 4-4). (Regional industries in the Project Area are outlined in 4.2.)

Table 4-4 Outline of Regional Economy

Kecamatan	Regional GDP per Capita	Number of Villages Designated Poor Villages	Number of Farming HHs (% of All HHs)	Major Crops	Stock Raising
Curup	Rejang Lebong 1,495,167 Rp (54.71% for agriculture)	14	16,200 (54.5%)	Coffee, Paddy Rice, Maize, Cassava, Sweet Potatoes, Pinang, Soybeans	Beer Cattle, Water Buffaloes, Chickens, Ducks
Kepahiang		8	15,200 (76.6%)	Coffee, Paddy Rice, Cassava, Ginger	Beer Cattle, Water Buffaloes, Chickens, Ducks, Goats

Source: Rejang Lebong Dalam Angka 1995

There are 14 villages in Kec. Curup and 8 villages in Kec. Kepahiang which are designated as poor villages. The size of the land owned by each household of an average of 0.5 ha to 1.5 ha is rather small.

(4) Infrastructure

Table 4-5 shows the state of infrastructure in the Project Area. Almost all villages have a primary school. The number of health and care facilities including, hospitals, health centers, public health sub-centers, poly-clinics and *posyandu* (general service centres) is relatively numerous. 14% of all households in Kec. Curup and 5% in Kec. Kepahiang receive water supply, showing a significant difference between the two kecamatans.

Table 4-5 State of Infrastructure and Public Services

Kecamatan	Asphalt Roads		Schools			Health Care			Mosques	Households
	No. of Roads (share in Kec.)	Total Length (km) (share in Kec.)	Primary	Second-ary	High	Hospitals	Health Centres	General Service Centres		with Water Supply (% of total households)
Curup	62 (26.6%)	732.01 (54.3%)	115	22	18	1	7	130	100	43,523 (14.4%)
Kepahiang	60 (25.8%)		99	13	3	-	8	105	101	970 (4.7)

Source: Kepahiang Dalam Angka 1995, Curup Dalam Angka 1995

The main roads from villages to markets are paved and are in relatively good condition. However, state of village feeder roads differs from one village to another. Many village roads, especially unpaved and narrow farm roads, are in poor condition and become muddy in the rainy season. There are two large permanent markets in Curup and Kepahiang while each village has a simple market which regularly opens once a week.

(5) Existing Organizations

There are formal or informal organizations in most villages in the Project Area. Formal organizations are the Perangkat Desa (council of village leaders), KUD (village cooperative), LKMD (village development council), LMD (village forum), Babinsa (village development organization of the military), PKK (women's group), Karang Taruna (youth group) and Takesra (saving group). The informal organizations include the Pengajian (Koran study group), Zikir/Risma (religious/arts group), R/PPHB (boar hunting group) and KTN (farmers' group). Their activities and the participation of villagers vary. In general, formal organizations are not active and the participation level is low compared to informal organizations. In addition, PLKB (family planning extension workers), PPL (agriculture extension workers), PLP (forestry extension worker) and Bidan Desa (midwives), etc. operate as governmental field workers for the purpose of providing extension services and technical assistance for villagers.

Furthermore, there are individuals, for example, Imam (religious leader) and members of the Lembaga Adat (customs council), who can influence villagers while operating in and outside village communities. In economic terms, Tengkulak/Anak ulo (middlemen) and Tauke (wholesale traders) influence villagers in their dealings with agricultural products.

(6) Customary Laws (Adat) and Traditional Customs

Most of the Project Area belongs to the sphere of the Rejang Adat but the southern part is a transitional zone from the Rejang Adat to the Lembak, Serawai and Pasmah Adats. In general, the Rejang ethnic group does not like to move to other land except for economic and educational reasons. People from Jawa and Bali come to new land for the purpose of agriculture and settle collectively with same ethnic group to form settlements. The Rejang people can be divided into four areas or four tribes (Marga, Petulai and Jurai) and leaders (Raja and Ajai) of the tribes have become established and coordinate norms and adats for local life. The Rejang Adat is summarized as follows based on the "ADAT ISTIADAT DAERAH BENGKULU (DEPARTMEN PENDIDIKAN DAN KEBUDAYAAN, 1977/1978)".

1) Group Activities or Mutual Help

- Non-irrigated land (ladang): Mutual help is seldom observed and labour is provided for wages.

- Paddy Rice fields: Among those farmers who use the same water course, labour is provided at the instruction of village officials. If someone fails to provide labour, the water allocation is stopped. If someone steals water, the violator is first warned by an elder and, if the behaviour is not corrected, the violator is dealt with by the village head.

- Collecting: Medicinal materials are collected through the mutual help of villagers.

2) Family System and Inheritance System

After marriage, a couple conducts forest development in order to set up their home near the dwelling area of a large family to which they belong. Before marriage, parents on both sides promise the relationship governing the new family after marriage, choosing one of the following three types based on the adat called Asen Bekulo.

- Asen Beleket: Wife belongs to the large family of her husband. She abandons her right to inherit from her parents.

- Asen Semendo: Husband belongs to the large family of his wife. However, the authority of the small family belongs to the husband and he does not abandon his right to inherit from his parents.

- Semendo Rajo-Rajo: The new couple is free to decide which family they belong to and where they live.

3) Use of Land and Forests

The development of non-irrigated land requires the permission of the village head. In order to demonstrate his/her right to others, a developer surrounds the land with stakes and clears the land surface around the stakes. Bamboo and trees are then planted around the newly enclosed farmland. The village head has knowledge of the land ownership, mainly in regard to farmland along footpaths. There are few conflicts over land ownership among villagers. Any conflict can be resolved according to the adat. In the case of non-irrigated land, the tenant system (garap; i.e. in exchange for giving part of the harvest to the land owner, a tenant acquires the right of cultivation

(paro)) is not practice. In the case or paddy rice fields, the paro system operates and the shares of the harvest between the land owner and tenant differ based on the difficulty of cultivation.

4.2 Local Industries

The state of local industries in Kec. Curup and Kec. Kepahiang, both of which incorporate the Project Area, is outlined below.

(1) Agriculture

1) Production of Main Agricultural Products

As described in 3.7, the main forms of land use in the Project Area are coffee fields, dry crops field, paddy fields and others. The current state of land use by category is described next.

① Coffee Fields

Kec. Kepahiang has a higher ratio of coffee fields in the total area of cultivated land than Kec. Curup [see 5.3-(1)-1) for details of coffee cultivation].

② Dry Crop Fields

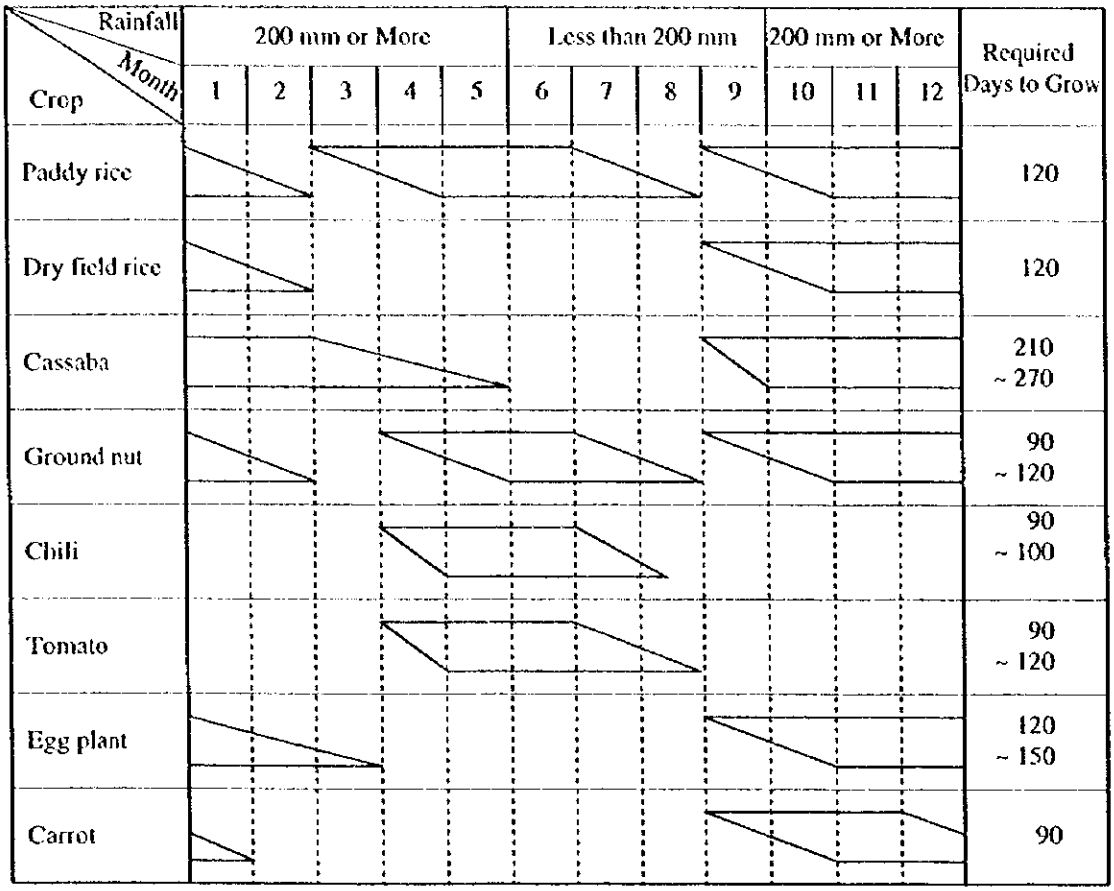
The crops cultivated on dry crop fields are maize, sweet potatoes, soybeans, ground nuts, cassava, ginger, chili and various vegetables, etc. The cultivation of dry crop fields in the Project Area is characterised by the dominance of staple crop cultivation and the resulting unpopularity of vegetable production which is a costly practice. In terms of the cultivated land size by crop, the cultivation area of each type of crop is generally smaller in Kec. Kepahiang than in Kec. Curup because of the popularity of coffee cultivation in the former. The exceptions to this general picture are ginger and tobacco.

Table 4-6 shows the annual farming schedule (calendar) for the main agricultural products. According to this schedule, there are two sowing periods, i.e. March – May and September - October. Given the climatic conditions of the Project Area, the cultivation of many agricultural products is possible throughout the year.

Dry field crops are generally cultivated using high ridges in the form of either inter-cropping or mixed cropping. Despite the predominance of sloping land, such soil conservation measures as terracing and contour cultivation are not sufficiently employed.

Shifting cultivation is permitted for the recultivation of fallow land and the development of new fields. Slashing and burning is conducted in September or October, followed by sowing in October or November. The crops planted in the first year include dry field rice, ginger and coffee.

Table 4-6 Annual Cultivation Schedule for Main Agricultural Products



Note: All-year-round cultivation is possible for maize (90 days), sweet potatoes (90 - 120 days), soybeans (90 days), ginger (120 days and 270 days), Chinese cabbages (85 days), cabbages (85 days), chili (90 - 100 days), French bean (70 - 80 days) and onions (60 - 90 days).

Source: Based on the findings of interviews conducted at Pal VIII Agricultural Extension Office (Kec. Curup) and Kelobak Agricultural Extension Office (Kec. Kepahiang).

③ Paddy Fields

At well irrigated paddy fields, rice is cultivated all year round since double-cropping is said to be possible. At those paddy fields using rainwater, the paddy fields are used as dry crops fields after the paddy rice harvest for the cultivation of sweet potatoes, chilies and pulses, etc.

④ Others

Other types of land use in the Project Area include mixed gardens (Kebun Campuran), home gardens (Pekarangan) and community forests (Hutan Rakyat).

Cloves, coconut palm, aren, kayu manis, pepper, kemiri, panili, kapok, fruit and bamboo, etc. are cultivated in the border areas between different land use categories and between cultivation plots. Kec. Kepahiang has larger cultivation areas of peppers, kemiri and panili than Kec. Curup (Curup and Kepahiang Dalam Angka, 1994).

Compared to Java, domestic gardens in the Project Area are smaller and have fewer crop and tree varieties. However, a rich variety of medicinal plants is grown, mainly for home consumption. The survey conducted at Desa Suro Bali puts the average area of a domestic garden at approximately 0.1 ha, inclusive of the house site. [See 5.3-(2) for details of the cultivation of aren, kayu manis, kemiri and panili, etc. and other biological resources around the home.]

2) Distribution and Price of Agricultural Products

Agricultural products from the Project Area are mainly traded at village desa markets, Curup Market (Pasar Atas Curup) and Kepahiang Market (Pasar Kepahiang). Vegetables, bamboo shoots, panili and kemiri, etc. are also sold to middlemen.

In the case of the Kepahiang Market, the prices of agricultural products fluctuate, reflecting the price fluctuation of coffee, the major local product.

The monthly fluctuations of agricultural product prices at the Curup Market show that the price of coffee tends to be high in August and low in February, that the price of kayu manis is high in July and low in September and that the price of ginger is high from July to November.

3) Export of Agricultural Products

Among the export products from Propinsi Bengkulu for the period from 1991 to 1995, coffee, tinned bamboo shoots and ginger are linked to the Project Area. In terms of both the export volume and export value, coffee is by far the dominant product even though the volume and price conspicuously fluctuate from one year to another. In contrast, exports of tinned bamboo shoots have been steadily increasing in terms of both the volume and value.

The monthly export volume and value data for 1995 show that coffee exports are restricted to May, July and October through December with July being the month with the highest coffee exports. Similarly, exports of ginger are restricted to May and November. Tinned bamboo shoots are exported throughout the year except for August and December with June recording the highest export volume.

The main export destinations in 1995 were the US, Singapore, Italy, Germany, Switzerland and Australia for coffee and South Korea, Japan and the US for tinned bamboo shoots.

(2) Livestock Industry

The production of livestock products in the Project Area is mainly aimed at self-consumption. The main livestock species are beef cattle, water buffaloes, goats, sheep, rabbits, chickens and ducks. The popular species are beef cattle in Kec. Curup and goats and beef cattle in Kec. Kepahiang. The number of goats raised in Kec. Kepahiang is larger than that in Kec. Curup.

Beef cattle and goats are generally raised in small sheds with an average of one or two heads per farming household.

At Desa Kampung Melayu, the Livestock Bureau conducted a beef cattle raising project in 1983 with the assistance of the World Bank. A total of 110 heads of beef cattle (Bali variety) were given to 10 farmers' groups at a rate of 10 cows and one bull per group. The locally used feed is king grass, rice straw, maize, soybeans, kayu res, kaliandra and lamtoro, etc. The state of growth of beef cattle (Bali variety) appears to be favourable.

The interview survey in each village found that many farmers cite beef cattle as the livestock they would like to raise.

(3) Fish Culture

Fish culture on a minor scale is observed in the Project Area at small fish farms using such sites as fish ponds, paddy fields and irrigation channels where a rich water supply is available to provide a source of side income for local people. In both Kec. Curup and Kec. Kepahiang, many fish ponds are actually irrigated paddy fields which are temporarily used (for approximately two months) as fish ponds or used for Mina Padi where fish culture is practiced along with paddy rice cultivation. Fish ponds are simply dug and water is supplied from a nearby swamp, river and/or fountain. At Desa Tebat Tenong Dalam and Desa Taba Renah, etc. in the Project Area, some check dams are used as fish ponds. The

main species cultured is Ikan mas (*Cyprinus capio*) which is a native species. In general, fish culture employs the traditional method. Fry are supplied from the hatchery in Kec. Kepahiang which is run by the Ministry of Fisheries.

The grown fish are sold not only at the village markets, Curup Market, Kepahiang Market and middlemen but also directly to consumers in some cases.

One villager from Desa Suro Muncar who responded to the survey cultures Ikan mas at a fish pond (0.25 ha in size) created in a swamp using one and a half month old fry hatched in a local paddy field. Bought pellets are fed to the fry and the grown fish are harvested some three months later. Many local farmers want official assistance in terms of fish culture techniques and the introduction of new species for fish culture.

(4) Use of Bamboo

Although few bamboo products are sold in local markets in the Project Area, bamboo is frequently used for self-consumption, underlining the close link between local people and bamboo.

① Bamboo Products

The baskets used daily by local people to store/carry vegetables, firewood, grass, maize and coffee beans, etc. are made by individual households. The main raw material is natural bamboo (mainly serik) collected by local people.

One elderly woman interviewed on bamboo products in Desa Kelobak said that some three year old serik, planted on dry crops field as the raw material for bamboo products, was used to make such woven bamboo products as baskets of various sizes for home use as well as for sale. The bamboo working skills are traditionally passed from mother to daughter.

The interview survey conducted at the Curup Market found that serik is used as the raw material for bamboo products which are mainly made in Desa Air Duku in Kec. Curup and in Kec. Muara Aman, both of which are located outside the Project Area.

② Production of Bamboo Shoots

Bamboo shoots provide a source of side income for local people and the existence of a factory producing tinned bamboo shoots encourages local people to collect bamboo

shoots. Betung is the main bamboo variety of which the shoots are used as food. The shoots of manyan have a bitter taste and, therefore, are unsuitable as food.

According to the interview survey on bamboo shoots at Desa Das Petah, the harvested bamboo shoots are firstly transported by the farmers for a distance of upto 4 km to the general store on the provincial road and are then supplied to a tinning factory in Bengkulu City. The bamboo shoots are normally harvested from August to February. After sprouting, a two week old bamboo shoot weights an average of 8 kg and 10 - 15 shoots can be produced from a single stock. In October, the volume of bamboo shoots taken to the general store reaches as much as an average of 4 tons/day and 8 tons on a particularly busy day. While bamboo shoots are generally not prone to damage by diseases and harmful insects, they may be eaten by wild boar.

③ Production of Construction Timber, etc.

As betung and manyan are hard and durable, they are popularly used as not only building materials for temporary huts, byres (cattle sheds), rice storage barns, shelves, bridges and civil engineering structures but also for posts to support some agricultural products, agricultural/forestry materials at nurseries and firewood, etc. The absolute quantity of marketed bamboo-based construction timber is rather small. The marketed bamboo is generally cut during the dry season, is four to 10 years of age and 4 m in length.

④ Planting for Soil Conservation and Other Purposes

Pancing, serik and manyan, etc. are planted in the Project Area for soil conservation on steep slopes and for marking of the boundaries of dry crops field and paddy fields, etc. [see 5.3-(1)-8) for the ecology of bamboo].

4.3 Land Use Plan and Related Projects

(1) Land Use Plan

Kab. Rejang Lebong has its own land use plan (prepared in fiscal 1995) based on the spatial development plan for Propinsi Bengkulu. According to the land use plan map, national forests in the Project Area will remain protection forests while private land is designated as Kebun Rakyat except for those areas of which their use as estates is authorised.

The second long-term plan (a 25 year plan commencing in fiscal 1994) under the same land use plan for Kab. Rejang Lebong identifies three priority items, i.e. ① promotion of socioeconomic growth in all areas of Kab. Rejang Lebong, ② balanced development of economic activities and ③ improvement of environmental conservation.

The Sixth Five Year Plan, the first such plan under this second long-term plan, identifies the following five major tasks in its first five year plan: ① improved quality of human resources, ② increase of employment opportunities, ③ expansion and improved efficiency of the economy, ④ improved ability and efficiency of administrative organizations and ⑤ improved efficiency of boundary control for the protection of forests, including measures designed to deal with illegal settlers, and environmental conservation management. In addition, several priority issues are identified, including ① development of infrastructure, ② promotion of agribusiness and ③ development of the tourist industry.

The land use plan for Kab. Rejang Lebong also puts forward land use classification criteria. The criteria used to determine the suitability of land for cultivation (or suitability of land for use as paddy fields, dry crops field or orchards, etc.) are soil texture, soil depth, gradient and drainage conditions, etc. as shown in Table 4-7.

Table 4-7 Criteria for Land Suitable for Cultivation

Classification Category	Gradient (%)	Soil	Soil Depth (cm)	Drainage	Restrictive Factors	
					Peat Moss	Stone
Best Suited	0 – 8	Fine – Medium	90	Good	None	None
Suited	8 – 15	"	60 - 90	"	upto 25 cm	upto 25%
Usable	15 – 40	"	30 - 60	"	upto 75 cm	upto 50%
Unsuitable	40 –	Coarse	0 - 30	Poor	more than 75 cm	75%

(2) Related Projects

1) Musi Hydroelectric Power Project

The P.T. Perusahaan Listrik Negara (National Power Corporation) is implementing the Musi Hydroelectric Power Project near Desa Ujan Mas Atas in the Project Area and the station should be operational in year 2001. This project involves the construction of an intake dam on Musi River and the channelling of the captured water to Simpangaur River in Kec. Tebapenanjung in Kab. Bengkulu Utara via a 7.5 km long pipeline; an underground power generation station (output: 210 MW) along this pipeline would generate 1,140 GWh of electric energy a year. The planned catchment

area is 587 km^2, the reservoir area is 1.14 km^2, the full storage capacity is 2,230,000m^3 and the effective storage capacity is 1,000,000 m^3. The maximum planned water level for the reservoir surface is El. 579.1m while the minimum is El. 578m and the elevation of the intake valve is El. 574.2m. Six hours will be spent daily for intake operation at a rate of 62 m^3/sec, and storing or discharge will take place in the remaining 18 hours. A minimum outflow of 1.1m^3/sec to the lower Musi watershed will be maintained at all times, even during intake and storing periods. The intake dam will be equipped with a facility for expelling accumulated sediment in order to prevent functional deterioration associated with such accumulation. A sedimentation basin is also planned for the purpose of reducing the volume of sediment and other foreign matters in water channelled to the power station (see Fig. 4-1~2).

The outlet for water from the power station will be placed on the Simpangaur River near Desa Susup. A regulating dam to control the discharge of water from Musi River is planned at a site 1.5 km downstream from the outlet. This dam will regulate the flow rate at 15.5 m^3/sec. The foundations of the regulating dam will be 141 m high while its planned catchment area is 30 km^2, its reservoir area is 0.27 km^2, its full storage capacity is 1,050,000m^3 and its effective storage capacity is 1,000,000 m^3.

2) Related Projects

Related projects in the Project Area are an environmental conservation project in which the Ministry of Interior, with the backing of the World Bank, plays a central role, aimed at preventing the devastation of and conserving the Kerinci Sebrat National Park and its surrounding areas, and a poverty alleviation project which targets the region around the same national park as a supplementary project of the former. As the former has no subject site in the Project Area, it has no direct bearing on the present Social Forestry Project. However, according to the latest information obtained, the poverty alleviation project is said to envisage the development of facilities to improve inter-village access and to facilitate the supply of irrigation and domestic water and also the training of local administrative staff in the Project Area of Kec. Kepahiang (involving 11 villages).

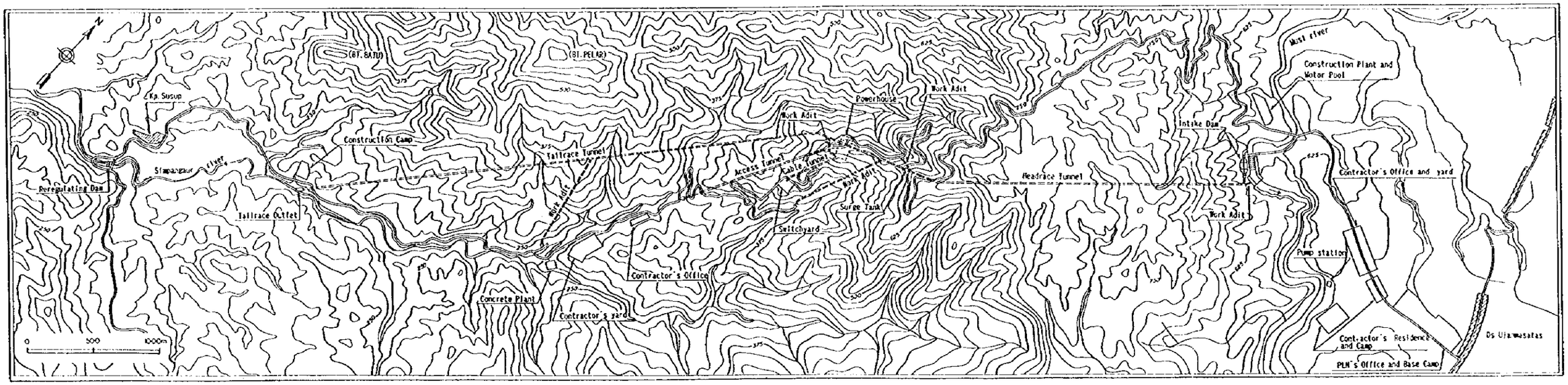


Fig. 4-1 Locations of Facilities Envisaged by Musi Hydroelectric Power Project

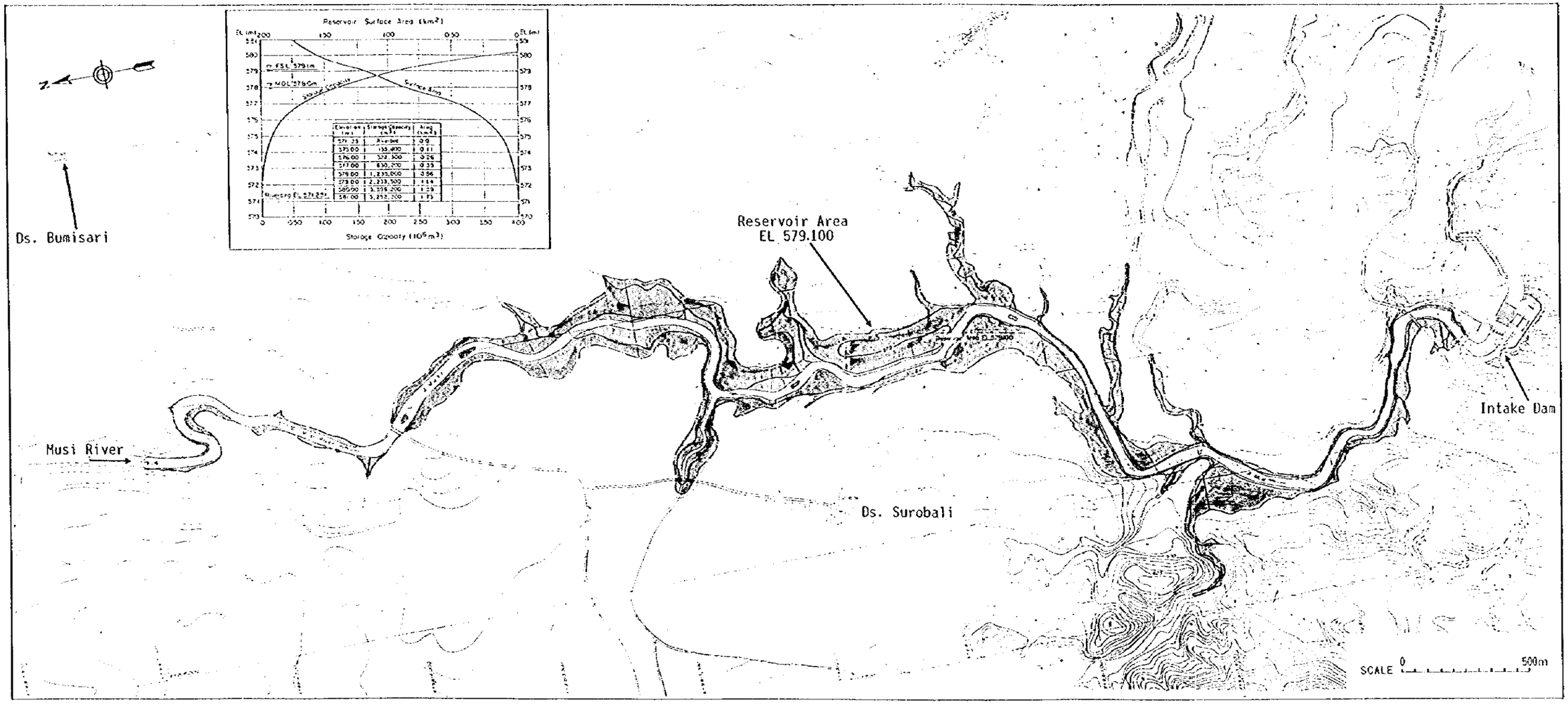


Fig. 4-2 Reservoir Area of the Intake Dam