PREPARATORY SURVEY REPORT ON THE [redacted] AREA IN THE [redacted] IN THE REPUBLIC OF THE PHILIPPINES

[redacted]

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

PROGRESS REPORT
ON
PREPARATION OF FOREST INFORMATION IN WIDE AREA AND FOREST MANAGEMENT PLANNING IN THE REPUBLIC OF THE PHILIPPINES

JUNE 1986

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

PROGRESS REPORT

ON

PREPARATION OF FOREST INFORMATION IN WIDE AREA

AND FOREST MANAGEMENT PLANNING

IN THE REPUBLIC OF THE PHILIPPINES

I N D E X

Chapter 1 Introduction

1 - 1 Background and Objective of the Study

1 - 1 - 1 Background

Forest development in the Republic of the Philippines was rapid and extensive after its national independence in July 1946 contributing substantially to the rebuilding of the national economy in the form of lumber exports.

At the same time, cutting of forest trees intensified to meet increased demands for charcoal and firewood under pressures of growing population as well as traditional Kaingin, while forest lands were turned into other uses like cropland and grazing lands.

Indiscriminate forest exploitation, however, destroyed natural environment causing soil erosion, surface run-offs and floods to inflict considerable damages on human lives and properties.

Measures are being worked out by the Philippine Government to cope with these problems. They include urgently needed

reforestation for denuded forest lands and, among social problems to be resolved, resettlement of Kaingineros.

In the course of this effort, it was realized that there was an urgent need for collection and analysis of data and information on the status of forest resources on a wider regional scale to help formulate forest control and management plans which take into account the public nature of forests.

Against this background, in June 1984, the Philippine Government requested the Japanese Government to undertake acquisition and analysis of data on forests and survey for formulation of such forest management plans.

In response, the Japanese Government dispatched a contact mission in January 1985 and the I/A mission in May of the same year to conclude the I/A for the study to be undertaken over a three-year-period.

1 - 1 - 2 Objective

The objective of the study is to collect, analyse, and compile data and information on natural and social environment of the study area to formulate the Forest Management Plan for Wide Area and the Forest Management Plan for Model Area.

1 - 2 Study Team Members, Study Period, and Philippine Officials

(1) Study Team Members and Study Period

The study is undertaken over the three year period from 1985 to 1987 (FY).

The study team members and the study periods are as listed in the table below.

Table 1-1: Team Members and Periods

Phase	Responsibility	Name	Period
Preliminary Study	Overall coordination	Iwao Nakajima	Aug.7,1985 - Aug. 21, 1985
	Sutdy planning & design	Seishiro Shojiguchi	Same
	Study instruction	Toru Kawasaki	Same
	Data compilation	Tetsuya Otsuki	Same
	Reconnaissance Map & Table Compilation	Shoji Ando	Same

Phase	Responsibility	Name	Period
	Overall coordination	Iwao Nakajima	Mar.31,1986- Apr.29,1986
	Study planning & design	Seishiro Shojiguchi	Mar.31,1986 May 29,1986
Wide	Study instruction	Toru Kawasaki	Same
Area Study	Data compilation & Reconnaissance Map/Table	Katsuyasu Yamaguchi	Same
		Testuya Otsuki	Same
		Shoji Ando	Same
		Fumitake Hashizume	Same
		Makoto Yoshida	Same
		Masahiko Hara	Same
		Toshiaki Udono	Same

(2) Philippine Officials

Following is the list of the Philippine officials concerned with the study for 1985.

Table 1-2: Philippine Officials

Phase	Affiliation	Name
Preliminary study		
-Meetings	MNR	A. Y. Capay
	"	Teodora Haresco
	"	Arsenia Estrella
	"	Alan C. Salvador
	"	Dorie Haresco
	BFD	Rodolfo Leal
	"	Alex M Lauricio
	"	N. B. Dalangin
	"	Jose Cabanayan
	"	M. C. Caisip
	"	Mariano Farrales
	"	Allan L. Gonzales
	NRMC	Danny Guerrero
	"	Marcial C. Amaro Jr.
	"	Danny Guevarra
	"	M. Lara
	MND	Capt. Guillermo Wong
	BMG	Nestor P. Punsal Jr.
	BL	Manerto Infante
	BCGS	Com. Alexander Feir
		Frances N. Dayrit

(Continued - List of Philippine Officials)

-Aerial photo interpretation	MND	Col. Agustin Q. Ariora
	"	Lt. Ramon E. Adea
	BFD	Jose Cabanayan
Wide Area Study		
	BFD	Virgilo Basa
	"	Jose Cabanayan
	"	Mariano Farrales
	"	Edward Butista
	"	REGION II Staff

Notes: MNR : Minsitry of Natural Resources
BFD : Bureau of Forest Development
URMC : Natural Resource Mangement Center
MND : Ministry of National Defense
BMG : Bureau of Mine and Geo-Sciences
BL : Bureau of Lands
BCGS : Bureau of Cost and Geodetic Survey

1 - 3 Supervising Commission

In accodance with the Guideline for Creation of Supervising Commission, the Surpervising Commission on the Forest Information and Mangement Planning for the Republic of the Philipphines has been established under the International Cooperation Agnecy. The Commission is comprised by the following members.

List of Commision Members

Responsibility	Name	Period
Overall Coordination	Masaaki Kuwabara Research Planner, Forestry Agency, Ministry of Agriculture, Forestry and Fisheries	May 12 - 21, 1986
Data Analysis	Itsuhito Ohnuki Chief, Forest Remote Sensing Lab., Research Institute of Forest Products, Ministry of Agriculture, Forestry and Fisheries	May 12 - 21, 1986
Management	Seigo Sakaguchi Chief, Management Research Lab., Research Institute of Forest Products, Ministry of Agriculture,Forestry and Fisheries	

(continued - Commission Members)

Development planning	Masao Mabuchi Chief, International Cooperation in Forestry, Ministry of Agriculture, Forestry and Fishereis

Chapter 2 Description of Study Area

2 - 1 Natural Environment

2 - 1 - 1 Location and Area

The study area is located in the northeast of Luzon Island, the largest island of the Philippines, covering the Cagayan River Basin and encompassing the eight provinces of Cagayan, Kalinga Apayao, Isabela, Mountain, Ifugao, Nueva Vizcaya, Quirino, and Quezon. The area is enclosed by mountain ranges on three sides, namely, the Siera Madre on the east, the Cordillera Central on the west, and the Caraballo on the south, and, on the north, it faces the Babuyan Channel.

It has an area of 2.7 million hectares occupying most of Region II, an administrative district. The Cagayan River which runs through the study area originates in Nueva Vizcaya Province flowing north over a distance of 505 kilometers to pour into the Babuyan Channel. Its major tributaries include Siffu-Mallig, Chico, Ilagan, Magat. Figure 2-1 shows the study area as defined on the map.

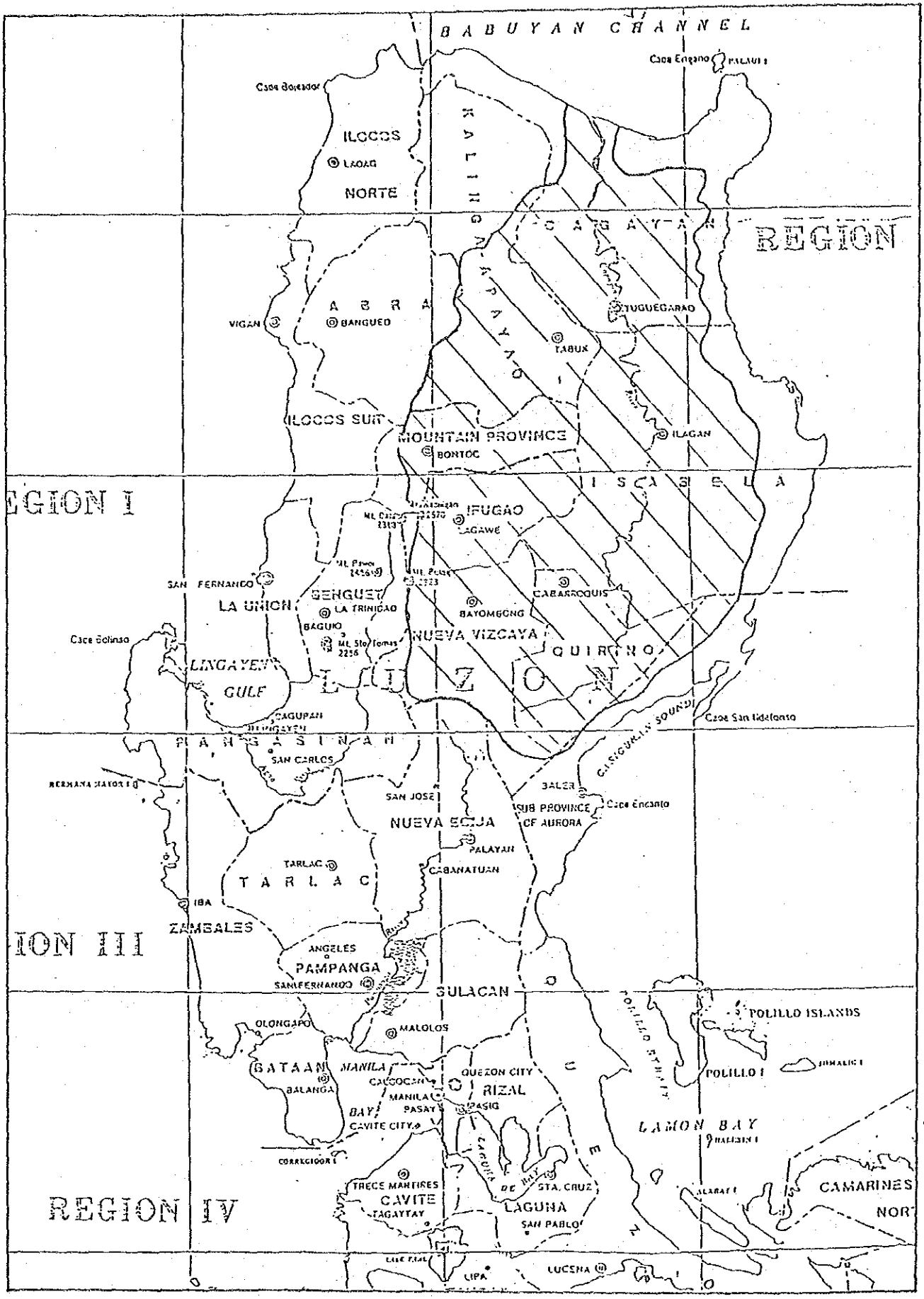


Figure 2-1. Location of Study Area

2 - 1 - 2 Terrain Features

The Siera Madre Mountains rise to over 2,000 meters on the eastern side of the study area running north-south. At high elevations there are observed outcrops of parent rocks penetrated with volcanic rocks. Tertiary sedimentary rocks are observed at the foot of the mountains forming generally the slopes on the western side.

The Cordillera Central Mountains are characterized by parent rocks of older metamorphic sedimentary rocks and volcanic rocks mixed with younger formations of intrusive rocks and eruptive rocks. They rise to over 2,000 meters above sea-level with Tertiary sedimentary rokcs forming the slopes on the eastern side. These sedimentary rocks went through repeated folding and faulting resulting in sharp facies changes.

The Caraballo to the south, where the parent rocks are also metamorphic rocks, have elevations of over 1,500 meters above sea level. This range of mountains constitutes the watershed separating the Central Luzon Plain from the Cagayan Valley. At the foot of the north slope are observed sedimentary rocks and volcanic rokcs. The river valley portiongs are relatively flat and covered with sedimentary deposits of sands, gravels,

and silts. There are some swamp areas downstream.

2 - 1 - 3 Climate

The Republic of the Philippines consists of over 7,000 islands lying between latitudes 4° North and 22° North. Its climate is under the strong influence of the ocean.

The average temperature is 27.0°C for nationwide (average of those at 44 locations across the country), 26.8°C for Luzon to the north, 27.3°C for Visaya at midway and 26.9°C for Mindanao to the south, with little differences between north and south. In most parts of the country, the range of annual temperature variance is less than 3°C and daily temprature variances average 7° - 8°C for all the islands.

The annual rainfall is 2,533 mm on the nationwide average but it varies substantially between areas. In some areas, there is a distinction of dry and rainy seasons and, in the dry season, water shortage is experienced from time to time.

The country can be classified into the following four zones by climate in terms of seasonal (dry and wet) characteristics and rainfall.

Classification of Climate Zones

Type I – Areas that have distinct dry and wet seasons. The dry season lasts from November to April the rest of year being wet. Average annual temperature 27.0°C; average annual rainfall 2,555 mm.

Type II – Mostly wet and there is no dry season per se. Rainfall is maximal in the months from November through January. Average annual temperature 26.8°C; average annual rainfall 3,279 mm.

Type III – There are no distinctive seasonal changes. Relatively dry from November to April, the other months being wet and humid. Average annual temperature 27.2°C; average rainfall 1,962 mm.

Type IV – Steady rainfall throughout a year. Average annual temperature 26.8°C; average annual rainfall 2,587 mm.

The Cagayan River Basin falls in Type III since it has no distinct rainy season though there is a short spell of dry season. Average annual temperatures range from 2,000 mm or less in the flat lands in the central and northern parts of

the basin to 3,000 mm or more in the mountains. Locally they change significantly from year to year.

Southern Philippines represented by Mindanao are least subject to tyhoons but the Cagayan River Basin lies in the path of tyhoons. Based on the records covering 89 years from 1884 to 1972, the area has been hit by an average of 19.2 typhoons annually (including tropical storms). The numbers of typhoons that hit the area are higher in the months of july to November, i.e., 2 or 3, or more monthly.

Table 2-1. Average Monthly Rainfalls

(㎜)

Month	Aparri (Cagayan)	Tuguegarao (Cagayan)	Consuelo (N.Vizcaya)
1	181	22	32
2	87	18	26
3	43	34	45
4	35	49	81
5	82	109	198
6	167	170	228
7	204	197	346
8	249	242	363
9	278	209	414
10	338	294	263
11	474	317	203
12	206	108	119
Annual	2,344	1,769	2,318

Source: Framework Plan, Cagayan Valley

Table 2-2. Temperature Data

(℃)

Month	Aparri (Cagayan)	Tuguegarao (Cagayan)	Consuelo (N.Vizcaya)
1	23.2	23.4	22.5
2	23.8	24.4	22.5
3	25.3	26.4	25.2
4	27.1	28.2	25.5
5	28.1	29.0	25.6
6	28.5	28.9	24.7
7	28.1	28.2	24.2
8	27.9	27.9	21.7
9	27.5	27.5	22.9
10	26.5	26.4	23.7
11	25.2	25.1	22.7
12	23.9	24.0	22.4
Annual Average	26.3	26.6	23.6

Source: A Report on Cagayan River Basin

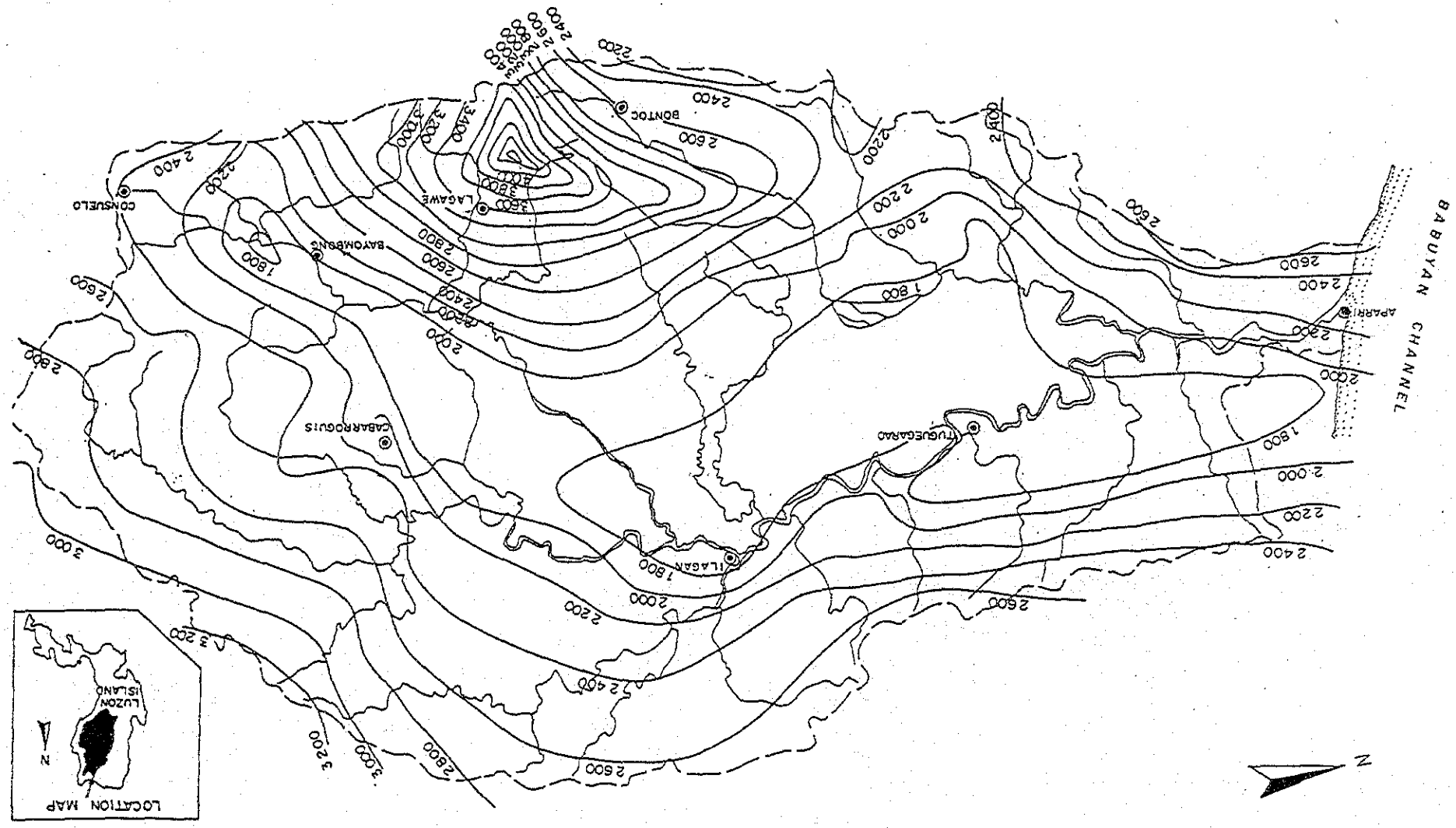


Figure 2-2. Isohyetal Map of Cagayan Basin

2 - 1 - 4 Vegetation

The fauna and flora of the Philippine Islands (not including Parawan) is defined by the New Wallace Line which extends north between Borneo and Slawesi, and the Weber Line which runs windingly between Slawesi and Halmahera into the Bashi Channel. They are basically of Continental Asia by origin and extremely inferior in strength allowing the intrusion of Australina elements. Coming in between the Weber Line which constitutes the eastern limit of Asian fauna and flora on the one hand and the New wallace Line forming the western border of the Australian on the other, the area has a mixture of both.

In the Philippine Islands, there are some 8,120 species of vegetation, of which about 2,000 are recognized as indigenous and some 5,500 considered as local species that can be found only in the Philippines.

Forests are mostly tropical heavy rain forests comprised by characteristically by complex mixtures of multiple stories of vegetation of numerous species including more than 2,000 species of trees of 30 cm or more in diameter. To indicate their relationship to the Asian Continent are pines. Benket pines (Pinus insularis) for example are a dominant species

in the Cordillera Central Mountains of Luzon while there are Mindoro pines (Pinus merkusii) in Mindoro Island. Those supposedly of Australian origin include Zanthostemon, Disbormia, Camptostemon, Eucaryptus, Casuarina.

Forests in the Philippines are generally classified into four types by elevation, i.e., Dipterocarp Forest, Pine Forest, Mangrove Forest, and Mossy Forest. Each type is briefly described below.

* Dipterocarp Forest:

Distributed in areas ranging in elevation from low lands upward to nearly 800 meters, this is a dominant form of forests and high in economic value. Upper story trees are over 65 meters in height and mostly those of Dipterocarpaceae in kind. Underneath them are middle story trees of other kinds than Dipterocarpaceae and further below are shade-bearing trees of 12 meters or so in height and with relatively small volumes of leaves forming the lower story. This type of forests feature three large vine type vegetations. Close to the ground surface, there are many types of ferns and shrubs forming a complex cover. Major species include: Pentacme contorta (white lauan), Dipterocarpus grandiflorus (Apitong), Shorea ploysperma (Tangile) Shorea squamata (Mayapis), Shore negrosensis (Red lauan).

* Pine Forest:

Distributed in highlands and mountains, they range 300 - 1,500 meters in height. In the Cordillera Central mountains, there are Pinus insularis (Benket pines) as a dominant species forming pure uniform forests or growing as single trees among broad-leaved trees. In the Zambales mountains that run from Lingayen Bay to Minila Bay, there are distributed two types of pines, i.e., Pinus insularis and Pinus merkusii (Mindoro pines). In Mindoro Island, there are Pinus merkusii in pure forests or as single tress.

* Magrove Forest:

Distributed at estuaries and littoral areas. A little further inland from estuaries, there appear Nipas (Nipa palum, Nipa fruitcans). Major species are of Rhizophoraceae including Rhizophora.spinculata, R. muscronata, Ceriops tagal, C. roxburgiana, Bruguiera gymnorrhiza, B. parviflora, B. cylindrica, B. sexangula, and, further, inland, Heritiera littoralis.

* Mossy Forest:

Distributed in humid highlands. Trees are about 5 meters in height with boughs and branches covered with ferns and mosses.

Conifers of Dacrydium and Podocarpus or broad leaves of Eugenia, Decaspermum, Lithocarpus, Myrica.

2 - 2 Socio-Economic Environment

The study area is covered mostly by Region II though it includes Region I partly. The socio-economic environment of Region II, therefore, is reviewed below.

2 - 2 - 1 Philippines Development Plan (1983 - 1987)

The Philippines National Assembly (Batasang Pambansa) adopted the 1983 - 1987 development plan on January 19, 1982 as Resolution No. 66. Former President Marcos signed it on February 26, 1982, and issued Presidential Decree No. 2166 ordering the agencies concerned to take necessary steps for implementation planning and budgeting.

The plan consists of six parts.

I. Introduction
II. National goals and challenge to development
III. Strategy and policy for sustained economic growth

IV. Strategy and policy for fair distributions development benefits

V. Strategy and policy to achieve development for all people

VI. Strategy and policy for funding the implementation of development plan

Each of them is described in outline below.

I. Introduction:

The past plan (1978 - 1982) is appreciated for its achievements and the significance of the new plan is stated.

II. National goals and challenge to development:

The goals are: (1) sustained economic growth, (2) fair distribution of development benefits, (3) development for all people. Specifically:

- Economic growth of 6.5% annually in real terms to be achieved over the 1983-1987 period. It should raise the per capita income to 13,199 pesos by 1987. The targeted growth rate is higher than ever experienced, 6.4% in the 1970's and 5.5% for 1978-1981. Therefore, it requires additional efforts to achieve this rate of growth particularly in view of the difficulties prevail-

ing in the world economic environment.

- GNP is projected to reach 749.2 million pesos by 1987.

- Employment opportunities to be generated by the plan are expected to greatly reduce underemployment and hold the unemployment rate below 4%.

- Enhanced productivity in agricultural and industrial sectors to contribute to foreign exchange earnings, and increased incomes for farming and fishery populations. It calls for international competitiveness to be attained by improving productivity in industrial productions through (1)fair distribution of capitals, (2)technical training, (3)cost saving, (4)technological progress.

- Attention to be paid to eliminate regional discrepancies. Particular consideration should be given to kaingineros and workers without land of their own living in deprivated areas.

- Exploration of alternative energy sources.

- Development of infrastructures. In particular, small scale

irrigations, small hydro power generation projects, roads, bridges connecting farms with market places, schools, communications systems.

- Population growth is expected to drop to 2.2% annually over 1983 - 1987 as a result of changes in lifestyles to be caused by industrialization and urbanization on the one hand and the government-sponsored family planning on the other. Nevertheless, the population is estimated to increase from 52.0 million in 1983 to 56.8 million in 1987.

- Institutional improvements to emphasize the role of the private sector as a major source of growth.

IV. Strategy and policy for fair distribution of development benefits:

To ensure fair distribution of benefits accruing from economic development, the following are stated as policy tasks.

-Expansion of productive employment opportunities

-Promotion of regional settlements

-Land reform; development of agricultural and natural resources

-Utilization of development facilities

-Preparations for social projects

Natural resources development as above, among others is explained as follows.

- Forest lands are reclassified (within the framework of existing laws) into productive forests, protection forests, agro-forestry lands, and grazing lands, in an attempt to release more land for production. Those who have occupied forest land for appropriate numbers of years for cultivation and development, as specified by forestry related laws, are to be given priority for extension of the lease permit.

- Farm laborers and highland farmers are to be given precedence over the use of idle farms, forest lands and swamps.

- Under the K.K.K. (Kilusang Kabuhayan at Kaunlaran), the Livelihood Movement, which envisions forestry for rural and industrial development, funds are to be made available to organize highland farmers and landless farm laborers so as to promote their employment.

V. Strategy and policy for development for all people:
Intensification of health, education, employment, and housing programs to achieve the national goals is envisioned. Housing construction, for example, is expected to increase at an ave-

rage rate of 122,000 units to benefit a total of 3.6 million people across the country over the 1983-1987.

VI. Strategy and policy for funding the implementation of development plan:

The implementation of the development plan will be funded in the following manner.

- Braodened tax base. Enahanced abilities of individual local governments and governmental corporations to generate funds.
- Extended availability of long term financial assistances by governmental financing institutions and commercial banks working together to provide joint funds for priority activities and to arrange for loan-credit and insurance schemes.
- Increased foreign exchange earnings through improved export revenues, reduced energy imports, promotion of tourism.

The Plan set forth these goals under the rigorous socio-economic conditions to reflect its positive and highly motivated posture.

2 - 2 - 2 Overview of Regional Economy

The Philippines 1983 - 1987 development plan estimates GNP (Table 2-3.) for 1987 at 136,700 million pesos assuming economic growth, in real terms, of 6.3% for 1983 - 1987 or 749,200 million pesos in nominal terms with inflation of 9% annually. Based on that estimate, the per capita income is projected to reach 13,199 pesos.

GDP of Region II that comprises the bulk of the study area is comapred with other Regions including Metropolitan Manila in Table 2-4 . The region's real term economic growth rate is below the national average for 1980-82, but over the average for 1983 - 87. In terms of its contribution to the national economy, the region ranks 12th accounting for a low of approximately 2.5% based on actual records for 1980, estimates for 1981 - 82, and projections for 1983 - 87.

GDP assumes real term economic growth rates for agriculture, fishery, and forestry as 3.6% for 1980 - 81, 3.8% for 1981 - 82, 4.9% for 1983 - 87, that is, below the average for all the years. Its share in the national total was 25.6% or 23,700 million pesos, actual, in 1980, which is projected to increase to 32,300 million pesos in 1987 but it is a sharp decline in its share with 23.7%.

Table 2-3. Gross National Product by Expenditure and Industrial Origin, 1980-83 and 1987

Item	Constant level (billion pesos)					Average annual real growth rates			Current level (billion pesos)				
	Actual		Estimate	Projections		Actual	Estimate	Projections	Actual		Estimate	Projections	
	1980	1981	1982	1983	1987	1980-81	1981-82	1983-87	1980	1981	1982	1983	1987
Personal consumption expenditures	59.3	61.6	64.2	67.5	84.1	4.0	4.2	5.6	178.0	205.6	239.9	277.7	492.5
Govermment consumption expenditures	8.4	8.7	8.7	8.9	10.7	4.1	(0.5)	4.3	21.4	24.6	27.1	30.6	51.0
Gross domestic capital formation	26.6	27.2	27.5	28.6	38.8	2.3	1.1	7.1	81.2	93.3	105.1	117.7	223.9
Fixed capital formation	22.7	23.5	24.1	25.1	34.3	3.5	2.3	7.3	68.0	79.3	90.5	101.9	197.1
Construction	11.1	12.0	12.3	12.6	17.2	8.3	2.2	6.9	37.4	46.0	52.3	58.9	114.2
Govermment	4.9	5.2	4.9	4.9	6.0	7.9	(6.2)	4.2	16.3	20.0	20.9	23.0	40.2
Private	6.3	6.8	7.4	7.7	11.1	8.6	8.6	8.6	21.0	26.0	31.4	35.9	74.0
Durable equipment	11.6	11.5	11.8	12.4	17.2	(1.0)	2.5	7.8	30.6	33.3	38.2	43.0	82.9
Increase in stocks	3.9	3.7	3.4	3.5	4.5	(5.0)	(6.8)	5.5	13.2	14.0	14.6	15.9	26.9
Exports of goods and nonfactor services	18.1	18.4	19.4	20.9	29.4	1.6	5.0	8.7	54.2	58.5	68.2	80.2	159.1
Imports of goods and nonfactor services	19.4	18.9	19.5	20.6	26.6	(2.9)	3.4	6.4	68.9	74.0	85.3	96.2	176.4
GROSS NATIONAL PRODUCT	92.6	96.1	100.0	105.2	136.7	3.8	4.1	6.5	265.0	305.5	352.7	408.2	749.2
Agriculture, fishery and forestry	23.7	24.6	25.5	26.6	32.3	3.6	3.8	4.9					
Industry	33.5	35.1	36.6	38.6	52.8	4.7	4.3	7.6					
Mining and quarrying	2.2	2.3	2.3	2.5	3.3	1.7	3.0	6.8					
Manufacturing	23.2	24.0	25.0	26.3	35.9	3.4	4.2	7.6					
Construction	7.1	7.8	8.1	8.6	11.8	9.7	3.8	7.8					
Electricity, gas and water	0.9	1.0	1.1	1.2	1.8	7.8	13.1	9.7					
Services	35.5	36.6	38.1	40.1	51.2	3.0	4.3	6.1					
Transportation, communication and storage	4.8	5.0	5.3	5.7	7.5	4.4	5.9	7.1					
Commerce	19.3	19.7	20.4	21.4	27.5	1.8	3.8	6.1					
Other Services	11.3	11.8	12.4	13.0	16.3	4.3	4.6	5.7					
GROSS DOMESTIC PRODUCT	92.7	96.2	100.2	105.3	136.3	3.8	4.2	6.3					

Source: EPRS-NEDA.

Table 2-4. Gross Regional Domestic Product, 1980-83 and 1987
(millions of psos at 1972 prices)

Region	Actual	Estimates		Projections		Growth Rates(percent)		
	1980	1981	1982	1983	1987	1980-81	1981-82	1983-87
Philippines	92,694 (100.0)	96,189	100,222 (100.0)	105,285 (100.0)	136,399 (100.0)	3.8	4.2	6.3
NCR	29,940 (32.3)	31,347	32,983 (32.9)	34,982 (33.2)	43,928 (32.2)	4.7	5.2	5.9
Region I	3,337 (3.6)	3,436	3,549 (3.5)	3,700 (3.5)	4,882 (3.6)	3.0	3.3	7.2
II	2,410 (2.6)	2,448	2,490 (2.5)	2,565 (2.4)	3,411 (2.5)	1.6	1.7	7.4
III	7,508 (8.1)	7,781	8,096 (8.1)	8,491 (8.1)	10,993 (8.1)	3.6	4.0	6.7
IV	12,977 (14.0)	13,375	13,831 (13.8)	14,399 (13.7)	18,712 (13.7)	3.1	3.4	6.8
V	3,244 (3.5)	3,408	3,595 (3.6)	3,828 (3.6)	5,070 (3.7)	5.1	5.5	7.3
VI	7,323 (7.9)	7,543	7,794 (7.8)	8,130 (7.7)	10,645 (7.8)	3.0	3.3	7.0
VII	6,767 (7.3)	6,988	7,242 (7.2)	7,559 (7.2)	9,775 (7.2)	3.3	3.5	7.2
VIII	2,318 (2.5)	2,341	2,366 (2.4)	2,404 (2.3)	3,221 (2.4)	1.0	1.1	7.6
IX	3,244 (3.5)	3,380	3,537 (3.5)	3,736 (3.6)	4,967 (3.7)	4.2	4.6	7.4
X	4,264 (4.6)	4,473	4,717 (4.7)	5,028 (4.8)	6,660 (4.9)	4.9	5.5	7.3
XI	6,303 (6.8)	6,515	6,759 (6.7)	7,063 (6.7)	9,355 (6.9)	3.4	3.7	7.3
XII	3,059 (3.3)	3,154	3,263 (3.3)	3,400 (3.2)	4,520 (3.3)	3.1	3.5	7.4

( ) = %

Source: RDS-NEDA.

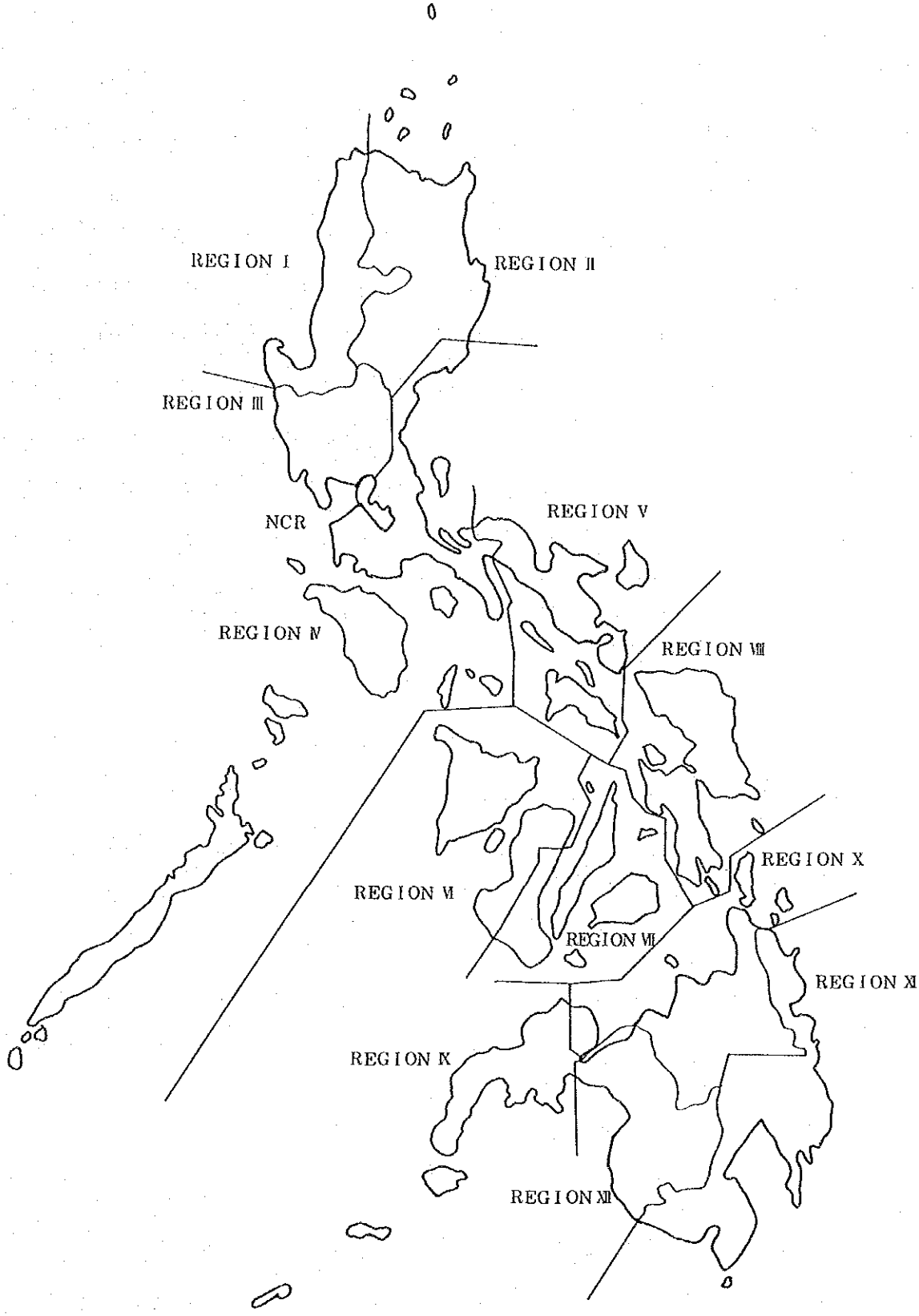


Figure 2-3. Administrative Regions

2 - 2 - 3 Population

According to the national census, the total population of the Philippines was 42.1 million in 1975, which increased at an annual rate of 2.7% to reach 48.1 million in 1980. The population of Region II (approx. 3.64 million ha. in area), which comprises the bulk of the study area (approx. 2.7 million ha.) is as shown in Table 2-5, with 2.2 million in 1980 accounting for 4.6% of the total population and population density of 60.9 persons per km^2, both being the lowest among all of the 13 Regions including the Metropolitan region.

According to Table 2-6 of population migrations, there were more people going out than those coming in over the five-year period of 1970 - 1975 in eight Regions including Region II. Over the subsequent five years from 1975 to 1980, Region XII changed the status to more ins than outs and Region III to more outs with the total number of "out" Regions remaining eight including Region II where population continued to move out.

According to the Cagayan Valley (Region II) Water Resources Framework Plan by the Natural Water Resources Council (NWRC), the Valley population will be increasing at 2.6% annually to

reach 3.55 million by 2000, with urban population of 520,000 or 15% of the total population and the remaining 3.03 million or 85% living in the outlying areas.

Table 2-5. Population and Land Area, by Region, 1980

Region	Population		Area		Density (Persons/Sq. Km.)
	Number	Percent	Sq. Km.	Percent	
Philippines	48,098,460	100.0	300,000.0	100.0	160.3
N C R	5,925,884	12.3	636.0	0.2	9,317.4
I	3,540,893	7.4	21,568.4	7.2	164.2
II	2,215,522	4.6	36,403.0	12.1	60.9
III	4,802,793	10.0	18,230.8	6.1	263.4
IV	6,118,620	12.7	46,924.2	15.6	130.4
V	3,476,982	7.2	17,632.5	5.9	197.2
VI	4,525,615	9.4	20,223.1	6.7	223.8
VII	3,787,374	7.9	14,951.4	5.0	253.3
VIII	2,799,534	5.8	21,431.7	7.1	130.6
IX	2,528,506	5.3	18,685.1	6.2	135.3
X	2,758,985	5.7	28,327.8	9.5	97.4
XI	3,346,803	7.0	31,692.8	10.6	105.6
XII	2,270,949	4.7	23,293.2	7.8	97.5

Source: National Census and Statistics Office.

Table 2-6. Number of In-and Out-Migrants, by Region, 1970-1975 and 1975-1980

(Persons)

Region	1970－1975			1975－1980		
	In Migrants	Out Migrants	Net Migrants	In Migrants	Out Migrants	Net Migrants
Philippines	8,887,910	887,910	－	1,136,953	1,136,953	－
N C R	263,058	195,860	67,198	378,878	202,169	176,709
I	29,739	70,739	(41,070)	35,588	85,329	(49,741)
II	24,070	28,218	(4,148)	33,259	36,041	(2,782)
III	99,210	72,279	26,931	90,504	92,257	(1,753)
IV	94,113	73,730	20,383	183,095	113,071	70,024
V	35,517	67,102	(31,585)	36,939	98,359	(61,420)
VI	39,909	55,788	(15,879)	33,523	104,781	(71,258)
VII	51,081	89,787	(38,706)	51,757	114,211	(62,454)
VIII	44,664	49,706	(5,042)	27,605	96,912	(69,307)
IX	17,993	40,860	(22,867)	28,143	36,956	(8,813)
X	81,935	45,950	35,985	92,319	56,477	35,842
XI	77,385	49,850	27,535	89,017	61,853	27,164
XII	29,306	48,041	(18,735)	56,326	38,537	17,789

Source: National Census and Statistics Office.

2 - 2 - 4 Major Infrastructures

1) Roads

Table 2-7 shows existing roads by Region. while Regional roads account for an average of 7.7% of the nationwide total road length, Region II has approximately 12,444 kilometers or 8% of the nationwide total exceeding the average. All Regions are equipped with city roads, municipality roads,and Barangay roads with the exception of Region II which lacks city roads. Region II is the lowest in road density with 0.3 km/km^2.

Table 2-7. Existing Roads, by Category and by Region, 1983
(Kilometers)

Region	Total		National		Provincial		City		Municipality		Barangay		Density km/km²
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Philippines	155,700,401	100.0 (100.0)	24,140,181	100.0 (15.5)	29,724,922	100.0 (19.1)	3,718,131	100.0 (2.4)	12,269,753	100.0 (7.9)	85,847,414	100.0 (55.1)	0.5
N C R	2,647,049	1.7 (100.0)	674,961	2.8 (25.5)	124,597	0.4 (4.7)	1,117,815	30.1 (42.2)	530,712	4.3 (20.1)	198,964	0.2 (7.5)	4.2
I	17,728,419	11.4 (100.0)	2,159,336	8.9 (12.2)	3,015,219	10.1 (17.0)	309,720	8.3 (1.8)	1,405,533	11.4 (7.9)	10,838,611	12.3 (61.1)	0.8
II	12,443,613	8.0 (100.0)	2,283,872	9.5 (18.3)	2,048,452	6.9 (16.5)	—	— (—)	1,122,570	9.2 (9.0)	6,988,719	8.1 (56.2)	0.3
III	12,835,225	8.2 (100.0)	1,660,016	6.9 (12.9)	2,402,459	8.1 (18.7)	258,553	6.9 (2.0)	941,306	7.7 (7.4)	7,572,891	8.8 (59.0)	0.7
IV	18,663,294	12.0 (100.0)	3,594,810	14.9 (19.3)	4,259,712	14.3 (22.8)	286,183	7.7 (1.5)	1,383,193	11.3 (7.4)	9,139,396	10.7 (49.0)	0.4
V	8,440,813	5.4 (100.0)	1,644,609	6.8 (19.5)	2,035,521	6.9 (24.1)	230,418	6.2 (2.7)	776,408	6.3 (9.2)	3,753,857	4.4 (44.5)	0.5
VI	13,029,749	8.4 (100.0)	2,406,930	10.0 (18.5)	2,455,499	8.3 (18.8)	223,483	6.0 (1.7)	689,620	5.6 (5.3)	7,254,217	8.4 (55.7)	0.6
VII	10,968,388	7.0 (100.0)	1,659,916	6.9 (15.1)	2,385,262	8.0 (21.8)	302,139	8.1 (2.8)	892,443	7.3 (8.1)	5,728,628	6.7 (52.2)	0.7
VIII	9,064,564	5.8 (100.0)	1,883,646	7.8 (20.8)	1,506,779	5.1 (16.6)	70,595	1.9 (0.8)	645,111	5.3 (7.1)	4,958,433	5.8 (54.7)	0.4
IX	8,291,385	5.3 (100.0)	905,932	3.7 (10.9)	1,993,624	6.7 (24.0)	121,954	3.3 (1.5)	680,390	5.5 (8.2)	4,589,485	5.7 (55.4)	0.4
X	15,642,299	10.1 (100.0)	2,099,116	8.7 (13.4)	2,634,724	8.9 (16.9)	218,239	5.9 (1.4)	1,097,008	8.9 (7.0)	9,593,212	11.2 (61.3)	0.6
XI	14,749,733	9.5 (100.0)	1,939,308	8.0 (13.1)	2,826,695	9.5 (19.2)	450,332	12.1 (3.1)	1,246,116	10.2 (8.4)	8,287,282	9.6 (56.2)	0.5
XII	11,195,870	7.2 (100.0)	1,227,729	5.1 (11.0)	2,036,379	6.8 (18.2)	128,343	3.5 (1.1)	859,343	7.0 (7.7)	6,943,719	8.1 (62.0)	0.5

( ) = %

Source: Ministry of Public Works and Highways.

2) Ports

Region II is surrounded by the Cordillera Central Mountains to the west and the Caraballo Mountains to the south. With Siera Madre Mountains in the east extending to the sea coast, the Aparri area in the north is the only part of the region that opens up onto the sea coast facing the Babuyan Channel. Thus the region as a whole is industrially underdeveloped. (Table 2 - 8). There are ports but only three of them have customs, extremely few compared with other regions.

Table 2-8. Number of Ports, by Category, and by Region, As of March 1984

Region	Total	Ports of Entry	Sub-Port of Entry	Other National Ports	Municipal Ports	Private Ports
Philippines	542	38	14	24	226	240
NCR	3	3	—	—	—	—
I	6	1	—	1	2	2
II	3	2	1	—	—	—
III	16	1	2	—	—	13
IV	110	3	1	4	58	44
V	26	5	1	2	12	6
VI	74	3	—	3	19	49
VII	68	2	3	3	29	31
VIII	19	4	—	3	7	5
IX	47	2	4	3	30	8
X	81	4	1	3	23	50
XI	37	6	—	—	10	21
XII	52	2	1	2	36	11

Source of Basic Data: Philippine Ports Authority

3) Airports

There are six airports in Region II but no international airports.

Table 2-9. Distribution of National Airports, by Region, 1983

Region	Total	International	Feeder	Secondary	Trunkline
Philippines	84	6	29	38	11
N C R	1	1	—	—	—
I	6	1	2	2	1
II	6	—	1	5	1
III	3	—	2	1	—
IV	15	1	8	5	1
V	7	—	1	5	1
VI	6	—	1	2	3
VII	6	1	2	2	1
VIII	9	—	5	3	1
IX	9	1	4	4	—
X	7	—	3	3	1
XI	6	1	—	4	1
XII	3	—	—	2	1

Source: Ministry of Transportation and Communications

4) Schools

There are 2,215 primary schools, 273 junior high schools, and 318 senior high schools, totaling 2,526 in Region II. Though simple comparison is difficult since the basis such as residential distributions and school sizes is different, Region II has 1 school for every 1,000 persons which compares with 0.8 for nationwide. Overall, including Region II, schools are distributed fairly evenly across the country.

Table 2-10. Distribution of Schools, by Level of Education Offered, and by Region, School Year 1981-1982

Region	Total Public & Private	Percent	Elementary			Secondary			Tertiary		
			Total	Public	Private	Total	Public	Private	Total	Public	Private
Philippines	38,169 (100.0)	100.0	31,729 (83)	30,561	1,168	5,354 (14)	3,298	2,056	1,086 (3)	316	770
NCR	1,310	3.4	754	440	314	366	128	238	190	13	177
I	3,679	9.6	2,933	2,836	97	671	460	211	75	19	56
II	2,526	6.6	2,215	2,164	51	273	164	109	38	17	21
III	3,007	7.9	2,473	2,335	138	445	253	192	89	26	63
IV	4,740	12.4	3,823	3,676	147	772	447	325	145	44	101
V	3,286	8.6	2,800	2,733	67	412	282	130	74	26	48
VI	3,816	10.0	3,163	3,057	106	544	397	147	109	56	53
VII	2,959	7.8	2,564	2,498	66	337	170	167	58	19	39
VIII	3,434	9.0	3,029	3,008	21	350	277	73	55	40	15
IX	2,212	5.8	1,937	1,899	38	229	160	69	46	18	28
X	2,686	7.0	2,269	2,237	32	350	213	137	67	16	51
XI	2,506	6.6	2,055	2,002	53	351	199	152	100	13	87
XII	2,088	5.3	1,714	1,676	38	254	148	106	40	9	31

Source: Ministry of Education, Culture and Sports

5) Hospitals

There are 127 hospitals in Region II. In terms of the number of beds per 1,000 persons, Region II ranks third with 1.41 beds, though below the national average, among the regions excepting Metropolitan Manila. Again it is difficult to compare in simple terms, but in terms of the number of hospitals per 1,000 persons, Region II tops the list with 0.054 which compares with 0.033 for the nationwide average.

Table 2-11. Hospital and Hospitals Beds: Number and Ratio to Population, by Region, 1982

	Total[1/] Population (000)	Total Hospitals	Hospitals		Total Hospital Beds	Hospital Beds		Hospital Beds/ 1000 Population
			Government	Private		Government	Private	
Philippines	50,783	1,672	494	1,178	83,137	43,485	39,652	1.64
NCR	6,345	162	24	138	27,751	15,871	11,880	4.37
I	3,682	144	46	98	5,617	2,820	2,797	1.53
II	2,340	127	48	79	3,300	2,175	1,125	1.41
III	5,070	188	53	135	6,274	3,672	2,602	1.24
IV	6,516	220	70	150	8,182	4,205	3,977	1.26
V	3,658	153	37	116	4,913	2,060	2,853	1.34
VI	4,755	71	38	33	4,405	2,025	2,380	0.93
VII	3,951	92	33	59	4,876	1,992	2,884	1.23
VIII	2,910	73	45	28	2,818	2,057	761	0.97
IX	2,671	76	28	48	2,720	1,891	829	1.02
X	2,931	125	28	97	4,661	2,075	2,586	1.59
XI	3,551	153	26	127	4,557	1,417	3,140	1.28
XII	2,403	88	18	70	3,063	1,225	1,838	1.27

1/ Population figures based on NCSO Revised Population Projection, Series 2.
Source: Ministry of Health

2 - 3 Present Status of Forest Lands as Landuse

The Republic of the Philippines has a total land area of 30,000,000 hectares, of which 14,467,600 hectares or 48.2% are alienable & disposable (A/D) and 15,532,400 hectares or 51.3% forest lands. Regional II accounts for 12.1% in total land area, 8.2% in A/D, and 15.8% in forest lands.

Compared with other regions, Region II with a total land area of 3,640,300 hectares is the lowest in the share of A/D with 32.4% but the highest in the percentage of forest lands with 67.6% (Table 2-12)

Table 2-13 shows the classification of forest lands. As shown in the table, of the total forest land area of 2,460,000 hectares in Region II, 71% or 1,736,000 has been classified. The percentage breaks down to 63% for protective forests, 27% for productive forests, 7% for conservation forests, and 3% for military and other purposes. Compared with other regions (Table 2-14), Region II has the third largest share of protective forests following Region I and IX, with 44.5%. Another characteristic of Region II is the ratio of productive forests being among the lowest next only to Region I, with 19.2%.

Table 2-12. Land Classification, by Region, 1983

Region	Total Land Area		Alienable & Disposable		Forestland	
	Hectares (000)	Percent	Hectares (000)	Percent	Hectares (000)	Percent
Philippines	30,000.0 (100.0)	100.0	14,467.6 (48.2)	100.0	15,532.4 (51.8)	100.0
N C R	63.6 (100.0)	0.2	34.7 (54.6)	0.2	28.9 (45.4)	0.2
I	2,156.9 (100.0)	7.3	951.8 (44.1)	6.6	1,205.1 (55.9)	7.8
II	3,640.3 (100.0)	12.1	1,180.3 (32.4)	8.2	2,460.0 (67.6)	15.8
III	1,823.1 (100.0)	6.1	1,071.5 (58.8)	7.4	751.6 (41.2)	4.9
IV	4,692.4 (100.0)	15.6	2,138.6 (45.6)	14.8	2,553.7 (54.4)	16.4
V	1,763.2 (100.0)	5.9	1,292.9 (73.3)	8.9	470.4 (26.7)	3.0
VI	2,022.3 (100.0)	6.7	1,460.2 (72.2)	10.1	562.1 (27.8)	3.6
VII	1,495.1 (100.0)	5.0	903.4 (60.4)	6.2	591.8 (39.6)	3.8
VIII	2,143.2 (100.0)	7.1	1,027.9 (48.0)	7.1	1,115.2 (52.0)	7.2
IX	1,868.5 (100.0)	6.2	1,013.7 (54.3)	7.0	854.8 (45.7)	5.5
X	2,832.8 (100.0)	9.4	1,110.9 (39.2)	7.7	1,721.9 (60.8)	11.1
IX	3,169.3 (100.0)	10.6	1,244.2 (9.3)	8.6	1,925.1 (60.7)	12.4
XII	2,329.3 (100.0)	7.8	1,037.5 (44.5)	7.2	1,291.8 (55.5)	8.3

Note: Figures in parenthesis denote percentage distribution to total land area of a region;

Source: Bureau of Forest Development

Table 2-13 Forestland, by Category, and by Region, 1983

(Units: 1,000ha)

Region	Total Forestlands		Unclassified Forestlands		Classified Forestlands											
					Total		Established Forest Reserves		Established Timberlands		Natural GRBS/WA[1]		Military & Civil Reservation		Fishponds	
	Area	Percent	Area	Percent	Area	Percent	Area	Percent	Area	Percent	Area	Percent	Area	Percent	Area	Percent
Philippine	15,532.4	100.00	5,060.1	100.0	10,472.3	100.0	3,496.0	100.0	4,959.5	100.0	1,571.4	100.0	436.3	100.0	9.2	100.0
NCR	28.9	0.2	28.9	0.6	—	—	—	—	—	—	—	—	—	—	—	—
I	1,205.1	7.8	417.3	8.3	787.8	7.5	619.1	17.7	93.0	1.9	9.0	0.6	66.4	15.2	0.3	3.3
II	2,460.0	15.8	724.1	14.3	1,735.9	(100) 16.6	1,094.2	(63)31.3	471.6	(27) 9.5	115.5	(7) 7.4	54.5	(3) 12.5	0.1	1.1
III	751.6	4.8	211.8	4.2	539.8	5.1	140.7	4.1	193.7	3.9	28.8	1.8	176.6	40.5	—	—
IV	2,553.7	16.4	427.6	8.4	2,126.1	20.3	276.2	7.9	567.8	11.4	1,212.0	77.1	69.8	16.0	0.3	3.3
V	470.4	3.1	27.6	0.5	442.8	4.2	52.9	1.5	364.5	7.3	25.3	1.6	—	—	0.1	1.1
VI	562.1	3.6	108.4	2.1	453.7	4.3	130.3	3.7	296.6	6.0	23.4	1.5	0.2	0.1	3.2	34.8
VII	591.8	3.8	229.5	4.5	362.3	3.5	53.0	1.5	289.1	5.8	18.7	1.2	—	—	1.5	16.3
VIII	1,115.2	7.2	769.0	15.2	346.2	3.3	51.5	1.5	292.3	5.3	2.1	0.1	0.3	0.1	—	—
IX	854.8	5.5	220.8	4.4	634.0	6.1	418.9	12.0	207.9	4.2	6.7	0.4	—	—	0.5	5.4
X	1,721.9	11.1	677.4	13.4	1,044.5	10.0	314.2	9.0	672.6	13.6	55.7	3.6	—	—	2.0	21.7
XI	1,925.1	12.4	575.9	11.4	1,349.2	12.9	217.8	6.2	1,016.3	20.5	53.6	3.4	60.4	13.8	1.1	11.9
XII	1,291.8	8.3	641.8	12.7	650.0	6.2	127.2	3.6	494.1	10.1	20.6	1.3	8	1.8	0.1	1.1

[1] Game Refuge and Bird Sanctuaries / Wilderness Area

Source: Bureau of Forest Development

Table 2-14. Forestland, by Category, and by Region, 1983

(Unit: %)

Region	Total Forestlands	Unclassified Forestlands	Classified Forestlands					
			Total	Established Forest Reserves	Established Timberlands	Natural GRBS/WA	Military & Civil Reservation	Fishponds
Philippines	100.0	32.6	67.4	22.5	31.9	10.1	2.8	0.1
N C R	100.0	100.0	—	—	—	—	—	—
I	100.0	34.6	65.4	51.4	7.7	0.8	5.5	0.0
II	100.0	29.4	70.6	44.5	19.2	4.7	2.2	0.0
III	100.0	28.2	71.8	18.7	25.8	3.8	23.5	--
IV	100.0	16.8	83.2	10.8	22.2	47.5	2.7	0.0
V	100.0	5.9	94.1	11.2	77.5	5.4	—	0.0
VI	100.0	19.3	80.7	23.2	52.8	4.2	0.0	0.5
VII	100.0	38.8	61.2	8.9	48.9	3.1	—	0.3
VIII	100.0	69.0	31.0	4.6	26.2	0.2	0.0	—
IX	100.0	25.8	74.2	49.0	24.3	0.8	—	0.1
X	100.0	39.3	60.7	18.3	39.1	3.2	—	0.1
XI	100.0	29.9	70.1	11.3	52.8	2.8	3.1	0.1
XII	100.0	49.7	50.3	9.9	38.2	1.6	0.6	0.0

Source: Bureau of Forest Development

Chapter 3 Study Plan

3 - 1 Basic Policy

This study is undertaken in line with the Implementing Arrangement (I/A) concluded between the government of the Republic of the Philippines and the Japan International Cooperation Agency. The objetive of the study is to prepare the Forest Management Plan for Wide Area covering the entire Cagayan River Basin (approx. 2.7 million ha.) in Luzon Island and the Forest Management Plan for Model Area to be selected from the above area (up to 50,000 ha.). Due consideration is given to the methodology applied in this study so that it can possibly serve as a standard approach for nationwide forestry management in the future. The study is conducted over the three year period from August 1985 to March 1988.

The study items for each year are as follows.

First Year (August 1985 - March 1986)

1. Data Collection
2. Base Map and Reconnaissance Map Production

Second Year (April 1986 - March 1987)

1. Basic Data Collection
2. Geographical (Geomorphological) Characteristics Analysis
3. Land Characteristics Analysis
4. Aerial Photographing of Model Area
5. Base Map Production of Model Area and Data Collection

Third Year (April 1987 - March 1988)

1. Forest Landuse Classification
2. Zoning of Forest Landuse Classifications
3. Forest Management Planning for Wide Area
4. Forest Management Planning for Model Area
5. Field Verification
6. Report Production

3 - 2 Contents of Study

3 - 2 - 1 Contents

Figures 3-1 and 3-2 are flow diagrams of the study as a whole and the Forest Landuse Classification respectively.

Specifically, the study is to: (1) collect and compile information on the study area from existing data, aerial photos, Landsat data, etc., (2) check data in field survey and supplement if necessary to finalize the basic data, (3) input basic data into computer to analyse forest landuse in terms of geomorphological characteristics such as slopes and slope aspects, as well as land characteristics such as soil erosion, land slides, land collapse, etc., (4) based on the findings, formulate a well-balanced forest management plan for wide area that meets the future needs of society and regional economy.

Based on the findings of the wide area surveys, the study proceeds to: (5) select Model Area and validate applicability of acquired data and findings to Model Area, and collect additional data including aerial photographing and analyse them, (6) based on the findings, formulate a well-balanced forest management plan for Model Area that meets the future needs of society and regional economy, and (7) produce a report describing the methodology, results, and future problems.

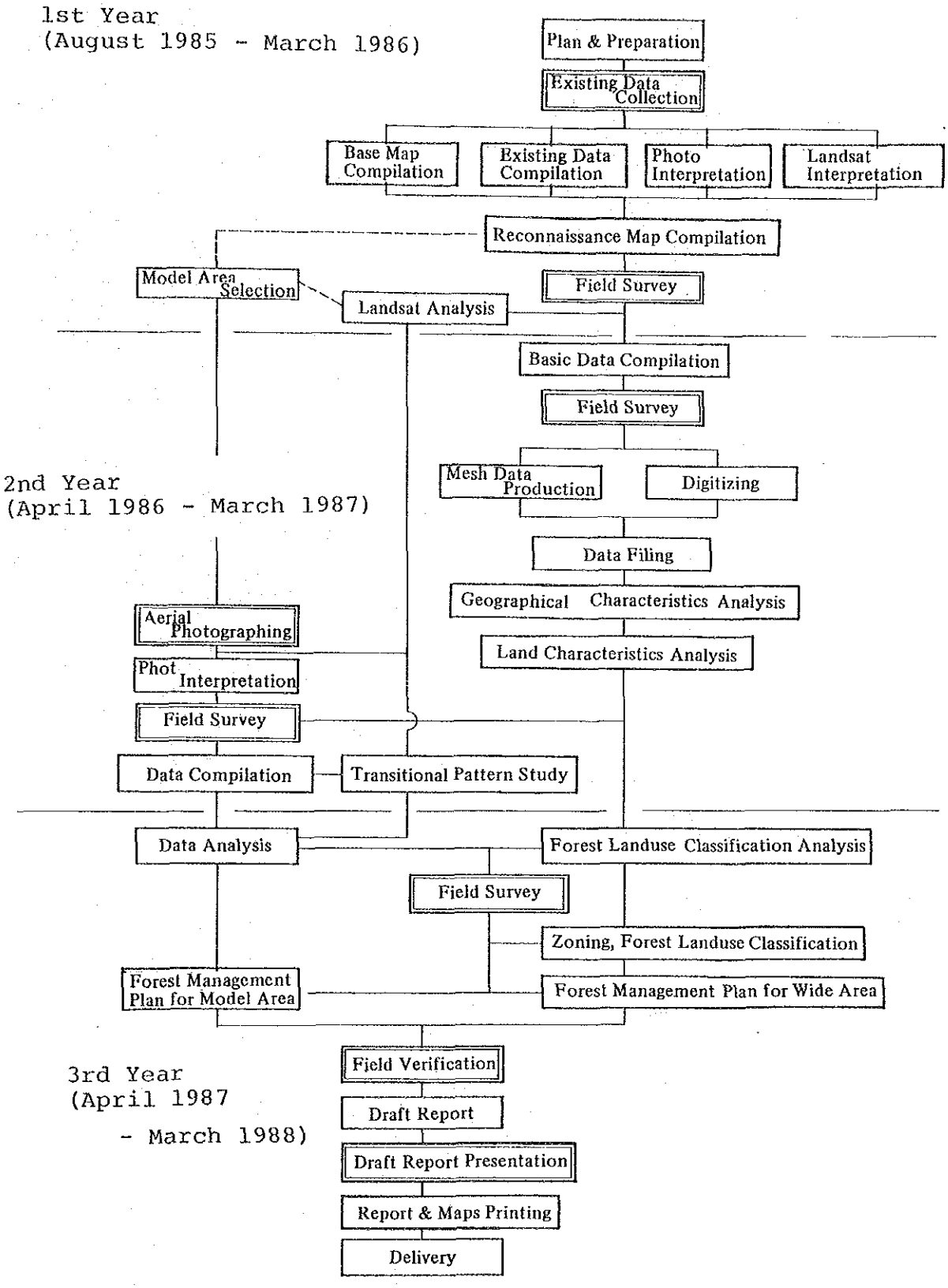


Figure 3-1. Study Flow

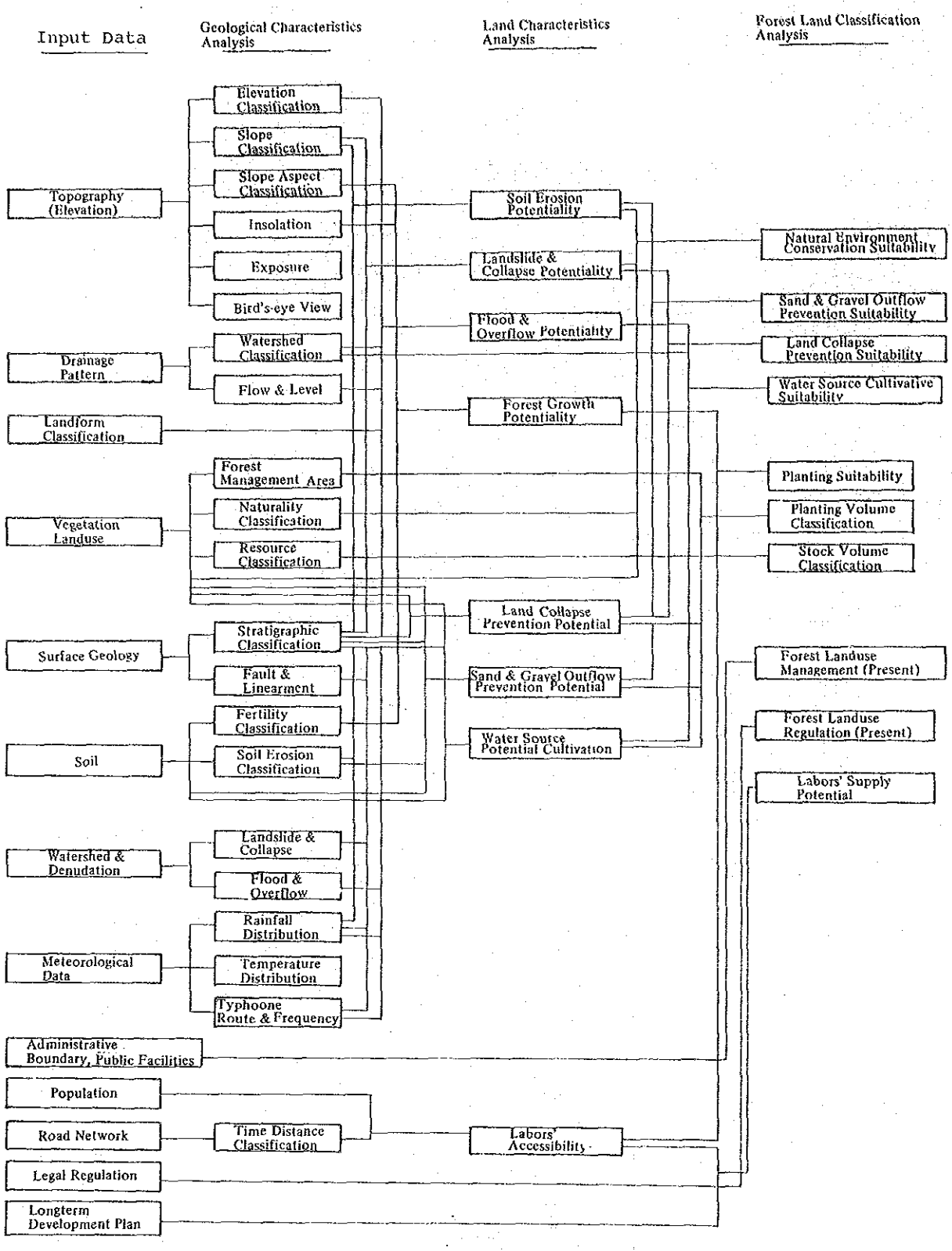


Figure 3-2. Data Analysis Flow of Forest Landuse Classification

3 - 2 - 2 Scope of Study

The scope of the study for the first year (FY 1985) is as follows. Aerial reconnaissance was conducted to have an overall understanding of the study area by flying in an aircraft hired for this exclusive purpose.

1) Planning and preparation in Japan:
   (1) Planning and preparation
   (2) Acquisition of LANDSAT imageries
2) Field survey:
   (1) Collection of existing data
   (2) Verification of Reconnaissance Map and Table
   (3) Selection of Model Area
3) Analysis work in Japan:
   (1) Basic map compilation
   (2) Existing data compilation
   (3) Aerial photo interpretation
   (4) LANDSAT data analysis
   (5) Finalization and production of Reconnaissance Map
   (6) Compilation of field survey results
   (7) Report writing

Chapter 4 Field Survey

4 - 1 Preliminary Work in Japan

(1) Data and information were collected and studied in Japan on the study area in terms of natural environment, socio-economic environment, forests and forestry, to gain a preliminary insight on the study area.

(2) Equipment and supplies necessary for field survey were procured.

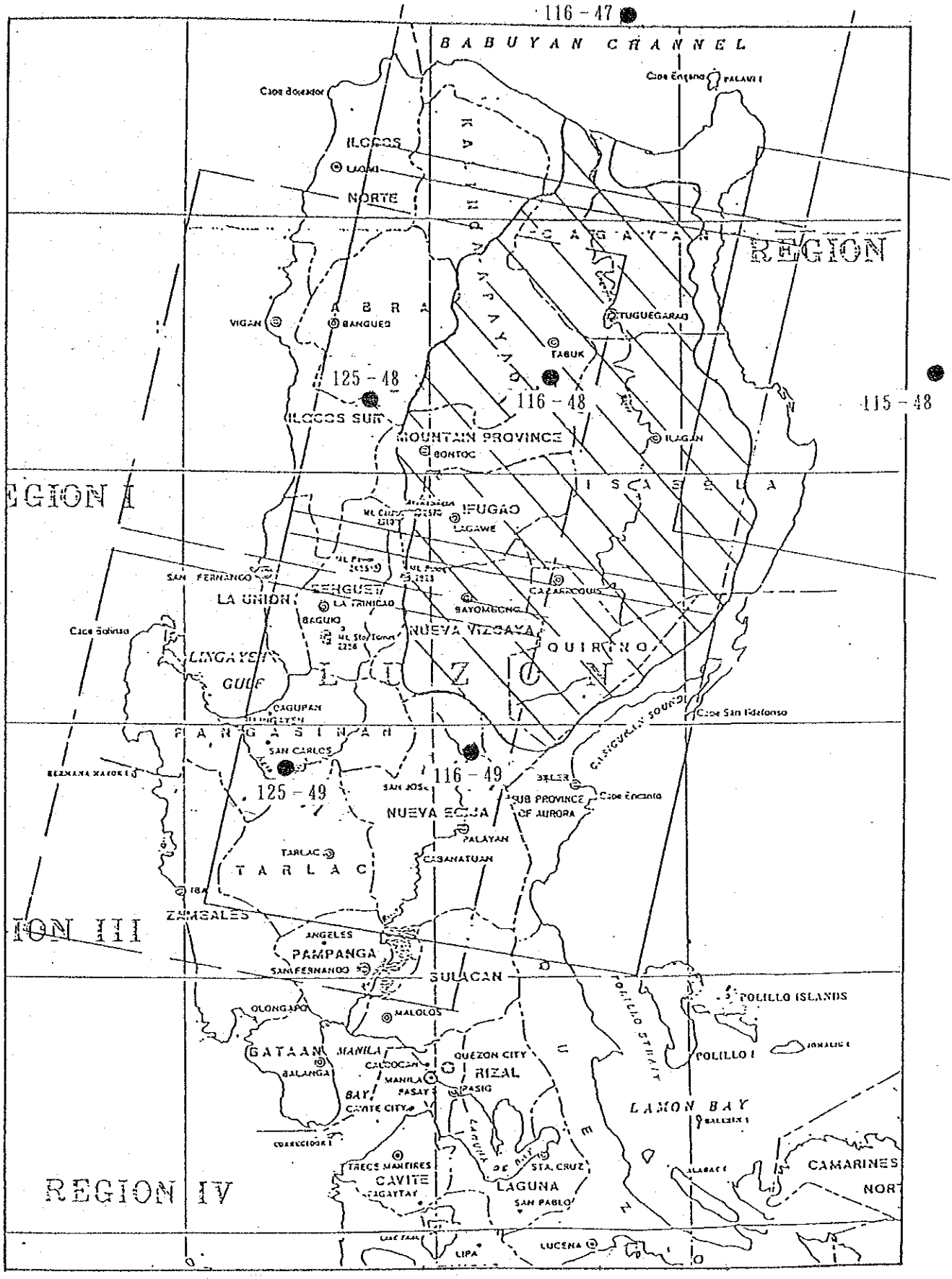
(3) Data and information to be acquired in the field were itemized in a list.

(4) LANDSAT imageries covering the study area were selected and acquired in CCT's (computer compatible tapes).

The LANDSAT scene index is given in Figure 4-1. The scenes were selected by the following criteria.

- Presently Landsat No.4 and No.5 are working. The study area comes in the purview of the receiving station at Bangkok, Thailand, from which CCT's are to be obtained.
- The scenes covering the study area are as follows and they are also shown in Figure 4-1.

  1. Path No. 115; Row No.48 2. Path No. 116; Row No. 47
  3. Path No. 116; Row No.48 4. Path No. 116; Row No. 49



——— Landsat No.4 & No.5

— — — Landsat No.1 - No.3

Figure 4-1. Landsat Scene Index

- From these tapes after radiometric, geometric, and other corrections and rectifications, quality color infra-red images (combination of Bands 4,5, and 7) were produced at scales of 1/200,000 and 1/100,000. The dates of Landsat observation for the respective scenes are as follows.

P115/R48	April 10, 1984 (cloud cover 10%)
P116/R47	April 15, 1983 (cloud cover 0%)
P116/R48	April 15, 1983 (cloud cover 10%)
P116/R49	April 15, 1983 (cloud cover 20%)

4 - 2 Preliminary Study

The study was discussed with the Philippine side in terms of its contents and schedule. Data and information related to the study and in the possesion of the Philippine side were made available for the study according to the terms of I/A. They include the following. Other documents collected for the purpose of this study were given in the attached list.

(1) Aerial photos:

Contact prints covering the entire study area -

At scale 1/60,000, made 1980 - 81

Contact prints covering forest lands in lowland -

At scale 1/30,000, made 1980

(2) Topographical maps:

For the entire study area at scales 1/50,000 and 1/250,000

(3) Thematic maps:

Include Forest Condition Map, Landuse Map, Soil Map, Geological Map.

(4) Statistical data:

Meteorology (temperature, rainfall, humidity), records of natural disasters, demography, production, etc.

(5) Others:

Plans, technical papers, reports, relating to the study area and its surrounding areas.

4 - 3 Base Map Compilation

The base map was compiled at 1/100,000 from the existing 1/50,000 topographic map sheets in the following manner. The neat lines (longitude and latitude) are 30 min. x 30 min.

(1) On the myler overlaid on the topographical maps of 1/50,000 in scale, main contour lines (intervals, 200m for mountains and 100m for flat land), cities, towns, villages, major roads, waters, drainage patterns, and other terrain features were delineated.

(2) The above were photographed and negatives made, reduced to 1/100,000, and compiled with legend and notes as shown on the following page, to make the original base map sheet.

In this study, the actual sheet number sixteen (16) including extentions shall be used, against the formal sheet number nineteen (19) through the automatical partition.

(3) From the original Base Map, the second original Base Map shall be produced for Base Map of the each Thematic Maps.

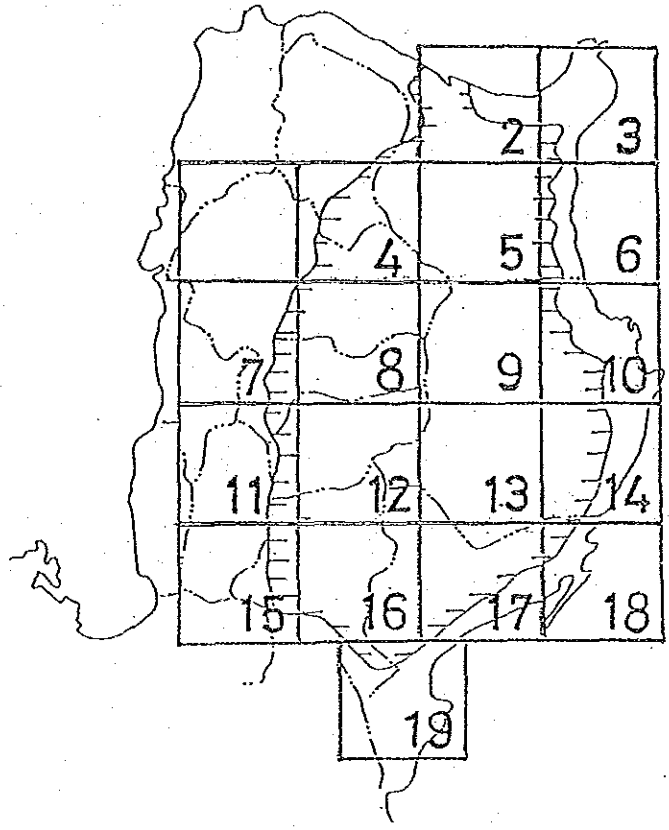


Figure 4-2. Index of S=1:100,000 MAP

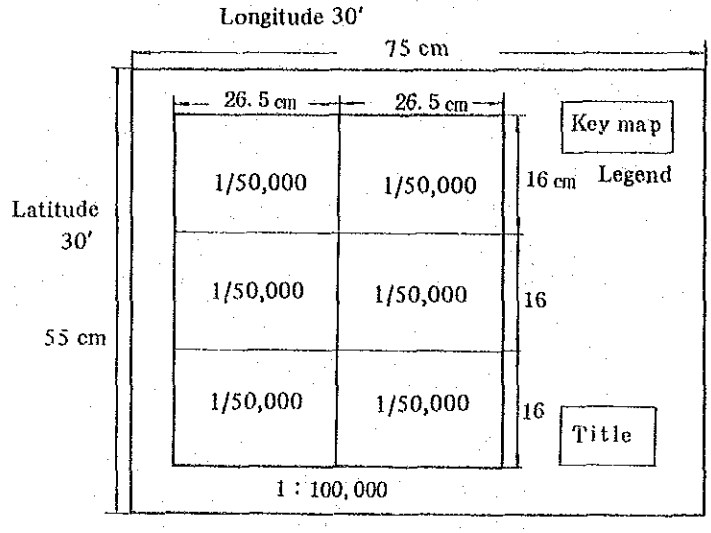


Figure 4-3. Compiled base map

4 - 4 Compilation of Reconnaissance Map and Table

Results and findings of existing data study, Landsat data analysis, and photo interpretation, were incorporated and compiled into the reconnaissance map and table, which were finalized in cosultation with the Philippine side. The Reconnaissance Map and Table include the following information.

1. Drainage patterns, watershed classification
2. Geomorphological classification
3. Vegetation and landuse classification
4. Surface geology classification
5. Soil classification
6. Watershed deterioration (land collpase, sands/gravels outflow, land slide, flood)

7. Meteorology (temperature, rainfall, typhoon)
8. Natural disaster records
9. Administrative boundaries
10. Demography
11. Road networks
12. Laws and regulations
13. Development plans (under planning, on-going)
14. Others

4 - 4 - 1 Compilation of Existing Data

From the data and information found in the collected documents, those relevant to the study area were sought, examined , and compiled. The list of collected documents is given at the end of this report.

4 - 4 - 2 Landsat Imagery Analysis

From the Landsat CCT's, after radiometric correction, sensor sensitivity compensation, and geographical correction, color negatives (scale 1/1.14 million) with a band combination of 4, 5, and 7, were produced. From these negatives, infra-red color images were developed at 1/100,000 (one scene: 100cm X 100cm X 4 sheets) and 1/200,000 (one scene: 100cm X 100cm X 1 sheet).

The study area is covered by four scenes of 1/200,000 images providing an overview of the area and,thus, together with other existing data, a basis for legend categorization for thematic maps. Furthermore, 1/100,000 images were interpreted for detailed categorization, and the Landsat Interpretation Map was produced. Sample points were selected on site for digital analysis of Landsat data. At least five points were selected for each legend category of Vegetation and Landuse.

Landsat images were interpreted for the following items of information.

- Forests (broad-leaved natural forests, coniferous forests, secondary stands, etc.)
- Grassland, bare land, land collapse)
- Cultivated land, farms (including orchards), villages
- Rivers, water bodies, roads, etc.

From interpretation of Landsat images, the following thematic interpretation maps were developed at 1/100,000.

- Drainage pattern, watershed (Also used: 1/50,000 topo map)
- Geomorphological classification :(Also used: 1/50,000 topo map)
- Vegetation/Landuse (Referred to: other existing data)
- Surface geology (Referred to: other existing data)
- Soils (Compared: topography, surface geology. Referred to: other existing data)

- Watershed deterioration (Compared: topography, Referred to: other existing data)
- Road networks (Referred to: 1/50,000 topo map, other existing data)

(1) Drainage patterns, watershed

Based on 1/50,000 topo maps, a reconnaissance map was produced. For some parts of mountain areas, however, there were discrepancies between topo maps and Landsat images, and in such instances aerial photographs were further referred to for verification.

(2) Geomorphology

From the study of the 1/50,000 topographic maps, it was concluded that the study area could best be classified into three major categories of Lowlands for 0 - 100 meters, Hills for 100 - 400 meters, and Mountains for 400 meters and higher, each in elevation, which would permit appropriate representation of terrain features of the study area by further classification in each category in terms of geomorphological formations. Since elevations on the order of several meters or tens of meters, cannot be distinguished on Landsat imagery, aerial photography was used

for interpretation of further details.

(3) Vegetation, land use

From Landsat images, major river basins were interpreted for forests, logged-over areas, cultivated lowlands, settlements/villages, etc. They were supplemented by aerial photo interpretation for grassland, bareland, dilapidated areas, as well as elevations.

(4) Geology

Faults and lineaments could be clearly recognized in Landsat images but strikes and dips were difficult to determine. Therefore, the study area was initially classified into blocks and further details interpreted from aerail photos.

(5) Soils

There were little available data. And Landsat images did not provide information in amount enough for mapping. Therefore, aerial photography, wide area survey, and geology survey data, were made to serve as major sources of information on soils.

(6) Watershed detetrioration

Deposits of sands and gravels along major watershed were understood whereas land collapses, land slides, land forms, were identified form aeriàl photography.

(7) Road networks

Based on 1/50,000 topo maps, major road networks were transcribed on the 1/100,000 base map. Substantial changes were recognized as occurring over years, which were incorporated by Landsat information with further details supplemented by aerial photo interpretation and wide area field survey.

The above interpretation maps were corrected and supplemented by using the existing aerial photographs (1/60,000 and 1/30,000).

The following thematic maps were developed mainly from the existing data.

- Watershed deterioration (land collapse, sands/gravels outflow, land slide, flood)
- Natural disasters (typhoon, flood, earthquake)
- Administrative boundaries, major public facilities

- Laws and regulations
- Development plans (including long term plans, on-going plans)
- Others

4 - 4 - 3 Aerial Photo Interpretation

The following aerial photos were used for interpretation that took place for a period from October 21 to November 22, 1985.

- The entire study area	: 1/60,000; photographed 1980 - 81. Contact print(23cm X 23cm), 2 sets, 1626 sheets.
- Lowlands and hills	: 1/30,000; photographed 1980. Contact print (23cm X 23cm), 1 set, 1407 sheets.

Interpretations made were as described under Landsat Imagery Interpretation. The results were incorporated in the Reconnaissance Map for Wide Area.

(1) Drainage and Watershed Map

Rivers of approximately 2 kilometers or longer in length were picked outfrom the topo maps and aerial photos, and their flook plains defined, to be incorporated in the 1/100,000 Reconnaissance Map.

(2) Geomorphology Map

Lowlands, Hills, and Mountains as defined in Landsat images were further classfied in terms of the legend as given in Table 4 - 1. Deteriorated areas were denoted on the 1/100,000 Reconnaissance Map with Water Body, Cliff, Landslide, Collapse, Collapse (small size), Rock Stream, respectively, as recognized in aerial photography.

Table 4-1. Legend of Geomorphology

LEGEND OF GEOMORPHOLOGY	
LOWLANDS (under 100m)	
L 1	Coastal ridge, Sand bar,Sand dune
L 2	Back marsh (coastal · fluvial)
L 3	Natural levee
L 4	Flood plain
L 5	Valley bottom lowland
L 6	Fan
L 7	River bed
MIDLANDS (100~400m)	
M 1	Terrace
M 2	Colluvial slope,Talus
M 3	Dissected upland
M 4	Hill
M 5	Piedmont (rolling)
M 6	Piedmont (dissected)
HIGHLANDS (over 400m)	
H 1	Escarpment
H 2	Plateau
H 3	Low relief surface on mountain
H 4	Dissected slope on mountain
H 5	Gentle slope on mountain
H 6	Steeply dissected slope
MISCELLANEOUS	
Water body	Collapse
Cliff	Collapse (small size)
Landslide	Rock stream

(3) Vegetation and Land Use Map

Classification of vegetation and landuse was made, initially in terms of land use as indicated in upper rows of the legend and, then in tree height as shown in lower rows of the lenged, to be incorporated into the Reconnaissance Map. The aerial photos covering the mountains were at a small scale of 1 to 60,000, and furthermore, they were prints from duplicated negative films resulting in sharp contrasts, making such distinctions difficult to make as between grassland and bare land, different tree types, and tree heights. Therefore, these informations were verified in the field.

Table 4-2

LEGEND OF FOREST AREA CLASSIFICATION

LAND USE CLASSIFICATION

Ma	MANGROVE FOREST
F	FLAT PLAIN FOREST (0 ~ 100m)
H	HILLY FOREST (100~400m)
M	MOUNTAIN FOREST (OVER 400m)
G 1	GLASS LAND (INCLUDE PASTURE)
G 2	LOGGING PROGRES OR LOGGED OVER AREA
B	BARE LAND
A	AGRICULTURE AREA (FARM)
K	KAINGIN
S	SETTLEMENT, VILLAGE, TOWN

(4) Geology Map

Information on distributions of strikes, dips, and characteristic rocks, was supplemented by aerial photo interpretation. The results were compiled into the 1/200,000 Reconnaissance Map. Its legend is given in Table 4 - 3. Precise boundaries and rock types were verified in the field at the time of Wide Area surveying.

Table 4-3. LEGEND OF GEOLOGY

Q ····· RECENT SEDIMENTS (MUD, SAND&GRAVEL)
S ····· SEDIMENTARY ROCKS(LIMESTONE, SANDSTON, ETC.)
V ····· VOLCANIC ROCKS (ANDESITE, BASALT, ETC.)
I ····· INTRUSIVE ROCKS (GRANITE, DIOLITE, ETC.)
M ····· METAMORPHIC ROCKS (SCHIST, GENISS, ETC.)

ANTICLINE
SYNCLINE
FAULT & LINEARMENT
DIP & STRIKE

LOW HIGH VERTICAL

4 - 5 Wide Area Survey

4 - 5 - 1 Aerial Reconnaissance

Aerial reconnaissance was conducted by flying in a chartered aircraft which left Manila (Domestic) Airport at 7:30 am covering Cagayan Valley areas from the south to the west where a model area was to be located. Visibility was hampered by clouds which prevailed till 9:30 am and intermittent rainfalls. In the latter half of the flight, as clouds diminished, reconnaissance proceeded, to cover the northwest and part of the east of the valley. The reconnaissance was ended as the aircraft landed at Tuguegarao at 11:30 am.

4 - 5 - 2 Checking of Reconnaissance Map and Table

(1) Outline of Study Area

The Cagayan Valley area is elongated in the north-south direction in shape and surrounded by mountains. The Cagayan River runs south to the east of the center of the basin with such tributaries as Adalan, Magat, Chico, on the left, and Rinagauan de Ilagan, Pinacauan de Tuguegarao, Dummon, on the right. The Cagayan Basin has the Cordillera Central Mountain Range (1,400 - 2,600 m in elevation) to the west, the Siera-

madre Range (400 - 1,600 m in elevation) extending to the sea coast to the east and another range of mountains (1,000 - 1,400 m in elevation) to the south.

Generally, the southern part and mainly the left bank side of the Cagayan River have extensive areas of gently sloping footslopes followed by hills, lifted fans, terraces, and fans. In terms of land use, the flat lowlands are used for rice paddies and cultivation,and hills for grassland while in the forestlands among steep mountains are underdeveloped secondary forests. The existing geomorphology reflects the deteriorating function of forestland to conserver itself due to such man-made causes as kaingin, felling trees, grazing, that have taken place extensively in footslopes, hills, and plateaus, as well as to the tremendous amount of sand and gravel outflow from left-side tributaries of the Cagayan River.

(2) Constraints and mitigatory measures involved in the field verification for Reconnaissance Map

1- For security reasons, the survey activities were restricted in some parts of the area.
2- There were some areas which proved inaccessible due to

the lack of roads. (The total maileage covered during the whole survey trip from Manila, the study area, and back to Manila, amounted to approximately 6,300 kilometers.)

For these reasons, the survey could not cover the entire study area (2,700,000 ha.) for verification and it was made up for by the following.

- Observation from afar using a telescope.
- Search of documents for information on the unchecked areas.
- Landsat data.

(3) Survey Results

1. Geomorphology, geology:

a. Geomorphology legend

The initially set classifications by elevation in terms of 100 m. and 400 m. was confirmed as valid. The difference between Midland and Highland relates to that of agricultural land use and forestry land use. It was also confirmed that sub-classifications would permit delineation of soil zones and forestry zones by translating the natural features related to forest management (ex. slopes and composing materials, soil formations, growth levels

of trees, hydrology). (See Legend of Geomorphology, in Table 4-1)

b. Field Survey Card (Sampling: Numbers and locations)

The way it was designed, the card proved to be very helpful to understand regional characteristics for respective sample locations and effective for future use in criteria setting for evaluation. (See Legend, in Table 4-2)

c. Regional characteristics

i) Northern Tuguegarao

Footslopes, hills, plateaus, are highly developed. Land use along smaller rivers is predominatly agricultural.

ii) Tuguegarao neighboring area

On the right bank of the Cagayan River, there is plateau of limestone and in talus downstream some afforested lands but mainly secondary forests. On the left bank, there are extensive grassland and farmland over hills and fans.

d. Geology

From aerial photos and Landsat imagery interpretations and investigation of existing documents, a 1/200,000

geology (reconnaissance) map has been developed and further verified and supplemented by the field survey. For reasons of security and inadequate roads, the field survey was not necessarily satisfactory. The survey results are summarized below.

-Geomorphology:

Correlation between geomorphology and geology is determined not by rock types but by levels of weathering of rocks. Namely, in the hills, transformation of sedimentary rocks and igneous rocks is in progress under the strong influence of weathering, becoming clayish and brittle. On the other hand, where there is little influence of weathering, slopes are steep and cliffs comprise hard rocks like limestone.

i) The faults and lineaments as identified in aerial photos and Landsat images could not be observed in the form of outcrops but characteristic formations such as continuous cliffs and linear valleys were observed at several locations. Specifically, they include a linear valley at Banaue and continous cliffs east of Tuguegarao which are considered indicative of faulting.

ii) Most of the hills are composed of weathered sandstones, shales, or their alternations, and occasionally covered

by fluviatile deposits of gravels. Distributions of raised limestone were observed south of Aparri and in the periphery of the mountains southeast of Cauyan, to represent the geological characteristics of the region. There was a distribution of highly weathered andesitic rocks observed at Santiago and Boyombong.

iii) The mountains east of Tuguegarao are somposed mainly of sedimentary rocks including limestone, and andesitic rocks, whereas the mountains around Banaue and Bontoc are comprised by andesitic rocks recrystalized and degenerated due to volcanic activities. There were many parts of mountains denying access, so were many facies that eluded observation. The above observations were based mainly on th outcrops. At quite a few locations, other types of rocks were found among pebbles in the river bed. In the mountains west of Bontoc and northeast of Tuguegarao, landslides were observed along the faults and lineaments.

- Facies:

i) Sedimentary rocks are widely distributed over the study area.

ii) Limestones distributed in some mountain tops mostly were found in cliffs to clearly distinguish them geo-

morphologically from other sedimentary rocks. In the limestone zones, there are caves of stalactic formations of varying sizes, such as those seen west of Bontoc and east of Tuguegarao.

iii) Volcanic rocks are distributed in the hills and mountains in the western and southern parts.

iv) Granitic rocks were partly observed south of Bontoc but not beyond. No extensive distribution was confirmed.

v) Metamorphic rocks were found only in the pebbles in the river bed and not in the outcrops.

2. Vegetation, land use

a. Legend:

The criteria for land use classification of forest lands set at the time of reconnaissance map compilation proved to be appropriate after verification in the field. Five categories of classification including tree heights were applied to the reconnaissance map compilation tentatively since aerial photographs were not good enough to provide assurance about the validity of this classification system leaving it to the field survey.Since the field survey could not cover the entire area due to difficulties in access, the classfication by tree height was dropped from the classification system for Wide Area.

b. Supplementation and correction of Reconnaissance Map

Vegetation and land use classifications were based mainly on aerial photograph interpretation. But the photos used were, taken in 1979 and 1980, 6 to 7 years old so that many changes have since taken place in land use and ground cover. The greatest changes were from kaingin which is in progress in hills, footslopes and mountain woods as well as losses of forests by fires and cultivation in the logged over areas. These changes were represented in the Reconnaissance Map as they were found in the field and Landsat imagery.

Since damages done to forests and vegetation, grassland, bare land, logged-over areas, can be distinctively identified in Landsat imagery, the use of Landsat data for verification proved particularly effective for classification of vegetation and land use for Wide Area. But the scale (1/100,000) of the imagery was too small to allow distinction of such small details as farms existing amid the grassland, grassland and farms on the slopes. Therefore, grassland and kaingin were defined in terms of 1 km^2 as the smallest unit.

At the time of the Reconnaissance Map compilation,

pine forests (coniferous) were not classified but as a result of the field survey, the need for such classification was recognized particularly for the south-western highlands and it was added accordingly. The study was based on 1/100,000 survey maps (18 sheets) and the study results were incorporated in the 1/200,000 Reconnaissance Map.

3. Administrative boundaries, developement projects

Information on the administrative boundaries and development projects in the study area were supplied by the Land Classification Office (LC) under the Ministry of Natural Resources, and Region II Office.

The information was provided in the form of 1/100,000 base map on which the following were shown in terms of location and area.

- Reforestation Project
- Forest Reserve
- Experiment Station
- Protection Forest
- Integrated Social Forest
- C.T.F. Project
- Military Reservation

- Resettlement Project
- District Boundary
- Municipal Boundary
- National Road
- Proposed Road
- Cagayan Basin

4 - 5 - 3 Present Conditions of Forests and Forest Industry

(1) Logging

1. Laws and Regualtions Related to Logging

- The Forest Reform Act based on PD No. 389, 1974, to regulate exports of logs in phases over long terms.
- Revisions by PD No. 705, 1975, to abolish short term license contracts of all forms.
- Under the said law, the government required licensees to domestically process all of the locally produced logs. (No exporting of logs.) Effective 1976. But considering the industry and international trade balance situations, it was partily revised. (PD No. 865)
- The revision, while upholding the basic principle of domestic processing, allows the below-mentioned to export logs in amounts not exceeding 25% of the total allowable cut.

i) License holders possessing a processing plant with future

potential.

ii) License holders with processing projects approved by Minister.

iii) License holders acquiring processing machines or equipment to be put in operation within two years after the promulgation of the law.

iv) License holders whose log exports help or meet the terms of a government approved trade agreement.

2. Types of Timber Licenses

Table 4-4 shows types of timber licenses which differ depending of periods, types of trees, forms of land ownership.

Table 4-4. Types of Timber Licenses

No.	Type
1	Timber Licence Agreement
2	Ordinary Timber Licence
3	Hardwood Timber Licence
4	Civil Reservation Timber Licence
5	Alienable or Disposable Timber Licence
6	Softwood Timber Licence
7	Land Grant Timber Licence
8	Special Timber Licence
9	Magrove Timber Licence
10	Provisional Timber Licence
11	Private Woodland Timber Licence
12	Pulpwood Licence Agreement

Table 4-5. Timber Licenses by Region

REGION	Location	No. of Licence		Area (1,000 ha)		Annual Allowable Cut (1,000m³)	
		1982	1984	1982	1984	1982	1984
I	North Luzon	4	6	168	365	70	468
II	North East Luzon	46	33	1,631	1,236	2,577	1,693
III	Central Luzon	3	1	49	6	82	9
IV	Aurora, Metro Manila Palawan, Mindro	15	7	505	325	522	380
V	South Luzon	9	—	142	—	241	—
VI	Antique, Iloilo, Negros Occ.	4	—	114	—	290	—
VII	Bohol, Cebu, Negros Or.,	—	—	—	—	—	—
VIII	Samar Leyte	14	12	563	485	752	649
IX	West Mindanao Sulu	21	14	518	433	848	763
X	North Mindanao	37	31	1,316	1,216	2,354	2,048
X	South Mindanao	46	36	1,761	1,430	4,667	2,386
XII	Central Mindanao	18	17	772	851	1,598	1,369
Total	12	217	157	7,539	6,347	14,001	9,765

Source: Philippine Forestry Statistics

3. Present Status of Timber Licensing

As of 1984, 157 licenses were issued, of which Region II accounted for 21% or 33 licenses. The area covered by licensing is 6,347,000 ha., of which Region II accounted for 19% or 1,236,000 ha. The annual volume cut under the licensing amounted to 9,765,000 m^3, of which Region II accounted for 17% or 1,693,000 m^3. (Table 4-5)

In 1982, the number of licenses, area, and the annual volume were 217 licenses, 7,539,000 ha., and 9,765,000 m^3, respectively. Compared with 1982, they were down in 1984 by 28%, 16%, and 30% respectively, and, similarly, 28%, 24%, and 34% for Region II. The declining tendency is attributable to the depression of the timber industry due to the doldrums of world economy as well as to the decline of domestic forest resources both in qaulity and quantity.

According to Table 4 - 6 , there are 142 cases of Timber License Agreement accounting for 90%, while the number of Ordinary Timber Licenses has decreased substantially due to the abolishing of short-term licensing.

With respect to Region II, (Toble 4 - 7) Cagayan and Isabela account for 79% with 26 licenses. By type, Timber License Agreement is many in number.

Table 4-6. Timber Licenses (Region II)

License	No. of License		Area (1,000 ha)		Annual Allowable Cut (1,000m³)	
	1982	1984	1982	1984	1982	1984
Timber Licence Agreement	186	142	3,709	5,878	12,879	9,027
Ordinary Timber Licence	18	1	338	6	390	9
Pulpwood Timber Licence	7	4	426	313	542	512
Civil Reservation Timber Licence	2	1	439	323	135	100
Special Timber Licence	1	1	13	13	7	9
Mangrove Timber Licence	2	–	2	–	44	–
Softwood Timber Licence	1	2	12	18	4	18
Provisional Timber Licence	–	5	–	70	–	64
Private Land Timber Licence	–	1	–	26	–	26
Total	217	157	7,539	6,341	14,001	9,765

Source: Philippine Forestry Statistics

Table 4-7. Timber Licenses by Province (1984)

Province		Type			Total
		Timber Licence Agreement	Provisional Timber Licence	Civil Reservation Timber Licence	
Cagayan	No.	14	–	–	14
	1,000 ha	665	–	–	665
	AAC 1,000m³	942	–	–	942
Isabela	No.	12	2	–	14
	1,000 ha	389	23	–	412
	AAC 1,000m³	446	17	–	463
Kalinga Apayao	No.	1	–	–	1
	1,000 ha	10	–	–	10
	AAC 1,000m³	10	–	–	10
Nueva Vizcaya	No.	1	–	–	1
	1,000 ha	31	–	–	31
	AAC 1,000m³	18	–	–	18
Quirino	No.	2	–	1	3
	1,000 ha	95	–	23	118
	AAC 1,000m³	160	–	100	260
Total	No.	30	2	1	33
	1,000 ha	1,190	23	23	1,236
	AAC 1,000m³	1,576	17	100	1,693

Source: Philippine Forestory Statistics

4. Logging Related Work

Selective cutting is standard for Dipterocarpaceae type forests. Clear cutting is permitted for fast growing tree type forests. In selective cutting, mature, overmatured, and defective trees are cut leaving healthy succeeding trees in appropriate numbers so as to protect forests with all its functions such as preservation of water resources, soils, and other resources.

The work procedure of selective cutting consits of three phases, i.e., tree marking, residual inventory, and timber stand improvement.

Tree marking distinguishes trees to be cut from those to remain. The criterion for selection is the diameter of 60cm. Trees of more than 60cm in diameter are for cutting and those of less than 60 cm are preserved. After cutting, residual inventory is taken to ensure healthy growth of succeeding trees.

Timber stand improvement is a step in which to remove cumbersome vegetation. It involves weeding, vines cutting, girdling. Proper rotation of Dipterocarpaceae cutting is 30 to

45 years, depending on the local climate. Type I - 45 years, for areas with dry and wet seasons. Type II - 35 years, for areas with no dry season having maximal rainfall during November - January. Type III - 40 years, for areas with little distinction of dry and wet seasons but relative dry months from November to April. Type IV - 30 years, for areas with rainfall evenly occurring throughout a year.

For pine forests, the clear cutting seed-tree protection regeneration system is applied. Cutting rotation is set as 50 years for now. The annual allowable cut is determined by the following formulas.

For Dipterocarpaceae:

$$C = A\frac{(v_0 + v_r)}{2\ cc}\ f$$

where:

A : Area, ha.

v_0: Average volume of stand (m^3) per ha. of total of:
25% of 60cm
55% of 70cm in diameter at breast height
100% of 80cm

v_r: Average volume of stand (m^3) per ha. of the total as above in v_0, at the final year of rotation.

f : Modified coefficient (70% standard)

cc : Years of rotation

For pines:

$$C = \left\{ \frac{V_0 - (V_w + V_s)}{R} \right\} f$$

$$A_c = \frac{A}{R} \text{ (for adustment)}$$

Where:

V_0 : Total volume of stand, 20cm + at breast height

V_w : Volume of trees to be left for watershed protection

V_s : Volume of seed trees

A_c : Annual cut area, ha.

R : Cutting rotation

5 Cutting and Logging

Tree cutting requires that:

- safety is ensured,
- trees are protected from possible damages during cutting operation and remaining trees not to be hurt,
- sequence of work and direction of felling are set in advance to facilitate operation,
- efforts are made to enhance productivity.

The operational sequence involves, determination of cutting areas, cable line routing, volume survey, cutting sections assignment, yield.

Cutting areas are determined considering collection by tree type and distance of transport. It is shown schematically in Figures 4-4 and 4-5.

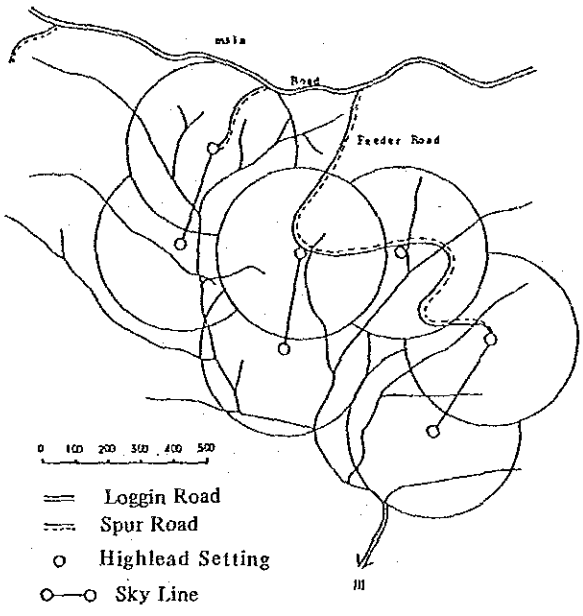


Figure 4-4.
Logging Area by Yarder

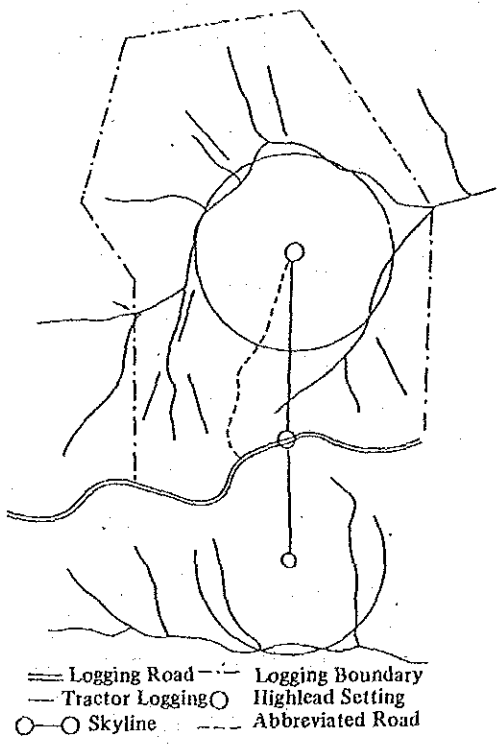


Figure 4-5.
Logging Area by Tractor

Cable routing is determined considering natural conditions and paying attention so that trees to remain will not be hurt by main cables in High Lead Method.

In inventory taking of trees to be felled is a necessary step for estimating volumes for timber transportation. First, trees to be felled and those to be used as supports for logging cables are marked and given serial numbers. Then the felling direction is market so as to reduce possible damage to trees and to facilitate bucking and long collection. Inventory is taken after the felling.

Cutting sections are determined so as to ensure the safety of works. With one team of workers for one section, the teams should be removed from each other by a distance equivalent to two or three times of the height of trees. It is designed also to ensure that every intended tree is cut.

When a tractor is in use for collection, the work should start from the furthest point to avoid felled tree crowns getting in the way.

6 Hauling

Short distance hauling or transportation of logs can be done using either manpower, animals, light machines, or heavy machines, Manpower and animals may not be as efficient as other means but considering that costly mechanization does not pay off in forest development, these primitive means should not be ruled out immediately. Systems using light machines include the small power winch method and the Padang logging method.

The small power winch method is effective when there is no readiness yet to introduce heavy machines; when the inventory is not much in volume or scattered; when there is the need to train workers in mechanization. But this is not powerful enough to allow maneuvering in log hauling and, since it works on roller principles, subject to topographical constraints and not efficient in the environment fraught with hazards. (Figure 4-6)

The Padang logging method uses a fixed truck with a winch mounted aboard with which loading, transporting, and unloading are performed. It has a drawback of being limited in area it can cover. And it would become necessary to build

an additional access road to take the vehicle far inside the forest. Therefore, it is not good for work during the rainy season and forest with small inventory. (Figure 4-7)

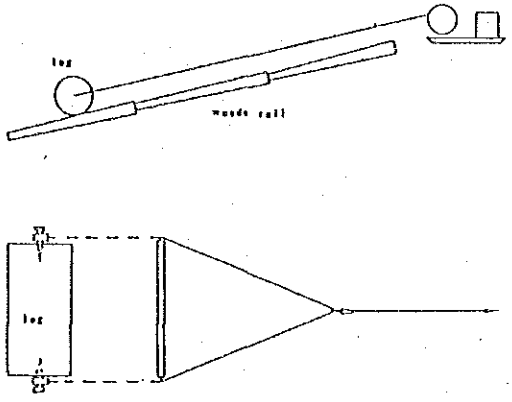


Figure 4-6.
Yarding by Small-Sized Winch

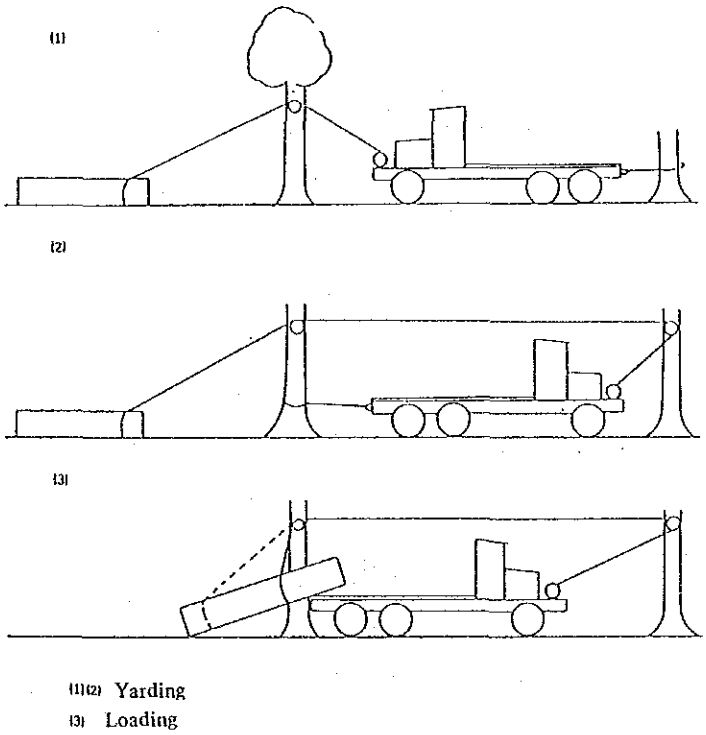


Figure 4-7.
Padang Logging

The heavy systems involve, typically, the hauling machine and the tractor. They are compared in Table 4-8.

Table 4-8. Comparison of Yarder and Tractor

◎: more advantage ○: advantage △: disadvantage ×: less disadvantage

Comparison Items	Yarder	Tractor
Investment cost	○	△
Running cost price per hour	○	×
Logging radius	△	○
Mobility	×	◎
Flexibility	×	◎
Operational difficulty	○	×
Technical hardness	×	○
Hindrance rate	○	×
Maintenance cost	○	×
Log freshen	×	○
Hanging down work	×	○
Hanging up work	◎	×
Topographic restraint	○	△
Open or scattered forest	×	○
Rest or regeneration tree damage	×	○
Operater training hardness	△	○
Climetical influence	△	×

The method using hauling machines is represented by the high lead method which is typically applied for heavy log hauling. The method is widely in use in the Philippines because of the high rate of inventory per hectare.

As can be seen from Table 4 - 8 , the hauling machine is effective even in rugged mountains, rocky terrains, and areas inaccessible by tractors during the rainy season, as long as there is enough volume in inventory and skilled labor is available.

The high lead method is operational in the 250m - 300m radius whereas the tractor has an operational radius of 300m - 400m. Since tropical timbers are large in size, the number of logs to be handled at one time is limited to one or two, thus allowing pre-yarding and hauling to be done in one continuous process. But in areas with difficult terrains, it is necessary to divide the work and apply an arch method.

7 Long/Medium Distance Timber Transport

For medium range transport, the skyline method is most effective. It involves hauling logs at one place and carrying them to the access road.

This method is less subject to damaging effect of rainfall than surface transportation. Rainfall is an important factor to be considered when the use of vehicles is involved. Therefore, the use of a tugging vehicle equipped with low pressure tires on the side is in order. There are other methods including a skidway.

For the long distance, a major concern is how to build a cost-effective access road under difficult conditions. Logs can be transported by waterway, by rail, and by truck. Trucking among others is promising as a means of transportation though it takes extra attention during the rainy season. Water-borne transportation requires an access road to the river and takes a long time to get to the market place. Also a raft needs to be fitted with buoys to prevent deadhead.

Rail transportation is advantageous in that it is not affected by rainfall. High construction cost and gradient factor (normally 2%) are constraints. Trucking is more commonly in use since the gradient factor (normally 6% - 8%) is not much of a constraint and it is easy to operate. Trucking, however, is vulnerable to rainfall. It denpends on which type of road it accesses. It is important to have a sturdy access road built at a reasonable cost for trucking to be effective.

(2) Status of Logged Over Areas

1. Present Conditions

The logs being cut are mostly 60 - 120 cm in diameter as far as they are observed in the yards of timber mills and as they are being delivered out in trucks, and few are smaller in diameter. Viewing from a distance of selectively cut forests gives an impression that succeeding trees have been left in adequate numbers, but at a closer look, there are many defective trees and the number of succeeding trees is not adequate to indicate selective cutting is not being performed properly enough. Technical side of this problem can be expected to be resolved by appropriate guidance and training in the future. But a larger concern is kaingin which follows in the wake of selective cutting destroying what have been left. The area burned down by kaingineros at one time or another is not much per family but as the number of families increase, it adds up significantly. Furthermore, as productivity of land declines, they desert the land and move in search of another forest ground for food. It takes place in a set pattern and regularly i.e., an average of every two years, as is said.

What happens to the land left behind is, by the time grass and tree shoots start growing, it is burned down again for cultivation and land productivity drawn down, and finally deserted. The land ends up being underdeveloped grassland and no more.

2. Post-felling Work

Afforestation in the Philippines dates back to around 1910. It is under way, though on a small scale, in bare lands and poor quality forests. It appears that in the background of this effort is a move to convert grassland to forest land. But the results are not satisfactory enough with many planted trees failing to grow properly. This is attributable to such factors as deteriorating land productivity and loss of forest land due to kaingin, and employment related elements. It is even seen that in the nursing process, trees are burned simply to create jobs for replanting.

As far as post-felling work is concerned, steady efforts, if not enough, are being made for selective cutting with respect to Dipterocarp forests. But the efforts are hampered by a number of pre-felling problems.

As revealed in Landsat images, the forest lands after selective cutting, with logging roads built and all that, are turning into grassland. Forests in lowlands, hills, and footslopes, are disappearing and receding into the deep of mountains or on steep slopes.

There are many government posters on displaywarning against serious consequences of such practices, and reminding the importance of forest resouces. But despite these efforts, it is :regretable enough to see no single day pass without witnessing fire in the mountains.

(3) Timber Related Industries

1 Volumes of Timber Production and Exports

In 1984, timber production amounted to appoximately 3.87 million m^3, of which some 20% was exported, the rest made into lumber, veneer sheet, plywood, domestically. In Region II, the prodcution accounts for about 20% or 750,000 m^3, of which 14% is exported and this is below the national average. In other words, the region has more of its production for domestic consumption. This is because the region has easier access to Manila by way of the Japan Philippine Friendship Road. Three Provinces of Cagayan, Isabela, and Kalinga-Apayao

produce 90% of the total output of Region II.

Compared with 1981, production volumes declined by 30% for nationwide and 32% for Region II but exports increased 20% and 40% respectively. The trend is conspicuous in Region II where the share of exports in the total production doubled. This reflects the easing of the ban on timber exports due to increased unemployment and deteriorating foreign exchange situation. The ban originally was instituted in May 1982 from the standpoint of forest resources protection and environmental conservation but lifted in July of the same year.

Table 4-9. Log Production and Exports

Province	Production		Exports		Exports/Production	
	1981年	1984	1981	1984	1981	1984
	㎥	㎥	㎥	㎥	%	%
Cagayan	–	235,797	–	–	–	–
Isabela	–	258,447	–	–	–	–
Kalinga-Apayao	–	177,082	–	–	–	–
Nueva Vizcaya	–	32,613	–	–	–	–
Quirino	–	44,288	–	–	–	–
(1) Region II	1,100,535	748,227	73,798	107,215	6.7	14.3
(2) Philippines	5,399,523	3,872,570	706,399	846,022	13.1	21.8
(1) / (2) (%)	20.4	19.3	10.4	12.7		

Source: 1981, 1984 Philippine Forestry Statistics

2 Lumber, Veneer Sheet, Plywood: Production Volumes and Exports

In 1984, production volumes of lumber, veneer sheet, and plywood were 1.234 million m^3, 84,000 m^3, and 438,000 m^3, respectively, of which Region II accounted for 275,000 m^3, (22% of the national total), 8,000 m^3 (similarly 9%), and 29,000 m^3 (7%) respectively. The shares of exports in production volumes were 44% for lumber, 85% for veneer sheet, and 57% for plywood, of which Region II accounted for 34%, 40%, and 46% respectively, showing higher ratios of domestic consumption as seen in timber.

Compared with 1981, volumes in all the categories decreased in both production and export. For production, veneer sheet sharply declined by 85% in the national total and by 84% in Region II. It is also noted that lumber and plywood productions dropped by 26% and 42% respectively in Region II while they were levelling off nationwide. As for exports, while there was little change in lumber both nationally and in Region II, veneer sheet and plywood decreased by 48% and 33% respectively nationwide and by 35% and 40% respectively in Region II.

Table 4-10. Lumber, Veneer, Plywood Production and Export

Province		Production			Exports			Export % in Production		
		Lumber	Veneer	Plywood	Lumber	Veneer	Plywood	Lumber	Veneer	Plywood
		㎥	㎥	㎥	㎥	%	%	%	%	%
Cagayan	1981	107,610	–	–	–	–	–	–	–	–
	1984	99,237	–	–	–	–	–	–	–	–
Isabela	1981	172,490	–	–	–	–	–	–	–	–
	1984	107,243	–	–	–	–	–	–	–	–
Kalinga-Apayao	1981	0	–	–	–	–	–	–	–	–
	1984	2,813	–	–	–	–	–	–	–	–
Nueve Vizcaya	1981	39,529	–	–	–	–	–	–	–	–
	1984	55,671	–	–	–	–	–	–	–	–
Quirino	1981	50,073	–	–	–	–	–	–	–	–
	1984	9,586	–	–	–	–	–	–	–	–
(1) Region II Total	1981	369,702	51,859	49,737	90,710	5,154	22,344	24.5	9.9	10.4
	1984	274,550	8,239	28,985	93,210	3,327	13,457	34.0	40.4	46.4
(2) Philippines	1981	1,218,906	552,771	457,037	546,530	138,303	370,496	45.0	25.0	81.1
	1984	1,234,086	83,607	438,052	539,840	71,370	249,874	44.0	85.0	57.0
(1) / (2) (%)	1981	30.3	9.4	10.9	16.6	3.7	6.0			
	1984	22.2	9.9	6.6	17.3	4.7	5.4			

Source: 1981, 1984 Philipine Forestry Statistics

3 Saw Mills

As of 1984, there were 189 saw mills in total, of which Region II accounted for 26% or 50 mills. They had a daily production capacity and daily required timber volume of 10,014 m^3 and 4,300,265 m^3 respectively, of which Region II accounted for 2,299 m^3 (23%) and 741,986 m^3 (17.2%) respectively. Compared with the ratio of the number of miles, the capacity and the timber volume were not as much, and the per mill production capacity is 46 m^3 which compares with the national average of 53 m^3. In other words, the individual mills in Region II are smaller in scope.

Assuming these mills operate 250 days yearly, the annual production capacity amounts to 2,503,500 m^3 nationally and 574,450 m^3 in Region II. Since production volumes, as mentioned earlier, were 1,234,086 m^3 nationally and 274,550 m^3 in Region II, the mills were operating at roughly half of their capacity, i.e., 49% nationally and 48% in Region II.

In terms of timber licenses, there are more mills with a license nationwide than those without but in Region II, the licensed and the unlicensed are equal in number. Those with a timber license are generally higher both in daily produc-

tion and required timber volume, nationally as well as in Region II. It can be seen, therefore, that mills are larger in scope because of stable timber supply.

Compared with 1981, the number of mills increased by 7 in total nationwide, 5 of which were in Region II. In terms of timber licenses, licensed mills decreased while the unlicensed increased. Therefore, there was little change in the per mill production capacity, both nationally and in Region II.

In 1974/75, there was a record number of 408 saw mills nationwide reaching 180,000 m^3 in daily production capacity but in 1984, as seen before, the number of mills declined to 46% of the peak years and production capacity to 55%. One reason is the government's policy for rationalization*, by which less cost-effective circular saw mills were phased out in favor of larger more productive mills.

*Bureau of National Economy and Development, Office of Director, "Rationalization of Timber Industry", Development of the Philippines, No. 1, IV, No. 21, 31, March 1977

Shut-down lumber mills:

Phased out were circular saw mills, band saw mills with daily production capacity of less than 10,000 board feet,

and those without a licensed area and dependent on timber, square timber and flitch for material supply. On the contrary, mills operating in excess of their capacity are required to produce 8 million m^3 in total. New mills can be set up where raw material supply is assured and economic conditions are favorable.

Table 4-11. Sawmills Daily Rated Capacity Annual Log Requirement

州 名		Total (①+②)			① With timber concession			② Without timber concession		
		Number	Daily rated capacity	Annual log requirement	Number	Daily rated capacity	Annual log requirement	Number	Daily rated capacity	Annual log requirement
			㎥	㎥		㎥	㎥		㎥	㎥
Cagayan	1981	10	585	212,124	10	585	212,124	–	–	–
	1984	13	733	264,087	7	448	168,903	6	285	95,184
Isabela	1981	22	917	252,027	11	448	129,077	11	469	122,950
	1984	21	849	256,401	12	495	151,985	9	354	104,416
Kalinga-Apayao	1981	–	–	–	–	–	–	–	–	–
	1984	1	71	28,302	1	71	28,302	–	–	–
Nueve Vizcaya	1981	8	346	99,852	2	113	32,602	6	233	67,250
	1984	10	434	131,771	2	94	27,177	8	340	104,594
Quirino	1981	5	212	61,125	2	85	24,450	3	127	36,675
	1984	5	212	61,125	3	127	36,675	2	85	24,450
(1) Region II	1981	45	2,060	625,128	25	1,231	398,253	20	829	226,875
	1984	50	2,299	741,686	25	1,235	413,042	25	1,064	328,644
(2) Philippines	1981	182	9,795	4,267,261	111	6,509	3,009,970	71	3,286	1,257,291
	1984	189	10,014	4,300,265	88	5,102	2,345,951	101	4,912	1,964,314
(1) / (2) (%)	1981	24.7	21.0	14.6	22.5	18.9	13.2	28.2	25.2	18.0
	1984	26.5	23.0	17.2	28.4	24.2	17.6	24.8	21.7	16.8

Source: 1981, 1984 Philippine Forestry Statistics

4 Veneer Sheet and Plywood Mills

As for single boards, there were only 6 mills nationwide in 1984, one of which was in Region II. The one in Region II had a daily capacity of 38 m^3 which compares with the national average of 47 m^3. In terms of annual rate of operation, the mill operates at 87% which compares with the nationwide rate of 120%. Compared with 1981, the number of mills sharply decreased from 23 to 6 nationally, and, in Region II, the number declined from 3 to 1 with daily production capacity reduced to one sixth.

As for plywood, there were 38 mills nationwide in 1984 and 4 of them or 11% were in Region II. The daily production capacity was 5,887 m^3 nationally and 489 m^3 or 8% in Region II. The per mill capacity was 122 m^3 which was below the national average of 155 m^3. The rate of operation was 24% for Region II as against the national average of 30%. Compared with 1981, the number of mills increased from 33 to 38, whereas there was no change in that respect in Region II.

Table 4-12. Veneer and Plywood Plant by Region

REGION		Veneer Plant			Plywood Plant		
		Number	Daily rated capacity	Annual log requirement	Number	Daily rated capacity	Annual log requirement
(1)			m^3	m^3		m^3	m^3
II	1981	3	126	60,366	4	489	284,366
	1984	1	38	39,840	4	489	278,574
IV	1981	1	28	13,231	5	447	260,011
	1984	—	—	—	5	440	251,197
VII	1981	2	61	35,459	1	57	32,930
	1984	—	—	—	—	—	—
IX	1981	—	—	—	4	425	296,371
	1984	—	—	—	4	424	241,920
X	1981	7	507	292,880	8	1,286	897,454
	1984	1	48	50,298	11	1,531	864,442
XI	1981	6	506	292,152	8	1,625	1,134,196
	1984	2	94	99,600	10	2,005	1,112,754
XII	1981	4	428	247,150	3	954	665,254
	1984	2	100	105,908	4	998	556,532
(2)							
Philippines	1981	23	1,656	941,238	33	5,283	3,570,582
	1984	6	280	295,646	38	5,887	3,305,419

Source: 1981, 1984 Philippine Forestry Statistics

5 Timber Procurement

One major reason for the low rates of operation in the wood processing industry (lumber, veneer sheet, plywood) as seen before, i.e., 49% in lumber (48% in Region II), and 30% in plywood (24% in Region II), not to mention single board mills which are small in number, is unstable timber supply.

These three sectors of the wood processing industry combinedly required 7,901,330 m^3 of timber annually in 1984, of which Region II accounted for 13% or 1,060,100 m^3. From Table 4-5 the annual allowable cut volumes are 9,765,000 m^3 nationally and 1,693,000 m^3 for Region II. If the whole of these amounts were produced and made available exclusively for domestic use, they would be enough to meet that requirement. But actually, as shown in Table 4-9, only 40% of the annually allowed volume of timber, i.e., 3,872,570 m^3 nationwide and 44% or 748,227 m^3 for Region II, were produced. Furthermore, some of the timber are exported. All of these combine to make timber procurement difficult for the wood processing industry.

In 1984, 38% of the industry's (three sectors combinedly) timber requirement nationally and 60% for Region II, were met by domestic production minus exports. One can note the high rate for Region II.

6 Other Sectors of Wood Processing Industry

Statistics for block boards, particle boards, fiber boards, are given in Table 4 - 13 . As of 1984, there were 2 block board mills (21 nationwide) and 1 particle board mill (3 nationwide) in Region II. Compared with 1981, there was a remarkable increase in the number of block board mills, i.e., from 5 to 21 nationwide and 1 to 2 in Region II.

Table 4-13. Block, Particle, Fiber Board Plant by Region

REGION	Block Board		Particle Board		Fiber Board	
	Number	Daily rated capacity	Number	Daily rated capacity	Number	Daily rated capacity
		㎥		㎥		㎥
I	—	—	—	—	—	—
II	2 (1)	33	1	126	—	—
III	1	17	1	62	—	—
IV	2	53	1 (1)	78	—	—
V	—	—	—	—	—	—
VI	—	—	—	—	—	—
VII	—	—	—	—	—	—
VIII	—	—	—	—	—	—
IX	2 (1)	26	— (1)	—	—	—
X	4 (1)	58	—	—	— (1)	—
XI	8 (1)	184	—	—	1 (1)	230
XII	2 (1)	61	—	—	—	—
Total	21 (5)	432	3 (2)	260	1 (2)	230

( ) Number of mills in 1981.

In 1984, there were 5 integrated pulp & paper mills nationwide. Of non-integrated mills, 4 are pulp mills and 19 paper mills. Compared with 1981, there is no change in the number of integrated mills. Among non-integrated mills, there was no change in the number of pulp mills but paper mills increased from 16 to 19.

7 Forestry Products

1984 volumes of forestry products are given in Table 4-16. The table shows that in Region II, Almaciga Resin, Nipa Sap, Nipa Shingles, Split Rattan, are produced in volumes that accounted for 6%, 100%, 16%, and 16%, respectively of the national totals. Table 4-17 shows volumes for 1981. In Region II, Bamboo and Boho, Nipa Shingles, Unsplit Rattan, Nipa Sap, were produced accounting for 0.7%, 8.2%, 0.5%, and 100%, respectively of the national totals.

Comparisons with 1984 show that there was no production of Almaciga Resin in 1981 and its production started in 1984, whereas Bamboo and Boho were produced in 1981 but not in 1984. Among other products that were produced in both years, nipa sap decreased to one fourth, nipa shingles slightly increased, and rattans changed from unsplit to split rattans.

Table 4-14. Pulp and Paper Mills (1984) (Capacity in metric tons)

Name of Plant	Pulp Type	Rated Capacity	
		Pulp	Paper & Paperboard
		303,400	550,195
Integrated Pulp and Paper		223,875	261,615
1. Bataan Pulp and Paper Mills	Hardwood	29,325	25,875
2. Central Asucarera de Bais	Bagasse	8,980	13,175
3. Menzi Development Corporation	Abaca/Kenaf	2,740	7,300
4. Paper Industries Corporation of the Philippines	Abaca/Kenaf & Hardwood	166,630	184,335
5. United Pulp and Paper Co., Inc.	Bagasse	16,200	30,930
Non-Integrated Mills			
A. Pulp Mills		79,525	-
1. Albay Agro-Industrial Dev. Corp.	Abaca/Kenaf	1,090	-
2. Canlubang Pulp Mfg. Corp.	Abaca/Kenaf	7,485	-
3. Cellophil Resources Corp.	Softwood	66,000	-
4. Isarog Pulp & Paper Co., Inc.	Abaca/Kenaf	4,950	-
B. Paper Mills			288,580
1. Aclem Paper Mills, Inc.			16,500
2. Asgard Corrugated Box Mfg. Corp.			9,900
3. Container Corp. of the Philippines			13,960
4. Eastern Paper Mills, Inc.			18,000
5. Globe Paper Mills			8,980
6. Kimberly-Clark Phil., Inc.			15,000
7. Liberty Paper Mills, Inc.			4,490
8. Manila Paper Mills, Inc.			72,600
9. Manila Press, Inc.			4,490
10. Massion Paper Mills			6,600
11. Paperland, Inc.			10,000
12. Paragon Paper Ind., Inc.			24,750
13. People's Paper Mill, Inc.			6,000
14. Philippine Paper Mills, Inc.			11,970
15. Premiers Paper Corp.			3,960
16. Scott Paper Corp.			27,390
17. Utility Enterprises Corp.			13,200
18. Vanson Paper Industries Corp.			6,600
19. Worldwide Paper Mills, Inc.			14,190

Source: PULPAPEL

Table 4-15. Pulp and Paper Mills (1981)

Type/Name of Firms	Annual Rated Capacity (MT)		
	Pulp	Paper	Paperboard
TOTAL	303,397	427,840	67,315
I. INTEGRATED PULP & PAPER MILLS	223,873	258,620	2,995
1. Bataan Pulp and Paper Mills	29,325	25,875	—
2. Central Azucarera de Bais	8,980	10,180	2,995
3. Menzi Dev. Corp.	2,738	7,300	—
4. PICOP — Bislig	139,690	157,395	—
5. PICOP — Iligan	26,940	26,940	—
6. United Pulp and Paper Co., Inc.	16,200	30,930	—
II. NON-INTEGRATED MILLS	79,524	169,220	64,320
A. Pulp Mills	79,524		
1. Canlubang Mfg. Corp.	7,485	—	—
2. Isarog Pulp and Paper Co.	4,950	—	—
3. Albay Agro. Industrial Dev. Corp.	1,089	—	—
4. Cellophil Resources Corp.	66,000	—	—
B. Paper Mills		169,220	64,320
1. Aciem Paper Mills	—	16,500	—
2. Arco Pulp and Paper Co., Inc.		4,950	—
3. Container Corp. of the Phil.	—	—	13,960
4. Durano Craft Paper Mill	—	13,200	—
5. Eastern Paper Mills, Inc.	—	18,150	—
6. Globe Paper Mills	—	8,980	—
7. Kimberly-Clark Philippines, Inc.	—	6,600	—
8. Liberty Paper Mills	—	4,490	—
9. Manila Paper Phils, Inc.	—	49,600	23,000
10. Paperland Incorporated	—	10,000	—
11. Philippine Paper Mills, Inc.	—	—	11,970
12. Premier Paper Corporation	—	3,960	—
13. Scott Paper Philippines, Inc.	—	27,390	—
14. Vanson Paper Industrial Corp.	—	—	6,600
15. Worldwide Paper Mills, Inc. Baler	—	—	4,190
16. Worldwide Paper Mills, Inc. Sucat	—	5,400	4,600

Source: PULPAPEL

Table 4-16. Non-Timber Forest Product (1984)

Region	Almaciga Resin (Kilo)	Anahaw Leaves (Piece)	Bamboo & Boho (Piece)	Buri (Kilo)	Hingiw (Kilo)	Nipa Sap (Liter)	Nipa Shingles (Piece)
Philippines	191,288	6,280	308,568	154,561	8,926	500	1,756.841
1	-	-	78,709	-	-	-	103,000
2	11,000	-	-	-	-	500	273,500
3	5,650	-	114,145	-	-	-	-
4	174,638	6,280	20,309	98,997	200	-	71,800
5	-	-	-	-	-	-	329,500
6	-	-	240	23,069	-	-	2,091
7	-	-	2,923	26,183	8,026	-	464,600
8	-	-	-	-	-	-	-
9	-	-	-	-	-	-	35,000
10	-	-	28	6,312	700	-	324,350
11	-	-	92,214	-	-	-	153,000
12	-	-	-	-	-	-	-

Region	Nito (Kilo)	Orchid/ Fern (Piece)	Split Rattan (Kilo)	Unsplit Rattan (LM)	Salago Bark (Kilo)	Tanbark (Kilo)	Vines (Kilo)
Philippines	12,205	130	2,769,991	25,369,952	143.735	98,326	6,335
1	-	-	91,415	-	-	-	-
2	-	-	445,486	-	-	-	-
3	-	-	-	-	-	-	-
4	-	130	4,131	1,388,877	-	1,326	6,335
5	-	-	-	142,797	-	-	-
6	3,350	-	-	3,000	900	-	-
7	2,855	-	700	317,803	142,835	97,000	-
8	-	-	2,205,365	-	-	-	-
9	-	-	-	1,579	-	-	-
10	6,000	-	19,894	14,713,942	-	-	-
11	-	-	3,000	8,801,954	-	-	-
12	-	-	-	-	-	-	-

Source : Philippine Forestry Statistics

Table 4-17. Non-Timber Forest Products Harvested (1981)

Region	Almaciga Resin (Kilo)	Anahaw Leaves (Piece)	Bakawan (Cu. M.)	Bamban	Bamboo & Boho (Piece)	Bikal (Piece)	Buri (Kilo)	Hingiw (Kilo)	Honey (Kilo)	Husked Lumbang (Kilo)
Philippines	467,385	39,600	17	17,543	885,212	9,000	307,579	2,055	681	14,242
1	2,500	—	—	—	156,425	9,000	—	—	—	—
2	—		—	—	7,000	—	—	—	—	—
3	—	—	—	—	10,000		—	—	—	—
4	459,408	—	17	—	240,400	—	44,384	—	681	—
5	—	39,600		—	—	—	—	—	—	—
6	—	—	—	17,543	—	—	—	180	—	180
7	—	—	—	—	30,902	—	252,167	1,875	—	—
8	—	—	—	—	—	—	—	—	—	—
9	—	—	—	—	—	—	—	—	—	—
10	5,477	—	—	—	10,800	—	11,028	—	—	—
11	—	—	—	—	357,775	—	—	—	—	14,062
12	—		—	—	71,910	—	—	—	—	—

Region	Ligtang (Piece)	Nipa Shingle (Piece)	Nito (Kilo)	Salago Bark (Kilo)	Orchids/ Ferns (Piece)	Unsplit Rattan (L. Meter)	Split Rattan (Kilo)	Tanbark (Kilo)	Vines (Kilo)	Nipa Sap ((Liter)
Philippines	4,000	2,977,770	25,019	673,510	180/300	33,510,915	1,177,089	859,000	6,040	2,000
1	4,000	60,000	12,200	—	—	25,000	—	—	—	—
2	—	244,700	—	—	—	163,915	—	—	—	2,000
3	—	—	—	—	—	146,300	—	—	—	—
4	—	81,100	—	—	—	435,388	5,648	5,000	—	—
5	—	312,040	—	—	—	543,778	7,604	—	6,040	—
6	—	434,400	—	—	—	1,550	1,330	—	—	—
7	—	1,295,880	12,129	673,510	35/300	14,445,896	238,907	844,000	—	—
8	—	35,250	—	—	—	3,998,815	—	—	—	—
9	—	—	—	—	—	606,580	600	10,000	—	—
10	—	176,000	—	—	145/	7,065,117	923,000	—	—	—
11	—	126,400	690	—	—	5,682,585	—		—	—
12	—	212,000		—	—	395,991	—	—	—	—

Source: Philippine Forestry Statistics

(4) Forest Reserve, National Park, Bird Sanctuary, Game Refuge, Wilderness Area, Watershed Forest Area

1. Overview

Forest lands in the Cagayan Basin are classified as follows by the Region II Office which has the jurisdiction over the area.

Table 4-18. Forest Land Classification (Region II)

Province	Esta-blished For. Res.	Esta-blished Timberland	National Parks GRBS/WA	Millitary & Naval Reserv'n	Civil Reserv'n	Fish-ponds
合　計	1,094,108	1,042,176	115,490	412	54,097	61
Batanes	—	13,954	—	—	—	—
Cagayan	35,806	502,703	192	—	—	61
Ifugao	163,053	1,458	42	—	—	—
Isabela	67,713	395,393	115,256	412	—	—
Kalinga-Apayao	476,826	99,898	—	—	—	—
Nueva Vizcaya	116,934	28,770	—	—	54,097	—
Quirino	233,776	—	—	—	—	—

Source: Philippines Forest Statistics - 1984.

According to the table, restricted forests, namely those other than Established Timberland, amount to 1,264,168 ha. in total accounting for 35% of total land area of Region II (3,640,000 ha.) and 52% of total forest land (2,453,420 ha.). Most of such restricted forest lands are Established Forest Reserves. They are mostly low grade secondary forests with past records of felling. Forestry activities are totally banned in these forests. But actually residents continue to fell trees for their immediate needs and use other resources of the forest.

According to Region II Office documents, the following blocks are listed for Forest Reserves.

- Taggut F.R.
- Ballesteros F.R.
- Lallo F.R.
- Magapit F.R.
- Nasping F.R.
- Nammambalan F.R.
- Callao F.R.
- Divilican F.R.
- Centran Cornner F.R.
- Chico River F.R.
- Natonin-Tanudan F.R.

- Natonin F.R.
- Central Mayoyao F.R.
- Ifugao-Isabel F.R.
- Mt. Sto Domingo
- Singkion F.R.
- Sundon Catalangon F.R.

Of these blocks, those concerned with the study area are noted in the attached figure 4-5.

2. National Park

Areas designated as National Park in the study area are as follows. They are included in the Forest Reserves.

Balabalasang-Balbala National Park (Kalinga-Apayao)
... 1,338 ha.

Calloo Cave National Park (Penablanca, Cagayan)
... 192 ha.

Fuyat Spring National Park (Isabela, Ilagan)
... 819 ha.

Total: 2,349 ha.

3. Bird Sanctuary, Game Refuge

Mangapit Island (Lao and Cattaran, Cagayan) with an area of 7,577 ha. is designated as such. Hunting is restricted within one kilometer of all national parks, watershed forest reserves, botanical gardens, parks, public schools, public athletic fields, national test stations, reserved forests, timber stock yards, public buildings, public nurseries, public farms, graveyards, government dormitories, etc.

4. Wilderness Area

There are Isabela Wilderness Area Part I (8,812 ha.) and Part II (10,562 ha.) totalling 19,374 ha. as such. But they are all outside of the study area.

5. Watershed Forest Reserve

As such there are:

- Abutung Watershed Forest Reserve
- Chico Watershed Forest Reserve
- Upper Magat Watershed Forest Reserve
- Upper Cagayan Watershed Forest Reserve

At Dupax, Nueva-Vizcaya, there is a 425 ha. project forest reserve. Afforestation is presently under way at the following.

- Ambuklao Watershed Forest Reserve (Mountain Prov.) ... 73,380 ha.
- Talavera Watershed Forest Reserve (Nueva Viscaya) ... 32,295 ha.

Total: 105,675 ha.

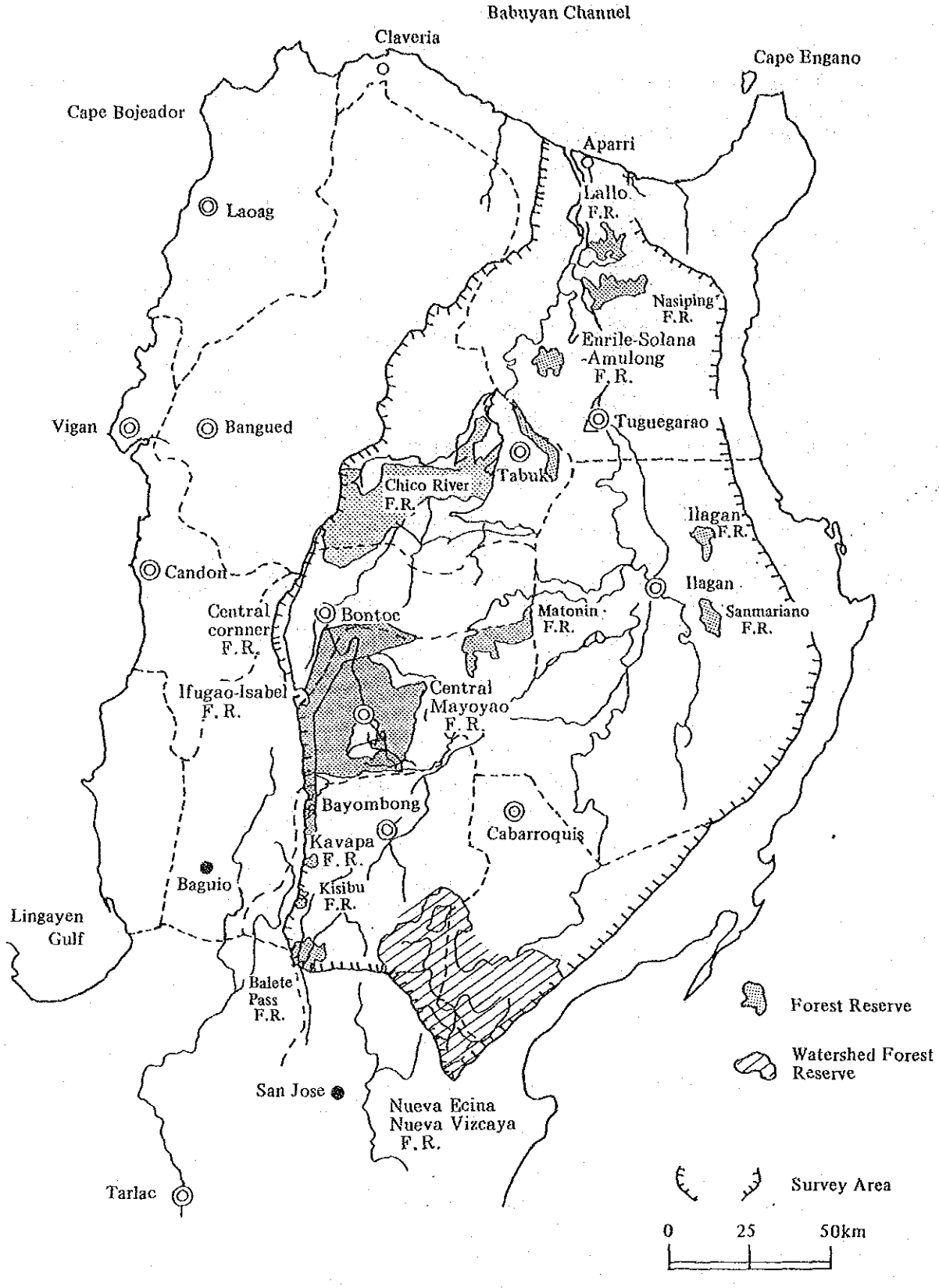


Figure 4-5. Forest Reserve Location