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

JUNE 1988

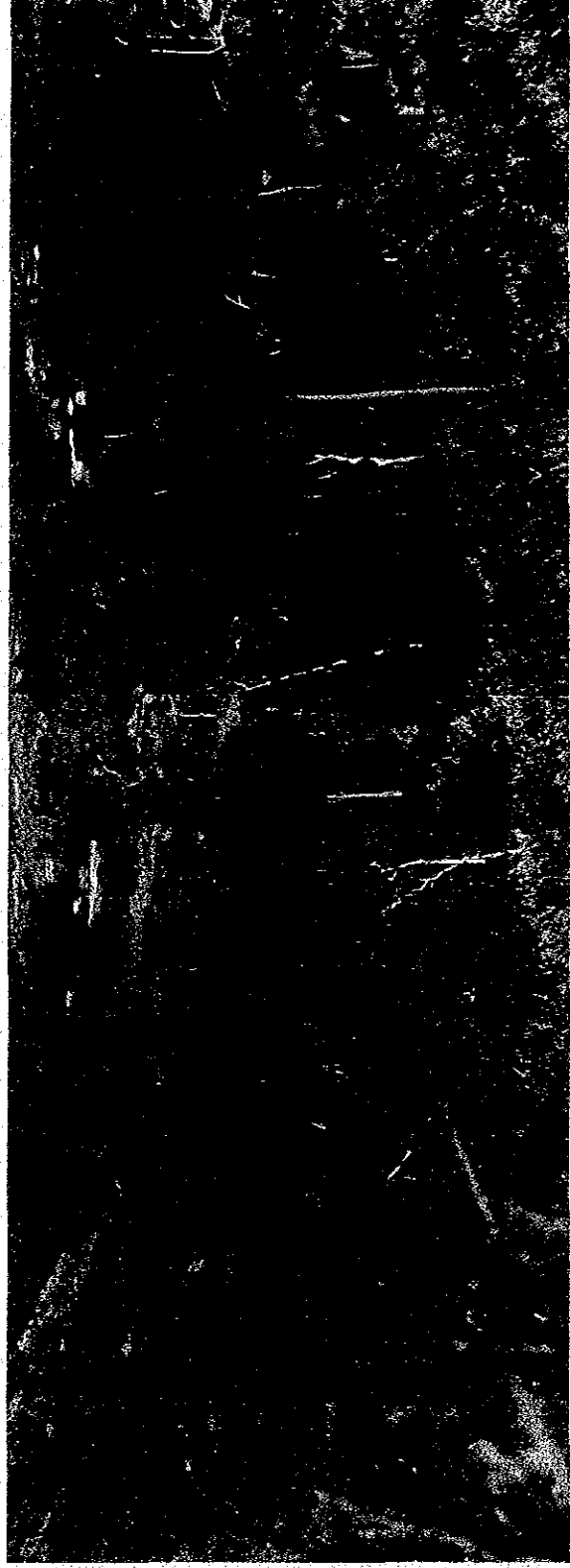
JAPAN INTERNATIONAL COOPERATION AGENCY  
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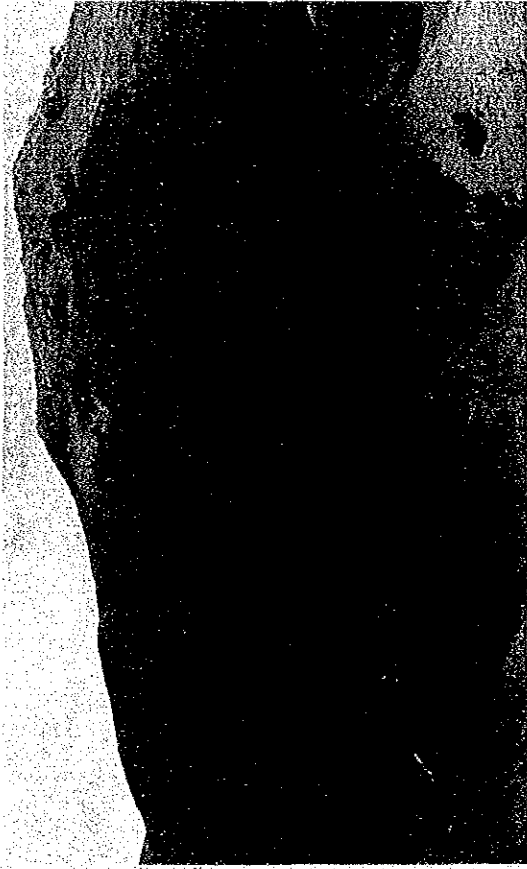
Sight of felled sites after burning in the background . Repeated burning leads to denuded forests.



Typical landuse in relatively new settlement.







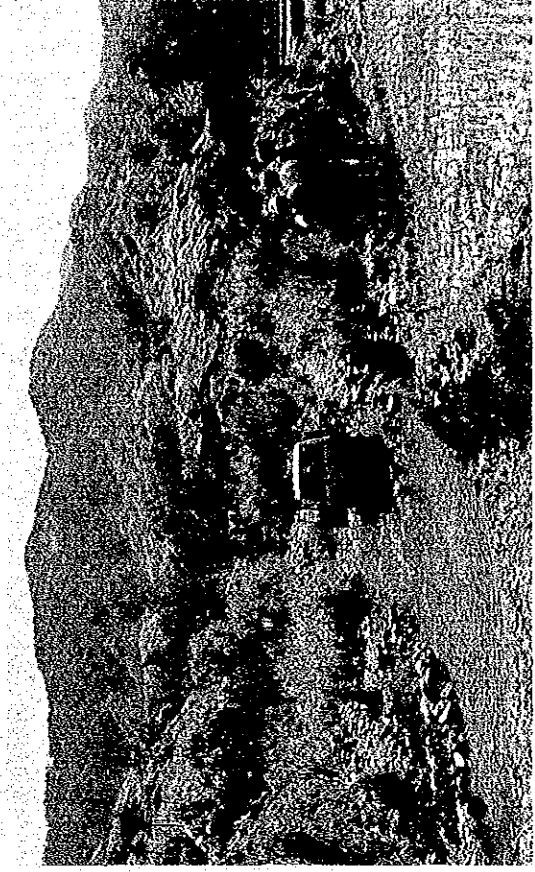
A few remaining forests along a river valley and burning in grassland



Grazing cattle (in white in photo) rarely seen in other parts



Felled sites near the boundary of the Model Area on the east



Felled sites seen in the background. Former roads in the foreground



## PREFACE

In response to the request of the Government of the Republic of the Philippines, the Japanese Government decided to conduct a survey on Preparation of Forest Information in Wide Area and Forest Management Planning in the Republic of the Philippines and entrusted the survey to the Japan International Cooperation Agency (JICA).

JICA sent a survey team headed by Dr. Iwao Nakajima representing a Japanese Joint Venture in charge of the said survey seven times in the period from August, 1985 to February, 1988.

The team had a series of discussions on the survey with the officials of the Government of the Republic of the Philippines and conducted field survey in the project area. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the sound management of the forest in the Philippines and contribute to the promotion of friendly relation between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of the Republic of the Philippines for their close cooperation extended to the team.

June, 1988



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Kensuke Yanagiya  
President  
Japan International Cooperation Agency



## ABBREVIATION

A and D	Alienable and Disposable
BCGS	Bureau of Coast and Geodetic Survey
BFD	Bureau of Forest Development
BL	Bureau of Lands
BMG	Bureau of Mines and Geo-Sciences
DENR	Department of Environment and Natural Resources
FMB	Forest Management Bureau
GDB	Gross Domestic Product
GNP	Gross National Product
ISF	Integrated Social Forest
JICA	Japan International Cooperation Agency
LC	Land Classification
MND	Ministry of Natural Defence
MNR	Ministry of Natural Resources
NAMRIA	National Mapping and Resource Information Authority
NEDA	Natural Economic and Development Authority
NRMC	Natural Resource Management Center
PAGASA	Philippine Atmospheric Geophysical and Astronomical Service Administration
PCARRD	Philippine Council for Agricultural Resources Research and Development



**REPORT ON  
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AND FOREST MANAGEMENT PLANNING IN  
THE REPUBLIC OF THE PHILIPPINES**

**CONTENTS**

**PREFACE**

**SUMMARY** ..... (1) ~ (54)

<b>CHAPTER 1.</b>	<b>INTRODUCTION</b> .....	1
1-1	Background and Objective of Study .....	1
1-1-1	Background .....	1
1-1-2	Objective .....	2
1-2	Study Periods, Study Team Members, and Philippine Officials .....	2
1-3	Supervising Commission .....	8
<b>CHAPTER 2.</b>	<b>STUDY PLAN</b> .....	10
2-2	Basic Policy for Implementation of Study .....	11
2-3	Scope of Report .....	12
<b>CHAPTER 3.</b>	<b>DISCRIPTION OF STUDY AREA</b> .....	14
3-1	Outline of Philippines .....	14
3-1-1	Natural Environment .....	14
(1)	Location and Area .....	14
(2)	Geomorphology .....	14
(3)	Geology and Soils .....	16
(4)	Climate .....	18
(5)	Vegetation .....	22
3-1-2	Socio-Economic Environment .....	24
(1)	Medium Term Development Plan (1987–1992) .....	25
(2)	Outline of Regional Economy .....	25
(3)	Population .....	29
(4)	Major Infrastructure .....	29
(5)	Present Status of Land Use and Forest .....	35
3-2	Outline of Study Area .....	38
3-2-1	Natural Environment of Study Area .....	38
(1)	Location and Area .....	38
(2)	Geomorphology .....	38
(3)	Topography .....	40
(4)	Drainage and Catchment Area .....	58
(5)	Geology and Soils .....	58
(6)	Meteorology .....	63
(7)	Vegetation and Land Use .....	69
(8)	Evaluation of Natural Environment .....	83
3-2-2	Socio-Economic Environment of Study Area .....	85

	(1) Administrative Units .....	85
	(2) Road Network .....	85
	(3) Development Plans .....	85
3-2-3	Forest Land Classification Analysis .....	90
	(1) Data Analysis Flow of Forest Land Classification .....	91
	(2) Analysis of Prevention of Soil Erosion Potential .....	92
	(3) Analysis of Hazard of Land Collapse and Slide .....	103
	(4) Water Holding Potential Analysis .....	113
	(5) Flooding Potential Analysis .....	123
	(6) Tree Growth Potential Analysis .....	127
	(7) Analysis of Natural Environment .....	131
<b>CHAPTER 4.</b>	<b>FOREST MANAGEMENT PLAN FOR WIDE AREA .....</b>	<b>135</b>
4-1	Basic Policy of Forest Management .....	135
4-2	Setting of Forest Management Block .....	135
4-3	Zoning for Forest Management .....	139
4-4	Preparation of Forest Information Table .....	139
4-5	Compilation of Basic Forest Management Map .....	141
4-6	Forest Management Objective in Wathershed .....	150
<b>CHAPTER 5.</b>	<b>FOREST INFORMATION MANAGEMENT SYSTEM BY PERSONAL COMPUTER .....</b>	<b>157</b>
5-1	Data Base Contents .....	157
5-2	Soft-Ware .....	158
5-3	Hard-Ware .....	158
<b>CHAPTER 6.</b>	<b>FOREST MANAGEMENT PLANNING FOR MODEL AREA .....</b>	<b>161</b>
6-1	Selection of Model Area .....	161
6-2	Methodology of Forest Management Planning for Model Area .....	163
6-3	Outline of Model Area .....	166
6-3-1	Natural Environment .....	166
	(1) Location and Area .....	166
	(2) Geomorphology .....	166
	(3) Topography .....	170
	(4) Drainage & Catchment Area .....	173
	(5) Geology and Soils .....	173
	(6) Meteorology .....	183
	(7) Vegetation and Land Use .....	183
	(8) Land Use Changes Over Years .....	186
6-3-2	Socio-Economic Environment .....	191
	(1) Socio-Economic Condition .....	191
	(2) Matters of Local Residents .....	191



	(3) On-Going Projects .....	194
6-3-3	Land Classification Analysis of Model Area .....	194
	(1) Data Analysis Flow of Land Classification .....	194
	(2) Analysis of Natural Environment .....	195
	(3) Analysis of Forest Functions .....	201
6-4	Basic Policy for Forest Management of Model Area .....	210
6-4-1	Allocation of Model Area in Cagayan Watershed .....	210
6-4-2	Basic Guideline for Forest Management of Mode Area .....	210
	(1) Maintenance/Promotion of Public Functions of Forest .....	210
	(2) Contribution to Regional Social Development .....	211
	(3) Continued Supply of Forest Products .....	211
6-4-3	Target Forest of Forest Management Plan .....	212
6-5	Forest Management Planning .....	214
6-5-1	Forest Block .....	214
6-5-2	Forest Information Table .....	215
6-5-3	Term of Management Plan .....	217
6-5-4	Forestry Classifications and Work Standards .....	217
	(1) Timber Production Forest .....	217
	(2) Fuel-wood Production Forest .....	218
	(3) Protection Forest .....	218
	(4) Parks and Outdoor Recreation Area .....	218
	(5) Grazing Land .....	218
	(6) I.S.F. (Agroforestry) .....	218
6-5-5	Reforestation .....	219
6-5-6	Seedling Production .....	225
6-5-7	Wood Production .....	227
6-5-8	Forest Road .....	233
6-5-9	Conservation of Soil and Water .....	234
6-5-10	Parks and Outdoor Recreation Area .....	237
6-5-11	Minor Forest Production .....	239
6-5-12	Forest Protection .....	240
6-5-13	Research Activities .....	246
6-6	Integrated Social Forestry (I.S.F.) .....	250
6-7	Matters of Implementation for Forest Management Planning .....	260
6-7-1	Total Input Necessary Requirement for the Management Plan .....	260
6-7-2	Schedule for Implementation .....	260
6-7-3	Manpower Requirement by Activity .....	262
6-7-4	Yield Prediction .....	262

## ANNEX

1. Cross Tabulation of the Natural Environmental Factors in Specific Combinations of Two in Wide Area
2. Weighting Table in Each Evaluation
3. Forest Information Data in Wide Area
4. Forest Information Data in Model Area
5. Reforestation Planning Data (Location to be planted)
6. Reforestation Planning Data
7. Data of Cutting Planning of Timber Production Forest
8. Data of Cutting Planning of Fuel-wood Production Forest
9. Information Data of I. S. F.
10. Planning Data of I. S. F.
11. Questionnaire Survey
12. Aerial Photographing of Model Area and Interpretation
13. Reference

## SAMMARY

### 1. INTRODUCTION

#### 1-1 Background and Objective of 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.

In a Bureau of Forest Development (B.F.D.) survey of 1983, over 50% of the nation's total land area of approximately 300,000 km<sup>2</sup> is listed under Forest Land. However, the forest land as such continues to shrink in area year after year. Administrative efforts have been made to restrict exploitation of forests and monitor land conditions in an attempt to prevent indiscriminate destruction of forests but apparently with little success.

Consequently, in areas of aggravated forest felling, the balance of natural environment has been destroyed causing such hazards as soil erosion, draining of sand and gravel, and flooding to inflict considerable damages on human lives and properties.

To cope with these problems, and Philippine Government has taken measures to restrict forest felling and promote reforestation of denuded forest lands. At the same time, resettlement of kaingineros and more realistic land use classification of forest lands are being considered.

In the course of these efforts, 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 wide regional basis covering the river basin to help formulate forest control and management plans taking 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 covering the entire Cagayan River Basin (approximately 2.8 million ha.) in northern Luzon, and a study for formulation of forest management plans, one basic (for Wide Area) and another for the selected model area (approximately 50,000 ha.). 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 Cagayan River Basin located in northern Luzon to formulate the Forest Management Plan for Wide Area and the Forest Management Plan for Model Area with a view to conserving the natural environment as well as to stabilizing socio-economic conditions. In every phase of the study, necessary technology transfer to Philippine counterparts is to be implemented.

## 2. STUDY PLAN

### 2-1 Basic Policy for Implementation of Study

This study was 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 objective of the study was to prepare the Forest Management Plan for Wide Area covering the entire Cagayan River Basin (approx. 2.8 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 was given so that the methodology employed in this study and the study result can apply to other areas and possibly serve as a standard approach for nationwide forestry management in the future. The study was conducted over the three year period from August 1985 to June 1988.

The study items for each year are as follows.

#### (1) First Year (August 1985 – June 1986)

Data Collection

Base Map and Reconnaissance Map Production

Field Survey (checking of Reconnaissance Map, collection of additional information)

Selection of Model Area

#### (2) Second Year (August 1986 – March 1987)

Basic Data Compilation

Geographical Characteristics Analysis by Computer

Forest Land Classification Analysis by Computer

Aerial Photography of Model Area

Aerial Photo Interpretation of Model Area (collection of existing data, Reconnaissance Map production)

Field Survey of Model Area (checking of Reconnaissance Map, collection of additional information)

#### (3) Third Year (August 1987 – June 1988)

1. Forest Land Classification Analysis

2. Model Area Data Analysis

3. Field Survey of Model Area (checking of analysis data, collection of additional information, questionnaire survey)

4. Preparation of Draft Forest Management Plans for Wide Area and Model Area

5. Field Verification

6. Presentation of Final Drafts

7. Delivery of Final Products

## 2-2 Study Contents

Figure 2-1 is a flow diagram of the study as a whole. The study consists of two parts, one for the Wide Area (covering the entire Cagayan River Basin) and the other for the Model Area. The respective steps of the study and their relationships with each other are described below.

## 2-3 Scope of Report

This report was prepared primarily from the technical perspective based on the understanding of natural and social environments of Philippines forestland (forests) while having an outlook on the future of forestland in the Philippines.

1) The Forest Management Plan for Wide Area attempts to envision the forestland as desired for the future and consider major requirements for forest management from a broad viewpoint with respect to the Cagayan River Basin (approx. 2.8 million hectares) based on the understanding of the existing condition and analysis and evaluation of related matters.

2) In the Forest Management Plan for Model Area, a model area (approx. 50,000 ha) was selected as an area which typifies the environment, both natural and social of the Cagayan River Basin. The size of the model area was determined with the actual implementation in mind. In addition to the studies undertaken for the same subjects as covered for the Wide Area, a questionnaire survey was conducted to find out about the local residents, their way of living and attitudes towards forests. Covering a wide ranging subjects related to forest management, the plan attempts to provide a guideline for effective forest management.

3) Implementation of the Plans will require further study of social needs, economic effects, and funding, and the implementation plan needs to be worked out.

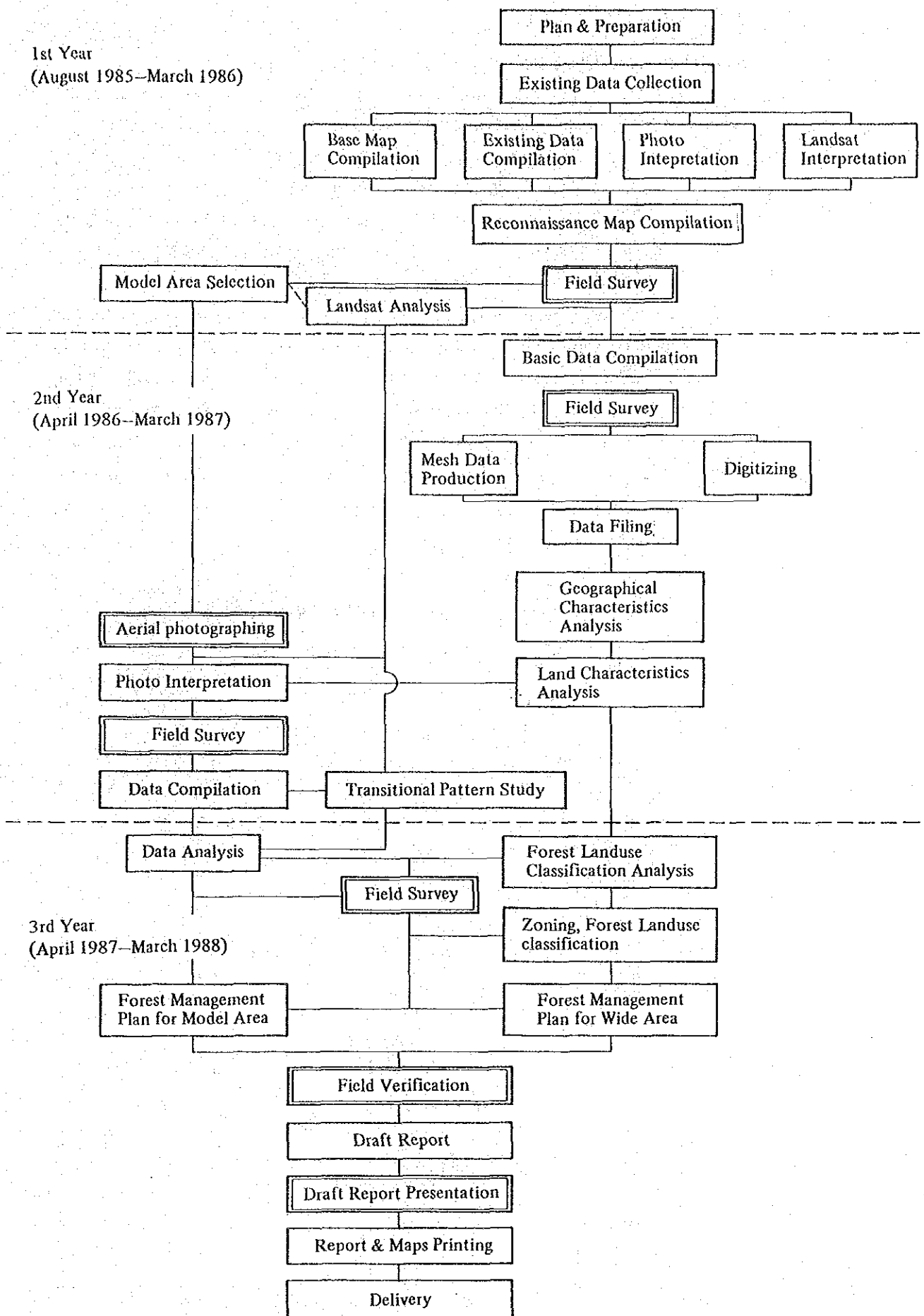


Fig. 2-1. Study Flow

### 3. DISCRPTION OF STUDY AREA

#### 3-1 Present Status of Land Use and Forest

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 & dispensable (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 15.2% 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 3-1).

Table 3-2 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 3-2), 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 3-1 Land Classification, by Region, 1983

(Unit: 1000 ha)

Region	Total Land Area		Alienable & Disposable		Forestland	
	ha	%	ha	%	ha	%
Total	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	1,863.5 (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
XI	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 3-2. 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
NCR	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

### 3-2. Outline of Study Area

#### 3-2-1. Natural Environment of Study Area

##### (1) Location and Area

The Cagayan River Basin, the study area, is located in the northeast of Luzon Island, the largest island of the Philippines, 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 Sierra 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. The study area has an area of approximately 2.8 million hectares involving the bulk of Region II, an administrative region. Figure 3-1 shows the study area as defined on the map.

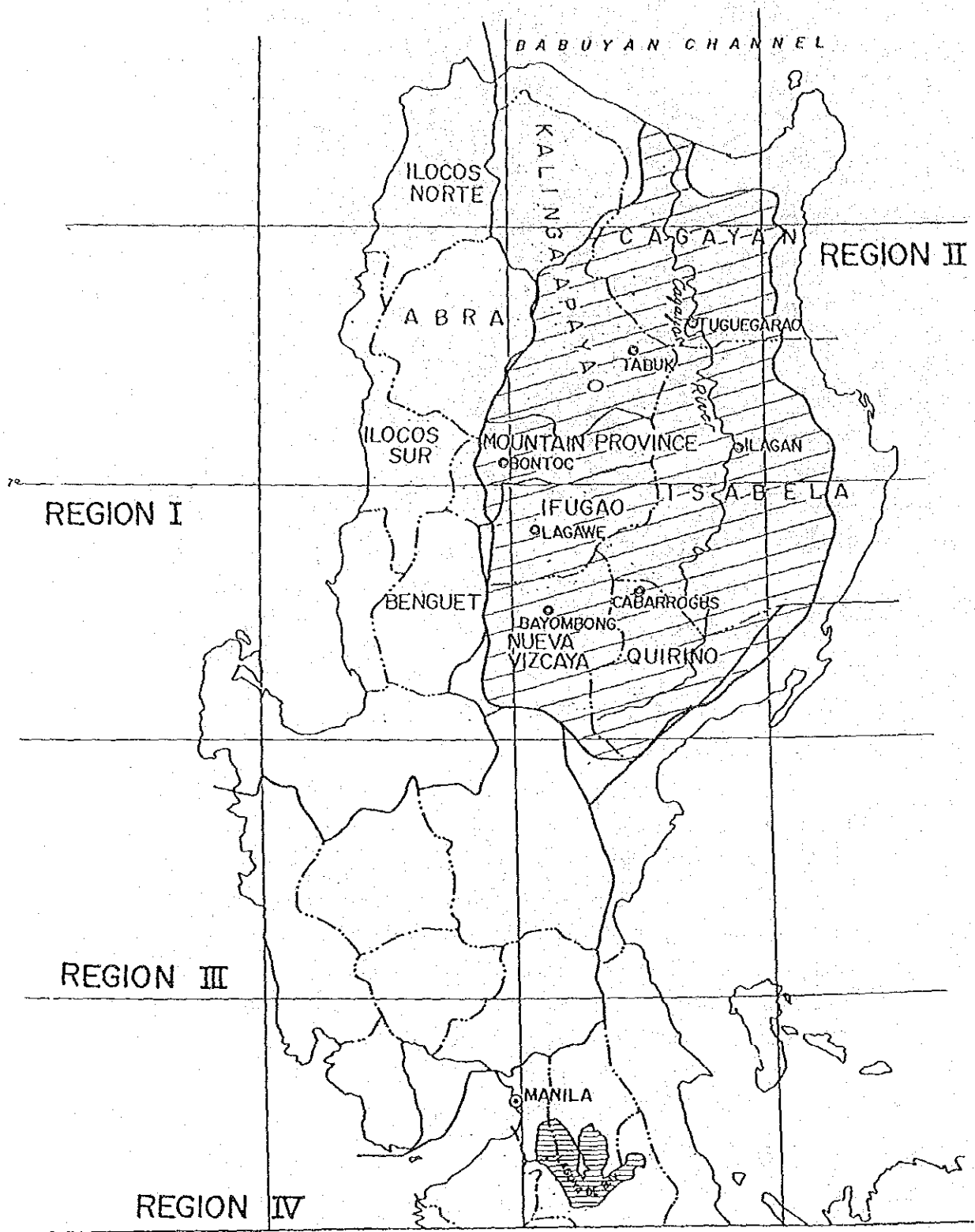


Fig. 3-1. Location Map of Study Area

(2) Vegetation and Land Use

1) Distribution Characteristics

Vegetation and land use classifications were compiled from interpretations of aerial photos and Landsat imagery, and field surveys, as shown in Table 3-3 and Table 3-4.

Table 3-3. Classification of Vegetation and Land Use

Ma	Mangrove Forest
F	Flat Plain Forest (0 ~ 100m)
H	Hilly Forest (101 ~ 400m)
M	Mountain Forest (over 401m)
G <sub>1</sub>	Grass Land (include Pasture)
G <sub>2</sub>	Logging Progress or Logged Over Area
B	Bare Land
A	Agriculture Area (Farm)
K	Kaingin
S	Settlement, Village, Town

In the study area from the lowland upto the elevations of about 800m, predominantly Dipterocarpaceae forests are distributed extensively. Other types of forests include mangroves in Aparri and Benquit Pines in Bontac. Forests in the plains (0-100m), hills (101-400m) at mountains are classified by land use.

Table 3-4. Changes of Vegetation and Land Use According to Elevation

Vegetation Height	Forest							Kaingin	Grassland	Agriculture area	Barcland	Settlement, Village, Town	Total
	Mangrov F.	Flat plain F.	Hilly F.	Mountain F.	Logging P.F.	Benquit pine F.	Subtotal						
0~100m	0 ( 0)	30,474 ( 5)	0 ( 0)	0 ( 0)	129 ( 0)	0 ( 0)	30,603 ( 5)	58,745 ( 9)	118,404 ( 18)	398,949 ( 62)	31,994 ( 5)	10,105 ( 2)	648,800 (100)
101~200m	0 ( 0)	5,780 ( 2)	43,609 ( 12)	0 ( 0)	15,316 ( 4)	0 ( 0)	64,705 ( 18)	82,292 ( 23)	120,649 ( 33)	81,618 ( 23)	10,409 ( 3)	727 ( 0)	360,400 (100)
201~400m	0 ( 0)	965 ( 0)	89,847 ( 21)	29,216 ( 7)	59,436 ( 13)	0 ( 0)	179,464 ( 41)	83,676 ( 19)	117,782 ( 25)	44,824 ( 10)	10,047 ( 2)	1,407 ( 0)	432,200 (100)
401~800m	0 ( 0)	0 ( 0)	46,541 ( 7)	309,841 ( 50)	84,464 ( 13)	6,208 ( 1)	447,049 ( 71)	48,497 ( 8)	106,976 ( 17)	19,814 ( 3)	3,879 ( 1)	185 ( 0)	626,400 (100)
801m~	0 ( 0)	0 ( 0)	1,402 ( 0)	345,541 ( 49)	50,989 ( 7)	175,023 ( 25)	572,955 ( 81)	45,777 ( 7)	40,165 ( 6)	40,952 ( 6)	851 ( 0)	0 ( 0)	700,700 (100)
Total	0 ( 0)	37,219 ( 1)	181,399 ( 7)	684,598 ( 25)	210,334 ( 7)	181,226 ( 7)	1,294,776 ( 47)	318,987 ( 12)	503,976 ( 18)	586,157 ( 21)	57,180 ( 2)	12,424 ( 1)	2,773,500 (100)

Note: The Figures in brackets indicate %.

### 3-2-2 Forest Land Classification Analysis

#### Data Analysis Flow of Forest Land Classification

Natural environmental elements of the study area are shown in basic combinations in the Land System Classification Table. The following analyses were made to work out the land classification which serves as the basis for the forest management plan formulation.

1. Soil Prevention Potential Analysis
2. Land Collapse & Slide Potential Analysis
3. Water Holding Potential Analysis
4. Flooding Potential Analysis
5. Tree Growth Potential Analysis

Contents and methodology of these analyses are as shown in the flow diagram in Figure 3-2.

To analyse soil erosion and land collapses & slides, it requires the study of not only the characteristics of individual natural environmental factors but also their correlations. The latter correlational analysis was made by cross tabulation of the natural environmental factors in specific combinations of two. For example, Table 3-5 shows the correlation of levels of slopes and incidence of land collapses. From the table, it can be seen that land collapses are most likely to happen in slopes ranging 30%–40%. These results are applied in the analysis of land collapse & slides for identification of relevant factors and evaluation of potential. Similarly, correlations were studied between elevations and slopes, slopes and soils, land collapses and geology, etc. The results of these studies are attached in the annex.

Table 3-5 Slopes and Land Collapses

Slope		Land collapse <number>
percent	degree	
0 ~ 3	0 ~ 2	53 ( 4 %)
4 ~ 8	2 ~ 6	62 ( 5 %)
9 ~ 18	6 ~ 10	147 (11 %)
19 ~ 25	10 ~ 14	118 ( 9 %)
26 ~ 35	14 ~ 19	261 (20 %)
36 ~ 46	19 ~ 24	272 (21 %)
46 ~ 55	24 ~ 29	207 (16 %)
56 ~ 65	29 ~ 33	114 ( 9 %)
66 ~ 75	33 ~ 37	33 ( 3 %)
76 ~ 85	37 ~ 40	7 ( 1 %)
86 ~	40 ~	6 ( 1 %)
Total		1,208 (100 %)

# Forest Land Classification Analysis

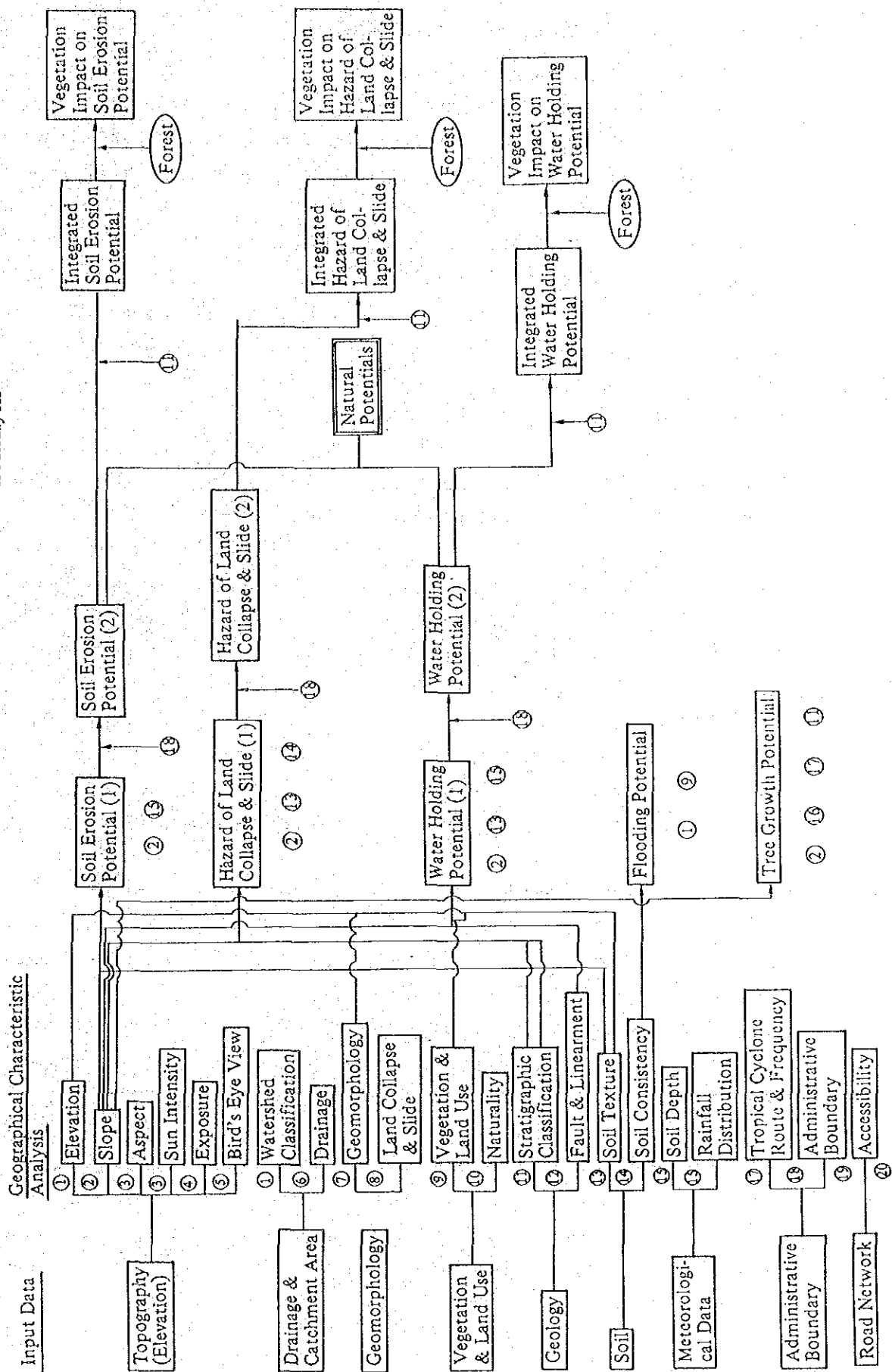


Fig. 3-2 Data Analysis Flow of Forest Land Classification

#### 4. FOREST MANAGEMENT PLAN FOR WIDE AREA

##### 4-1 Basic Policy of Forest Management

In the study area, located in the northeast of Luzon Island covering the Cagayan River Valley, the land use is characterized by agriculture, mainly rice production, livestock, fruit growing, and timber production, which are major industries in the area.

With respect to forests, the area originally is abundant in forest resources but due to excessive felling of Philippine mahogany and other species for export and for domestic construction purposes, augmented by the ever growing need for firewood, as well as the unabated increase of kaingin further inland for agricultural expansion, all these have shrunk the forest area substantially including a deterioration of the quality of resources therein resulting in reduced production capacity not to mention the bigger environmental problems they caused from frequent outflows of sand and gravel and increasing occurrence of flood which damaged farmland, infrastructure, and other built-up areas downstream.

In the face of this situation, the need is being strongly felt by regional communities to let the forests function fully in the public interests to control water, prevent hazards, and conserve the environment as a whole, and to promote forestry in such a manner as to help develop the region by providing increased employment while ensuring planned production of timber and firewood.

The basic policy for formulation of the Forest Management Plan for Wide Area, therefore, is to help maintain and nurture the forest resources while enhancing the multi-lateral functions of forests to benefit the regional communities in accordance with the basic forestry policy of the Philippine Government.

##### 4-2. Setting of Forest Management Block

The Cagayan River Basin has the Cagayan River running in the middle from south to north, and the Cordillera Central Range and the Sierra Madre Range closing in on the west and the east respectively.

For evaluations of the natural potentials, the study area was divided into some 3,000 'study units' according to the drainage patterns and ridges, to form the smallest unit for analysis. Those units were aggregated into 306 management unit and further into 12 Watersheds.

The Watersheds involve the river basins of six rivers: Chico, Magat, Cagayan, Dummon, Pinacanauan de Tuguegarao, and Ilagan. Figure 4-1 shows Watersheds as well as the Watersheds which have been made the basic units for the Forest Management Planning for Wide Area.

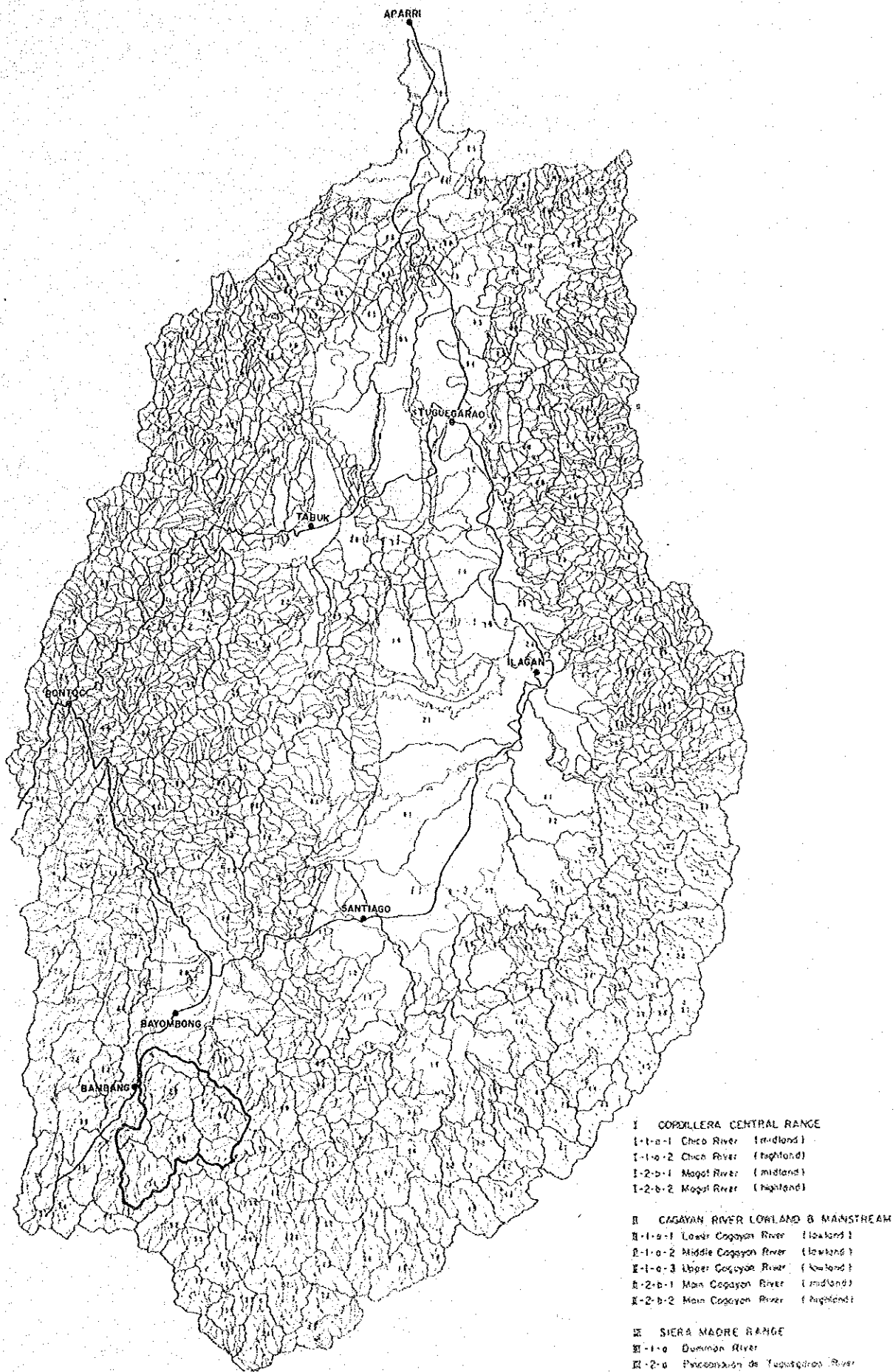


Fig. 4-1. Study Unit

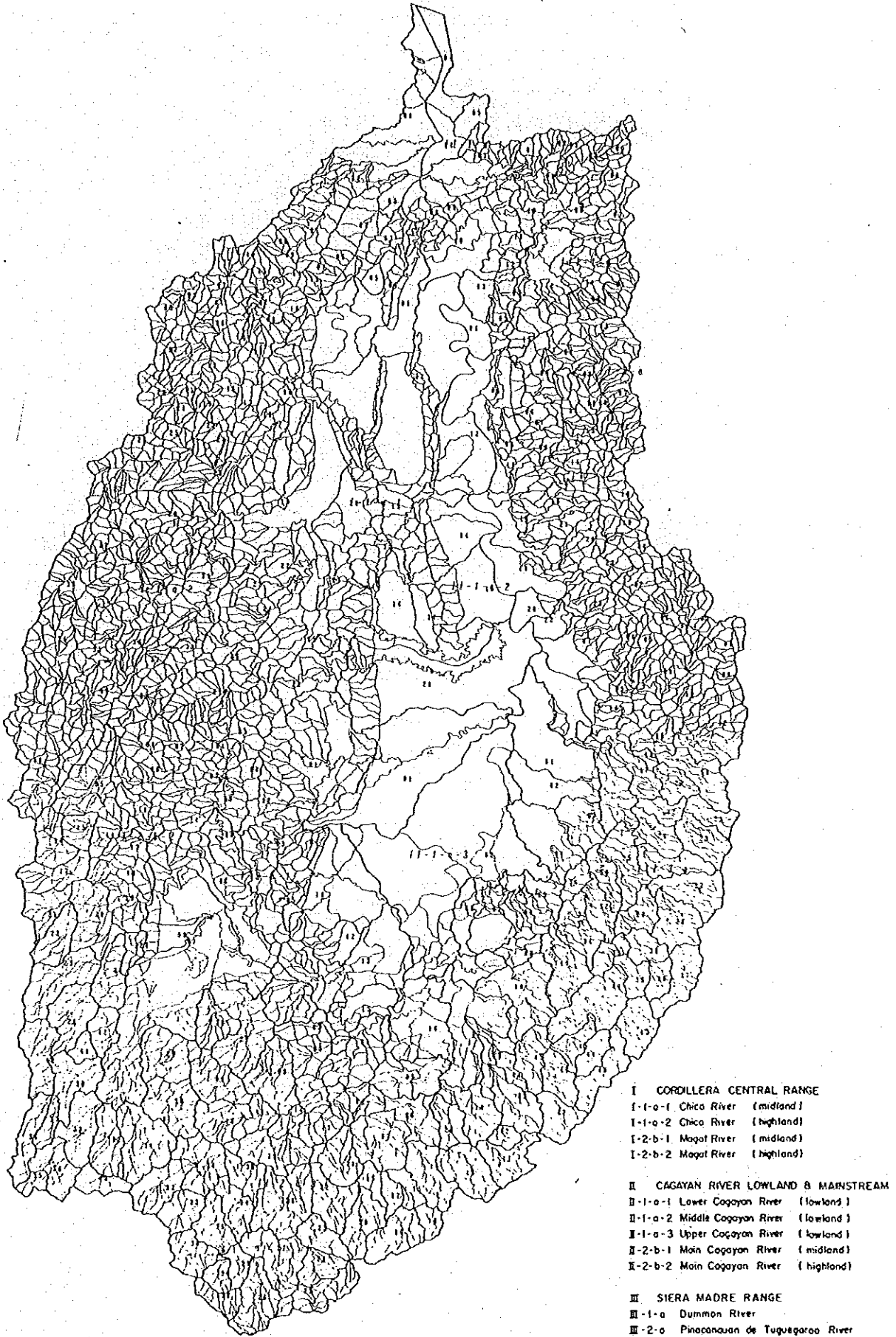


Fig. 4-1. Study Unit





#### 4-3. Zoning for Forest Management

As previously discussed, 306 Management Units have been set as the basic areal units for forest management. Furthermore, the forestland was classified into Existing Forestland and Existing Grassland, for which classifications were set as follows for the purpose of forest management.

##### 1) Existing Forestland

- (A) Areas with high potential for natural hazards requiring prohibition of felling for forest protection.
- (B) Areas with fairly high potential for natural hazards allowing selective felling subject to soil conservation.
- (C) Areas with low potential for natural hazards permitting clear cutting and afforestation subject to planned management.

##### 2) Existing Grassland

- (D) Areas with the continuing presence of soil erosion and land hazards (outflow of sands and gravel) requiring active reforestation to prevent hazards.
- (E) Areas with the continuing relative absence of soil erosion and land hazard (outflow sands and gravel) requiring reforestation stressing soil enrichment.

#### 4-4 Preparation of Forest Information Table

The findings of studies made to understand the existing natural and social conditions and analyse the forest land use for the purpose of forest management planning for wide area with respect to each management unit have been tabulated into "The Forest Information Table" as shown in the Annex.

#### 4-5 Compilation of Basic Forest Management Map

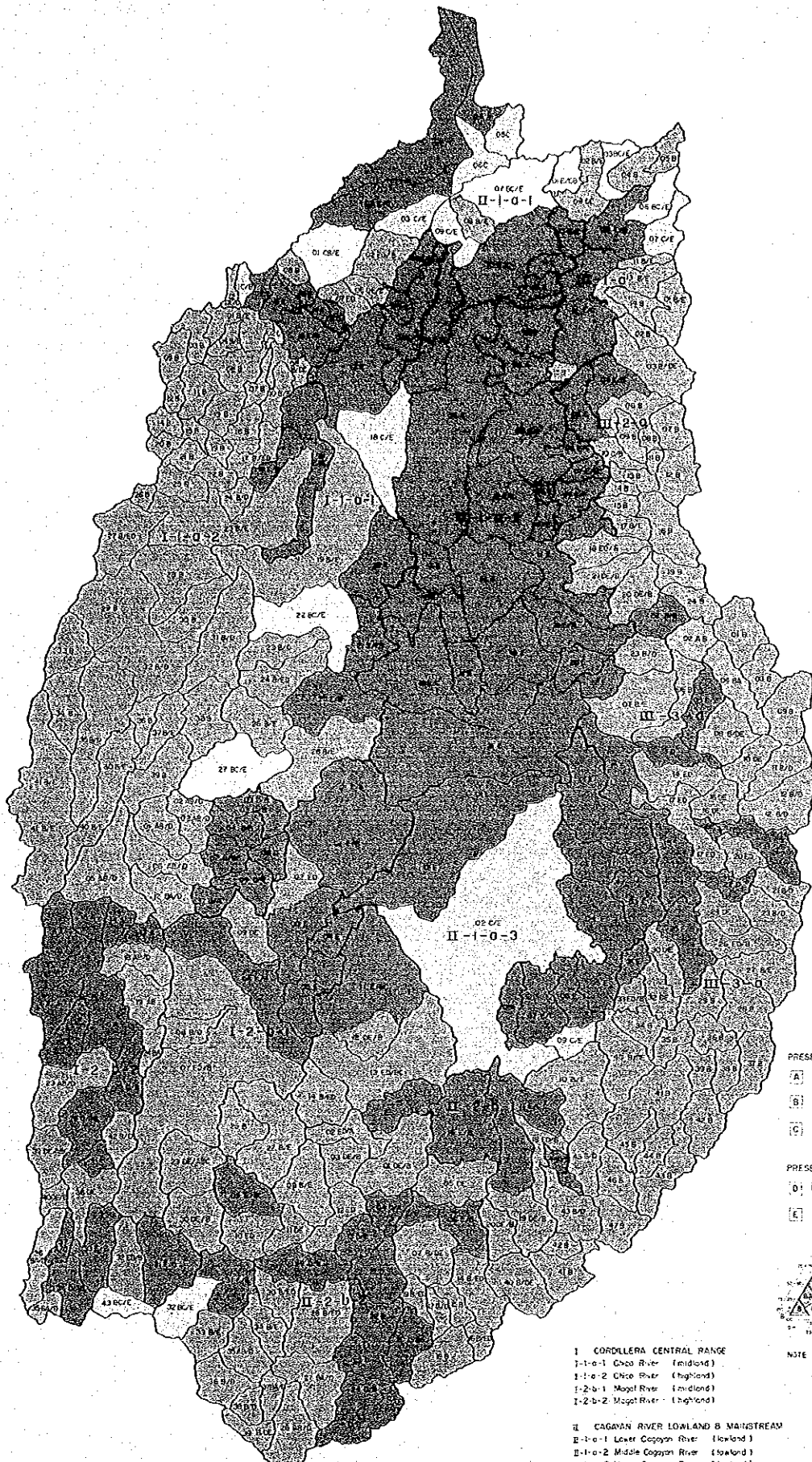
The Forest management Plan for Wide Area sets forth the goals and criteria for each Management Unit based on the Forest Information Table and provides for the management classifications in tables.

According to the management goals, the Existing Forestland is classified into three groups and the Existing Grassland into two, and criteria are set for each management unit in accordance with areas as defined by these classifications.

The management goals and criteria are as follows.







**LEGEND**

**PRESENT FOREST AREA**

- (A) AREAS WITH HIGH POTENTIAL FOR NATURAL HAZARDS REQUIRING PROMOTION OF CUTTING FOR FOREST PROTECTION
- (B) AREAS WITH FAIRLY HIGH POTENTIAL FOR NATURAL HAZARDS ALLOWING SELECTIVE CUTTING SUBJECT TO SOIL CONSERVATION
- (C) AREAS WITH LOW POTENTIAL FOR NATURAL HAZARDS PERMITTING CLEAR CUTTING AND REFORESTATION SUBJECT TO PLANNED MANAGEMENT

**PRESENT GRASSLAND AREA**

- (D) AREAS WITH THE CONTINUING PRESENCE OF SOIL EROSION AND LAND HAZARDS REQUIRING ACTIVE REFORESTATION TO PREVENT HAZARDS
- (E) AREAS WITH THE CONTINUING RELATIVE ABSENCE OF SOIL EROSION AND LAND HAZARDS REQUIRING REFORESTATION STRESSING SOIL ENRICHMENT

NUMBER OF MANAGEMENT UNIT  
IF BY ED

SECOND PRIORITY  
FIRST CATEGORY

- I CORDILLERA CENTRAL RANGE**  
 I-1-a-1 Chico River (midland)  
 I-1-a-2 Chico River (highland)  
 I-2-b-1 Mogot River (midland)  
 I-2-b-2 Mogot River (highland)
- II CAGAYAN RIVER LOWLAND & MAINSTREAM**  
 II-1-a-1 Lower Cagayan River (lowland)  
 II-1-a-2 Middle Cagayan River (lowland)  
 II-1-a-3 Upper Cagayan River (lowland)  
 II-2-b-1 Mori Cagayan River (midland)  
 II-2-b-2 Mori Cagayan River (highland)
- III SIERRA MADRE RANGE**  
 III-1-a Dumagan River  
 III-2-a Picoconson de Tuguegarao River  
 III-3-a Itayan River

NOTE: THE ABOVE FIGURES SHOW THE COMBINATIONS OF THE MANAGEMENT CLASSIFICATIONS WITH THE RATIOS OF RESPECTIVE AREAS DEVELOPED FROM THE FOREST INFORMATION TABLE.

Fig. 4-2. Forest Management Plan



## **5. FOREST INFORMATION MANAGEMENT SYSTEM BY PERSONAL COMPUTER**

A personal computer system has been designed to effectively utilize, maintain and update the data generated by this study.

## 6. FOREST MANAGEMENT PLANNING FOR MODEL AREA

### 6-1 Selection of Model Area

To select the most appropriate Model Area for the Forest Management Planning, the whole study area encompassing some 2.8 million hectares was studied in terms of the following as criteria.

- (1) Conditions of vegetation and land use:
  - Presence of tree stands,
  - Presence of burned-down or deserted kaingin sites,
  - Feasibility of forestry serving the local interests,
  - Possibility of the area becoming designated for forest development district,
  - Problems involved in land use (ownership) in connection with a forestry project,
  - Access to timber market place,
  - Possibility of incorporating “Integrated Social Forestry” in the Forestry Project,
  - Feasibility of forestry helping to prevent downstream sedimentary outflow, preserve watershed, and serve other public needs,
  - Conflicts with other projects,
  - Others.
- (2) Social factors:
  - Security for field work,
  - Availability of cooperation from agencies concerned,
  - Availability of cooperation from local citizens,
  - Availability of access roads,
  - Conflicts with other projects,
  - Others.

At the time of Reconnaissance Map compilation, Bayombong, Lagawe, Bontoc, and Tabuk were tentatively selected as candidate sites on the basis of preliminary interpretations of forests and land use. And they were further investigated on site in consultation with the Philippine side. The table below summarizes the study results.



The result is as follows.

Field Survey Result of Candidate Model Sites

Criteria	Candidate Sites	Bayom-bong	Lagawe	Bontoc	Tabuk
(1) Conditions of vegetation and land use					
1. Presence of tree stands		○	○	x	○
2. Presence of burned-down or deserted kaingin sites		○	○	○	○
3. Possibility of forestry serving the local interests		○	x	x	x
4. Possibility of the area becoming designated for forest development		○	○	○	○
5. Problems involved in land use in connection with a forestry project		x	x	x	○
6. Access to timber market place		○	x	x	○
7. Possibility of incorporating I.S.F. in the Forestry Project		○	○	○	○
8. Conflicts with other projects		○	○	x	x
Decision		○	○	x	○
(2) Social conditions					
1. Problems of security for field work		○	x	x	x
2. Availability of cooperation from agencies concerned		○	x	○	○
3. Availability of cooperation from local citizens		○	x	x	x
4. Availability of access roads		○	○	○	x
5. Conflicts with other projects		○	○	x	x
6. Others		○	○	○	○
Decision		○	x	x	x

○ : Suitable  
 x : Not suitable

Namely:

- Bayombong area meets all the requirements.
- Lagawa area meets many requirements but land is being occupied and utilized by local residents.
- Bontoc area has highland coniferous forests in the main which are not suitable as a model for our purposes. And access is difficult.
- Tabuk area is mostly inaccessible for field survey due to the lack of roads and other social constraints.

For the above reasons, the Philippine side, the counterparts, the Survey Team, and the Supervising Commission, agreed after consultations to select an area about 50 km southeast of Bayombong as the most appropriate site for the Model Area.

To expand further, the area, located in the north of Luzon and with forests and presence of kaingin and grazing land as they are, represents almost all of the problems involved in the forest management for the Cagayan River Valley. In addition, the potentials for forest development, marketing of forest products, and expanded I.S.F. make the area most appropriate to represent the study area.

The major rivers in Northern Luzon, Cagayan and Magat, originate here making the selected area important in its role to help water and land resources conservation and other public functions of forests. Access roads are also developed. These combine to make the area appropriate as the Model Area for forest management planning for the Cagayan River Valley. This selection of the area as such has been approved by the Ministry of Natural Resources, the Philippine Government.

#### 6-2. Methodology of Forest Management Planning for Model Area

The Forest Management Plan for Model Area sets forth the technical procedures and guidelines for implementation of forest management with respect to the Model Area in line with the management goals established for each management block and unit as defined in the Forest Management Plan for Wide Area while paying due attention to environmental conservation.

In the forest management planning for wide Area, data and information were acquired, organized and analysed in terms of the smallest land units for study ranging 500-1,000 ha. in area based on the watersheds and drainage areas, while the plan is designed from an overall viewpoint. To translate the plan into detailed criteria for implementation to suit the respective local conditions requires further supplementary work.

The Model Area involves Watersheds I-2-b-2 and II-2-b-2, and relates to 5 Management Units, as defined in the Wide Area. Based on the management objectives and forest information set for these Management Units, the Forest Management Plan was formulated in the procedure shown as the Work Flow.

Note: New Aerial Photographs

Aerial Photography : 3, 10, 17/Jan./1987

Courses : 10 courses, Flight Line: North to South

Sheets : 153 sheets

Scale : 1/20,000

Photo Interpretation

Contact prints and twice enlarged prints

Minimum Interpretable size of objects

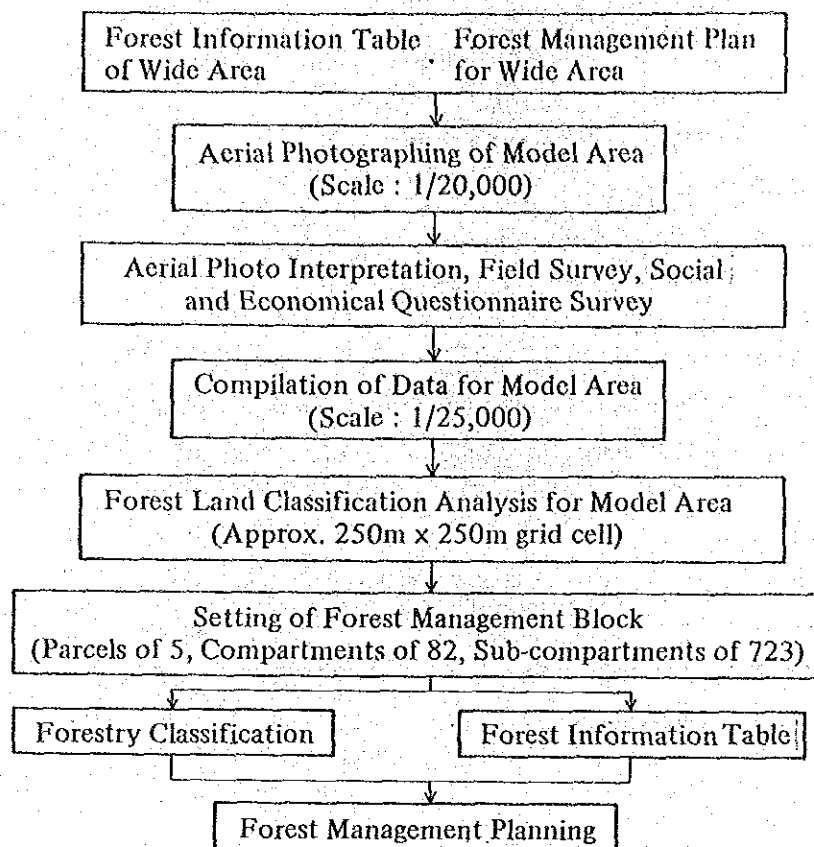
Approximately 1 ha

The two Forest Management Plans prepared in this project, one for the Wide Area and the other for the Model Area, are compared for differences and summarized in the Table 6-1 and Figure 6-1.

Table 6-1 Differences of the Wide Area and the Model Area for Forest Management Plan

Items	Forest Management Plan for Wide Area	Forest Management Plan for Model Area	Remarks (Supplement work, etc.)
Area	Approx. 2.8 million ha.	Approx. 50,000 ha.	
Base scale	1/100,000	1/25,000	Aerial photographic representation of photo interpretation field surveying, questionnaire survey
Geographic information unit	Approx. 1 km x 1 km grid cell	Approx. 250m x 250m grid cell	Mapping of elevations, slope, exposure, etc.
Management blocks	Watersheds (12), Management units (306), Study units (approx. 3,000 each ranging 500-1,000ha.) <i>Note:</i> The Model Area covers 5 management units of water- sheds I-2-b-2 and II-2-b-2.	Parcels (5, each 5,000-10,000 Compartments (82, each 500-1,000ha.) Sub-compartments (723, each 50-100ha.)	Parcels are formed by division or integration of Watersheds; Compartments by division or integration of Management Unit or Study Unit, Sub-compartments by division of compartment.
Management classifications	Classification of three for forest and two for grassland.	Forestry classifications (6): Timber production, fuel- wood production, protec- tion, parks and outdoor recreation, I.S.F.	

Figure 6-1 Flow of Forest Management Planning for Model Area



Further, main information on these five management units compiled in "Forest Information Table for Wide Area" is as follows;

watershed	management unit	area (ha)	forestland /A&D (ha)	natural potentials (forestarea)			natural potentials (grassland)		management objective main / sub	parcel in model area
				hazard (H)	hazard (M)	hazard (L) (ha)	hazard (H)	hazard (L) (ha)		
II-2-B-2	09	9,069	7,138/1,929	152	2,168	1,371	1,065	2,984	reforestation / elective cutting - ISF	I
"	10	7,601	3,556/4,043	0	0	0	2,108	5,308	reforestation	II
I-2-B-2	29	10,763	8,682/2,085	2,052	1,154	1,143	2,637	2,345	reforestation / protection - elective cutting	III
"	30	10,358	7,992/2,367	330	4,140	2,496	4,140	2,496	reforestation / elective cutting	IV
"	31	13,151	10,254/2,893	1,609	0	5,031	0	5,031	reforestation / elective cutting	V

### 6-3. Outline of Model Area

#### 6-3-1. Natural Environment

##### (1) Location and Area

The area under study is located in the northeast of Luzon Island of the Republic of the Philippines along the entire length of the Cagayan River encompassing an area of approximately 2.8 million hectares. The area chosen as the Model Area is about 50 kilometers south-east of Bayombong City in Nueva Vizcaya Province in the southern part of the Cagayan River Basin. It is a mountainous area of 48,980 hectares ranging 300 -- 1,600 meters in elevation and involving the two river basins of Cagayan and Manga.

##### (2) Vegetation and Land Use

Vegetation and land use classifications and their areas were compiled from aerial photo interpretations and field surveys as Table 6-2, and the vegetation and Land Use Map (Figure 6-2) prepared. In terms of tree species, there exists no natural *Pinus insularis* Forest. Except for the absence of Mangrove Forest quite obviously, the area has no outstanding characteristics of distribution compared with the Cagayan River Basin. Up to 800 m in elevation, Diptrocarp Forest is predominant but from 1,000 m. It is replaced by Mossy Forest in distribution. There are sporadic growths of bamboos but they are not large enough in space to be represented. Results of aerial photo interpretations are given in Annex 12. Their characteristics are categorically described below.

##### 1) Logged-over, secondary (NL)

Most of the areas delineated as Forest (except for Mossy Forest) are Logged-over or Secondary Logging in Progress. Usually, after first and secondary logging, succeeding stands continue to grow to form the secondary forests for subsequent logging in a continuous process. But in the Model Area, after logging the sites are mostly cultivated for farming (kaingin) by burning and eliminating the trees. Logged-over, secondary, areas were further subdivided into thin stands and close stands.

##### 2) Reproduction and Brushland (NR)

This represents brushland and young low forests. Forests of this type are only scatteredly distributed in the grasslands, occupying only 732 ha. or 1.5% of the Model Area.

##### 3) Mossy Forest (NY)

Distributions of Mossy Forest were observed in parts of the uppermost areas of forests. Being medium to low in height, Mossy Forest remains intact from logging. But there are such areas turned into cultivated area (grassland) by burning.

##### 4) Seasonal Cropland (Mc<sub>1</sub>)

Seasonal Cropland refers to rice paddies and farms, accounting for some 5,400 ha. or 11% of the Model Area. This type of land use exists not only in A & D but also in forestland. Seasonal Croplands of 1 ha. or more are shown in Vegetation and Land Use Map and those of less than 1 ha. are not represented. Presently, a significant number of such Seasonal Croplands of less than 1 ha. and distributed sporadically in the forestlands.

5) Permanent Cropland (Mc<sub>2</sub>)

Permanent Cropland is mainly where fruits are grown. It amounts to 53 ha. or 0.1% of the Model Area.

6) Grassland (including Pasture) (G)

Grasslands occupy approximately 55% of the Model Area as shown in Table 6-2. Field verification revealed that what had been interpreted as Reproduction and Brushland were mostly Grassland.

Most of Brush as interpreted turned out to be graminacea such as Cogon and Talahip. They were misleading because they were 3 to 4 meters in height appearing to have crowns.

In most Grasslands, except for the western part of the Model Area which is covered all over by Grassland, there are scattered growths of Brush, but in the presence of such vigorous vegetations like Cogon and Tarahibu, plant succession to high forests (mostly shade-bearing trees) is not very likely and, considering also the repeated kaingin, there appeared little possibility of their growing into Reproduction Brush (Reproduction Stand), and therefore scattered growths of Brush were included in Grassland in delineation. Sporadic brushes are included in Grassland.

7) Built-up Area (B)

The built-up areas as represented in the map are those of Dupax and Kasibu. They amount to 163 ha. in area or only 0.3% of the Model Area. Those of less than 1 ha. are not represented in the map but there are many of them present throughout Seasonal Croplands.

8) Kaingin (K)

According to the Philippine Forestry Statistics, kaingin is defined as follows.

Kainging – a portion of the forest land, whether occupied or not, which is subjected to shifting and or permanent slash and burn cultivation having little or no provision to prevent soil erosion (P.D. 705).

Statistically, kaingin is classified as cultivated land outside of A and D (Alienable or Disposable Lands).

According to Table 6-2, kaingin accounts for only about 2% of the total area, but it must be noted that there are many such areas that were not repre-

sented because they are not large enough to be expressed in terms of 5mm by 5 mm areal minimum units as specified for photo interpretation.

Therefore it must be understood that there are a substantial number of kaingins, too small in size to be represented, scattered and distributed in areas delineated as Forest and Grassland. Depending on how to look at cultivation in terms of its intensity, even among A and D, there are areas which are cultivated though loosely.

Table 6-2. Areas of Vegetation and Land Use

	(ha)	(%)
Logged-over, secondary (NL)	14,709	30.0
Reproduction and Brushland (NR)	732	1.5
Mossy Forest (NY)	39	0.1
	15,480	31.6
Seasonal cropland (Mc <sub>1</sub> )	5,439	11.1
Permanent cropland (Mc <sub>2</sub> )	53	0.1
	5,492	11.2
Grassland (include pasture) (G)	26,718	54.6
Built-up Area (B)	163	0.3
Kaingin (K)	1,127	2.3
	48,980	100.0

Note: The high density area in NL and NR is approx. 827 ha (5.4%). This figures are measured on the map. Least area of interpretation is approximately one hectare in unit.

Distributiojs of forests in the vegetation land use were classified by elevation for the Wide Area whereas for the Model Area they were distinguished by development (felling) status and conditions after felling.





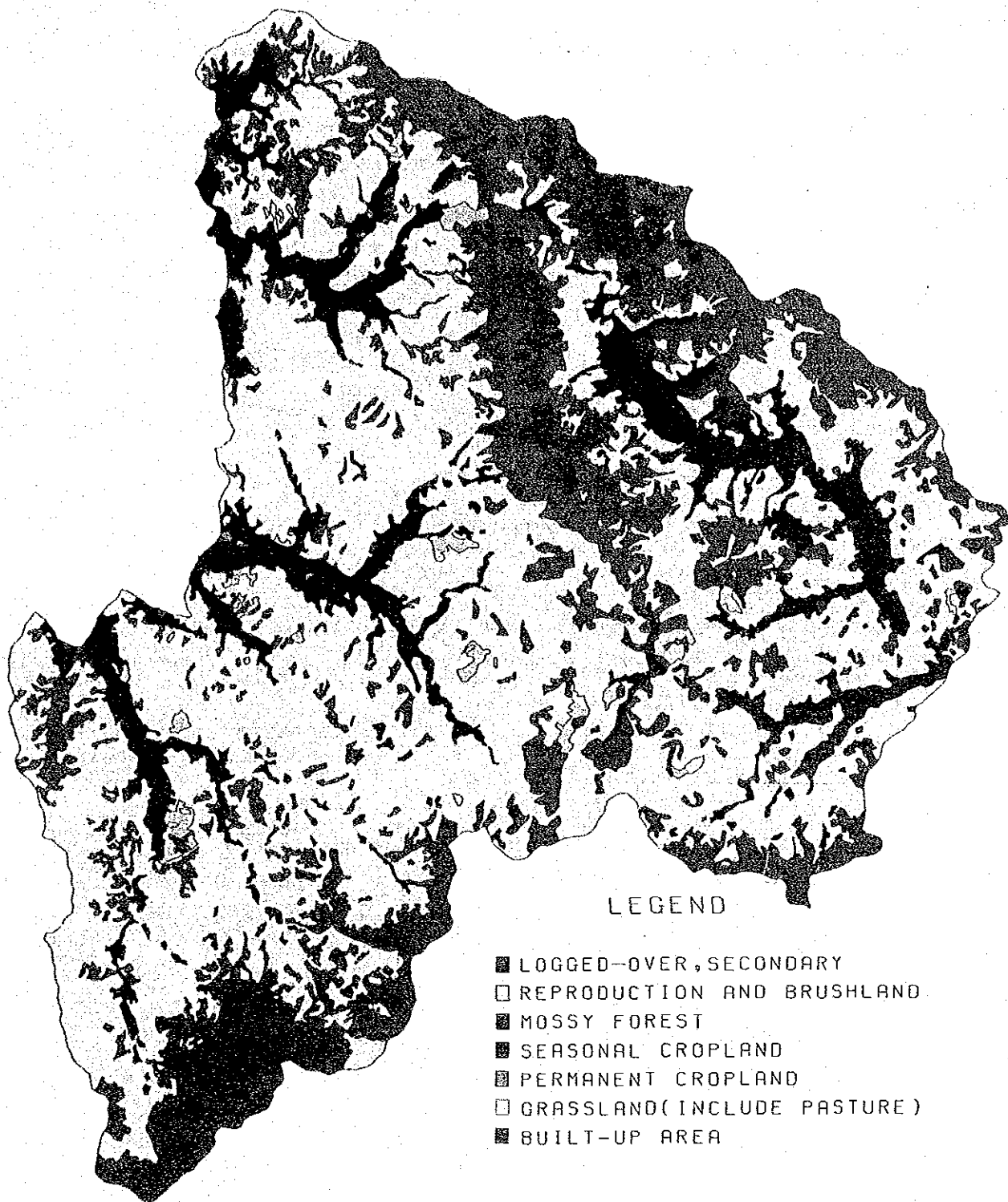


Fig. 6-2. Vegetation & Land Use



### 6-3-2 Matters of Local Residents

A questionnaire survey was conducted polling Barangay Captains and ordinary people living in the Model Area to find out the life of local people, their attitudes towards forests, what they expect of forest management, so as to reflect them in this forest management planning.

Table 6-3. Comparison of Regional Characteristics

Subject	Area			
		Dupax del Sur	Dupax del Norte	Kasibu
Composition	Years of settlement, Population/ household, Cooperative membership,	Many second generations, Small per household,  100%	First & second generations, Large village size,  80%	Many first gen- erations, 1 village— 200 households/ 1000 persons, 64%
Living environment, Industry, Economy	Water supply,  Average income per household, Wish to expand land, Way to expand,  Income outside of agriculture & livestock, Cottage industry,  Fuelwood purchase, Past disasters,  Reduction of forest Gradually/rapidly	Shortage infre- quent, P8,000.  Many, >>  Purchase, tree cutting, Yes,  Many (timber, rattan),  Often (some- times), Many (involving housing, farm),  75/25%	Small supply,  P6,200  Many, <  Purchase, tree cutting, Yes, but little,  Few (rattan),  Not often (sometimes), Few (involving farm, road),  0/100%	Half supplied,  P6,150  Many, ≐  Purchase, tree cutting, Yes,  About half (rattan, tiger grass) Not often (rare), Many (involving farm, road)  75/25%
Attitude	Planting experi- ence,  Forestry desired, Expected role of forest  Ways to help forest,	Many experi- enced (fuelwood)  Fuelwood, Fuelwood pro- duction,  Planting, protec- tion management,	Few experienced (timber)  Timber, Timber, employ- ment, disaster prevention, Same as left, forest road main- tenance,	Many experi- enced (fuelwood, fruits)  Fuelwood, Timber produc- tion, disaster prevention, Forest road, plan- ting, protection,
Observation	Types of settlement	Developed, esta- blished farm community	In transition to farming com- munity	Primitive community

The questionnaire survey was conducted in two parts, one polling Barangay Captains as representatives of Barangays and the other addressing individual residents. The replies of the two parts are very similar except for differences in incomes and disaster experience and, therefore, they can be taken as reflecting the actual life in the region properly.

Differences between the areas appear to reflect the differences in the attitudes of residents towards forests due to their respective levels of development and geographical conditions.

### **6-3-3. Land Classification Analysis of Model Area**

#### **(1) Data Analysis Flow of Land Classification**

The method of Land Classification, Analysis for the Model Area is basically the same as for the Wide Area and the procedure is described below.

- 1) Collection and compilation of basic information:
- 2) Computer input of data and basic analysis:
- 3) Analysis of natural environment:
- 4) Analysis of forest functions:

#### **(2) Analysis of Natural Environment**

Basically in the same manner of thinking and analysis as for the Wide Area, the following studies were made:

- 1) Soil Erosion Potential (2)
- 2) Hazard of Land Collapse/Slide (2)
- 3) Water Holding Potential (2)

The same weightings were applied as for the Wide Area.

#### **4) Evaluation of Natural Environment (Natural Potentials)**

This analysis combines the results of the above three analyses to evaluate the potential for natural disasters and water source conservation. It was based on the same procedure and criteria as used for the Wide Area.

The result of the natural potentials analysis are summarized by Parcel in the table below.

Parcel \ Potential	Soil Erosion Potential (2)	Hazard of Land Collapse & Slide (2)	Water Holding Potential (2)	Natural Potentials	
				Existing Forest Area	Existing Grassland Area
I (North of Kasibu)	High soil erosion potential in most area except farmland	Area-wise, medium potential dominant. High potential in sharp slopes in the north	Medium potential in high elevations, high potential in lowland	High potential from midway up mountain in to ridges	Mostly high potential
II (South of Kasibu)	ditto	Area-wise, medium potential dominant. High potential in sharp slopes	ditto	High potential at ridges	ditto
III (Bayombong area)	ditto	Area-wise, medium potential dominant. Low potential in lowland	High potential in lowland, medium potential in mountains	ditto	ditto
IV (South of Bayombong)	ditto	Area-wise, high and medium potential equally dominant	ditto	ditto	ditto
V (South of Dupax)	ditto	Area-wise, high potential dominant	ditto	ditto	ditto

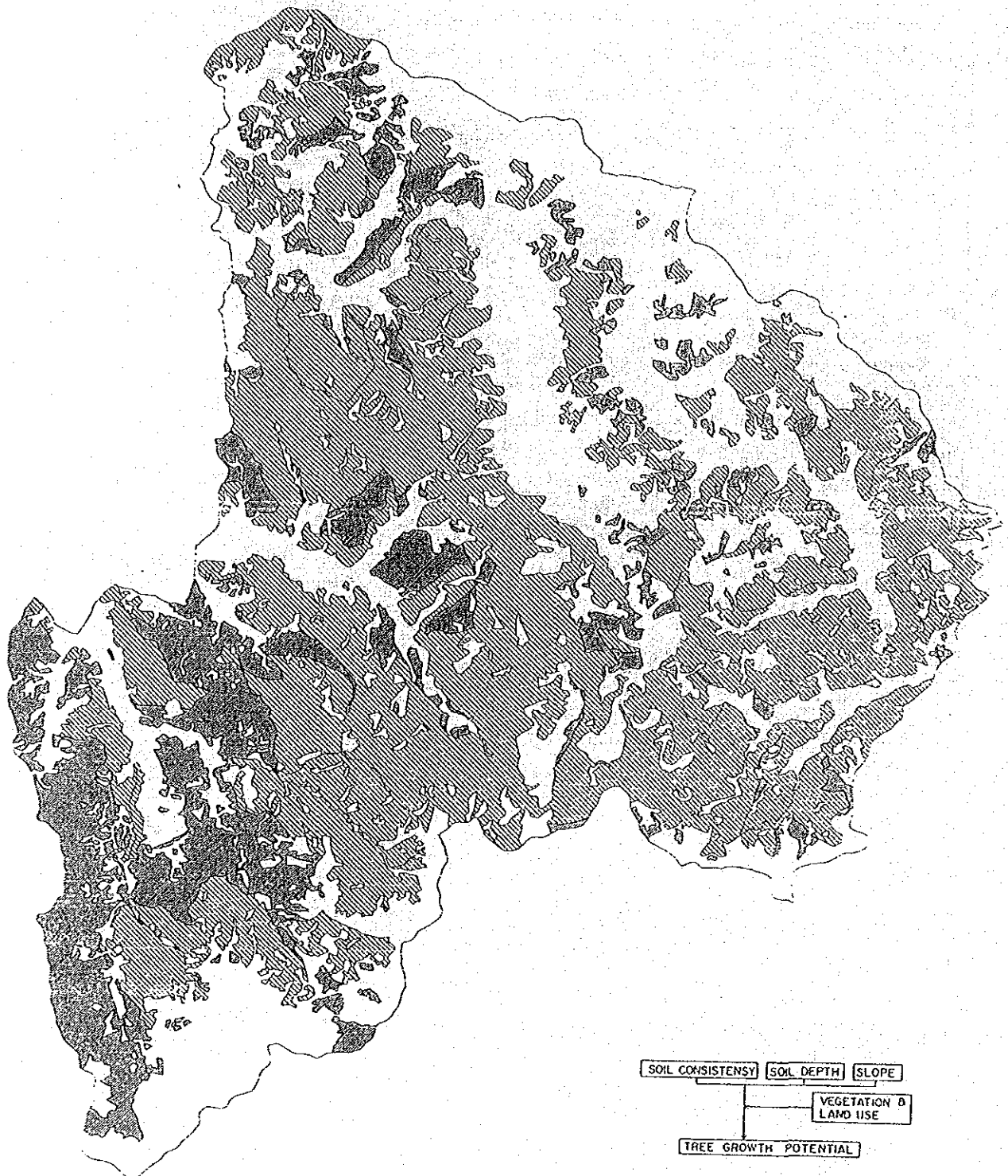


Fig. 6-3. Tree Growth Potential

#### 6-4 Basic Policy for Forest Management of Model Area

##### 6-4-1 Allocation of Model Area in Cagayan Watershed

The forests in the Model area amount to some 38,000 ha. in area accounting for 1.5% of the total forest land area of Region II. Geographically, the area is located nearly at the north of Luzon Island. With the present status of forests, and the presence of Kaingin and grazing lands, the area embraces all problems typical of the Cagayan River Valley at large involved in forest management including afforestation, marketing of forest products, I.S.F., etc.

Two major rivers of northern Luzon, i.e., Cagayan and Magat, originate here making the area central to the proper functioning of forests in the region as a whole in their public roles such as preservation of water resources and prevention of land hazards. Moreover, the access roads to the area are generally in order to make the area most appropriate for a model area of the Cagayan River Valley.

##### 6-4-2 Basic Guideline for Forest Management of Model Area

Forest Management Planning for the Model Area is based on the Forest Management Plan for the Wide Area. As basic guideline, emphasis is placed first on the maintenance and promotion of the public functions of forests in view of the fact that the destruction of the nature in the reckless felling of forests as seen has led to soil erosion, draining of sands and gravels, and flooding, to inflict considerable damages on human lives and properties. Secondly, emphasis is on the need for development of the regional communities through promotion of forestry by creating employment to solve such social problems that are due to increasing population and that relate to the settlement of kaingineros.

At the same time, it is important to work out a way to ensure sustained supply of forest products to serve as a basis for forest management in view of a growing concern held over shortages in forest product supplies due to shrinking forests.

The above tasks are described specifically in the following pages.

##### (1) Maintenance and Promotion of Public Functions of Forest

##### (a) Enhanced functions for preservation of water resources and preservation of natural hazards inherent in mountainous areas

The forest land accounts for 32% of the Model Area. But it is mostly poor in quality of tree stands since good ones have been cut and carried out, and weakened in its capacity to preserve water resources due to Kaingin which has reduced forests as it advanced further inland. While flooding after a torrential downpour is not as frequent as in some other parts, but damages built up over the years resulting in barlands due to land collapses on the steep slopes. Hence the need for efforts to protect forest lands by planned management as well as to improve the quality of tree stands.

##### (b) Establishment of Restricted Forests such as Protection Forest

Presently there are no restricted forests designated as Conservation Forest, Protection Forest, or Preservation Forest in the Model Area. As mentioned above, however, there is the need for restriction of activities involving forests for preservation of water resources and protection of outflow or collapses of lands. Therefore, the plan calls for establishment of restricted forests where necessary to protect steep slopes and riverside forests.

(c) Promotion of Function as Park and Outdoor Recreation

In view of the socio-economic environment surrounding the Model Area, obviously there is not much demand for parks and outdoor recreation at least for now. But in longer terms attention should be paid to the function of forests in this respect and preliminary steps taken so as to shape forests that can serve that purpose. For areas where forests can be expected to serve the purpose of parks and outdoor recreation of the populace, such steps can be taken as to restrict cutting of trees and to locate protection forests, for example.

(2) Contribution to Regional Social Development

Traditionally in this area the primary industry provides the bases for the regional economy and social activities. Since forests are closely related to the industrial development and the improved welfare of people in this region, their planned management is expected to contribute to the interests of the region as a whole.

(a) The plan is expected to raise the living standards of the regional population by supplying timber and fuelwood.

(b) Efforts will be made, under the Integrated Social Forestry Program (I.S.F.), for maintenance of regional productive capabilities, environmental protection, sustained supply of timber and fuelwood.

(c) Efforts will be made to create employment opportunities for local people.

(3) Continued Supply of Forest Products

In order to ensure sustained supply of forest products, resources must be maintained to keep up with supplying through afforestation to be made steadily and carefully, depending on individual locations so as not to disrupt the public functions of forests. At the same time, in order to improve the quality and health of forests, measures are to be worked out for nursing and protection of tree stands and particularly for prevention of forest fires.

(a) Development of Sound Afforestation

For afforestation, due studies will be made of climate, terrain conditions, elevations, soils and other related conditions. In this particular area, two types of area are considered, areas like bareland and grassland where certain preceding tree types are planted initially for coverage to be replaced by more useful types gradually in later stages on the one hand, and on the other, those where production type trees are planted from the beginning. Both areas



must be properly selected and adequate nursing and other necessary care taken to ensure sound afforestation.

(b) Promotion of Natural Forest Growth Management

Where afforestation is not possible because of steep slopes for example, natural forest growth will be promoted.

(c) Development of Forest Road Network

To help carry out forest operations efficiently, a forest road network will be developed. In doing so, due attention will be paid to the conservation of the environment, and forest land in particular, to be involved.

**6-4-3. Target Forest of Forest Management Plan**

In accordance with the basic policy, target forests are classified as follows. Logged-over, secondary (NY) consists of the production forest where selective tree cutting is allowed to supply the local population with required fuelwood and timber while harvest is yet to be expected from afforestation, and the rest as Protection Forest.

Reproduction and Bushland (NR) and Mossy Forest (NY) is mostly located on the ridges at a higher elevation, and therefore, designated as Protection Forest to preserve water resources and prevent land hazards.

Permanent Cropland (Mc<sub>2</sub>) is partly to be included in I.S.F. considering the actual conditions, but generally defined as Protection Forest.

Seasonal Cropland (Mc<sub>1</sub>) is to be included in I.S.F. in as much as possible and those scatteredly found in Logged-over, secondary and Grassland are defined as applicable to afforestation from the standpoint of forest management.

Grassland (G) is to be developed to help sustained supplying of forest products and to create employment opportunities for local people. Specifically, approximately one half of it will be developed for afforestation (production forest) and the other half for grazing land. In an effort to promote agroforestry (I.S.F.) so as to help stabilize the livelihood of local populace, sites for development for that purpose have been selected mainly from Grassland.

The existing status and the targets are as shown in Table 6-4.

Table 6-4. Existing Status and Targets

Existing status (Area for each Vegetation & Landuse)				Targeted Forests (ha)								
Classification	Sym bol	Area	%	Production forest			Protection forest			Parks & Outdoor Recreation forest	Grazing land	Agroforestry (I.S.F.)
				Timber	Fuel wood	Watershed forest	Wilderness area	Mossy forest				
Logged-over, secondary	NL	12,389	32.8	(992)	(2,314)	8,794						289
Reproduction and Brushland	NR	578	1.5				545					33
Mossy forest	NY	972	2.6						972			
Sub-total		13,939	36.9									
Seasonal cropland	Mc <sub>1</sub>	1,336	3.6	584	27							725
Permanent cropland	Mc <sub>2</sub>	14	0			7						7
Sub-total		1,350	3.6									
Grassland (include pasture)	G	22,449	59.5	5,361	4,083	9				255	10,362	2,379
Built-up Area	B	5	0									5
Sub-total		22,454	59.5									
Total		37,743	100.0	6,937	6,424	8,810	545	972	255	10,362	3,438	
Percentage of Target Forest %			100.0	18.4	17.0	23.3	1.5	2.6	0.7	27.4	9.1	

( ) Selective cutting, Watershed 9ha in C are soil and water conservation work area.

## 6-5 Forest Management Planning

### 6-5-1 Forest Block

Since the forests that the Forest Management Plan deals with are wide-spread in area and varying in nature, the forest lands require to be divided into blocks of an appropriate size for efficient forestry management. For each individual project, target forests must be identified in terms of location and area and given numbers for the convenience of keeping records of operations and changes done to forests. Forest lands are divided into areal units of the following three levels.

#### (1) Parcel

This is the largest unit on the order of 10,000 hectares in this particular plan defined on the basis of a major watershed relevant to the implementation and management of forestry.

#### (2) Compartment

Since this is intended as a permanent unit of segmentation, particular attention needs to be paid so that they are orderly defined. Boundaries are to be set on easily recognizable terrain features such as ridge lines, valleys, and other natural boundaries, or fixed objects like roads. This type of unit varies depending on the status of forests to deal with and intensity of a project, and in this particular plan, it ranges from 400 to 500 hectares.

#### (3) Sub-Compartment

When depending on the purpose of a project and Compartment deemed too general, it is further divided into Sub-Compartments. Such division of a Compartment into Sub-Compartments is based on the distinctions of tree species, ages, positions, accessibility to transportation as well as of land use and administrative boundaries. As far as this unit is concerned, division and integration are made as appropriate depending on the project.

#### (4) Identification of Forest Blocks

Parcels are identified by Roman numerals (I to V in this planning) and Compartments by serial numbers. Sub-compartments are referred to in capital letters of alphabet. When further division is necessary, resulting sub-sections are identified by small letters of alphabet.

#### (5) Names and Areas of Forest Blocks

Names and areal sizes of Parcels, Compartments, Sub-Compartments are given in the Forest Information Table and shown in the Base Map.

The table below shows the numbers and sizes of Compartments and Sub-Compartments for each Parcel.

Table 6-5. Numbers and Sizes of Compartments and Sub-Compartments for Each Parcel

Parcel	Compartment	Numbers of Compartment	Numbers of Sub-Compartment	Area (ha)
I	1 ~ 13	13	144	6,211.94
II	14 ~ 24	11	124	4,923.71
III	25 ~ 40	16	149	7,924.74
IV	41 ~ 58	18	130	8,055.28
V	59 ~ 82	24	176	10,627.59
Total		82	723	37,743.26

#### 6-5-2 Forest Information Table

The Forest Information Table as attached to this report was compiled to help the forest management planning, by tabulating the results of studies of natural environment and forest land classification in terms of the Sub-Compartment, the smallest unit of planning.

#### 6-5-3 Term of Management Plan

In view of the large size of forestland area that it deals with and the prolonged time it takes the trees to grow, the term of the Management Plan should be made as long as possible. At the same time, however, considering the pace and extent of social and economic changes in recent years too long a term would make little sense. In Japan, a standard term for forest management planning is 10 years, and every five years a review is made for checking the changes in the circumstances as well as the performance of the plan. Therefore, a 10-year term is applied also for this management planning.

#### 6-5-4. Reforestation

##### (1) Selection of Location to be planted and Reforestation Area

To increase the productivity of forests and ensure sustained supply of forest products while maintaining the public functions of forests such as preservation of water resources and conservation of the nation's land, requires appropriately planned regeneration and nursing of trees. Sites to be planted were sought mainly from Grasslands which account for approximately 60% of forest lands. Since the area lacks experience in forestry, there are many problems to be addressed in terms of technicalities and labor. In view of the past records of seedling production, it is not advisable to assign a large area. Also by taking the Pasture Lease into account, an average of 1,000 ha. per annum is proposed. A total of about 10,000 ha. over a planned period of 10 years and parts of Seasonal Crop-land that are not included in I.S.F. are planned for planting. Of the areas that

Table 6-6. Summary of Reforestation Planning Data

Parcel	Num bers of Compart ment	Regeneration area (ha)		Area of each planting species (ha)										Remarks	
		Artificial reproduction	Natural regeneration	Total	G-i-i	A <sub>m</sub>	A <sub>a</sub>	Y <sub>a</sub>	E <sub>c</sub>	P <sub>k</sub>	M <sub>o</sub>	M <sub>a</sub>	N <sub>a</sub>		T <sub>e</sub>
I	5	1,163.25	34.77	1,198.02	0	22.49	0	302.24	37.83	428.33	179.51	3.99	134.55	54.31	
II	5	1,196.02	27.66	1,223.68	0	119.39	48.33	203.42	0	252.30	203.36	105.61	121.65	141.74	
III	7	1,825.68	0	1,825.68	0	0	0	399.10	0	405.86	304.78	259.44	202.30	254.20	
IV	9	3,016.61	2.53	3,019.14	162.53	279.45	112.27	688.29	50.00	1,092.01	283.29	111.28	123.17	114.32	
V	11	2,853.32	21.11	2,874.43	140.43	561.47	0	953.34	30.00	672.03	217.44	152.52	47.86	78.13	
Total	37	10,054.88	86.07	10,140.95	302.96	982.80	160.60	2,546.39	117.83	2,850.53	1,188.40	633.14	629.53	642.70	
					3	10	2	25	1	28	12	6	6	7	Ratio of each species (%)

call for regeneration those with the rating of L of slopes are not suited for afforestation and therefore reserved for natural regeneration. Each site for planting with area is as listed in the Planned Reforestation Table with its summary table given in Table 6-6.

(2) Regeneration Species and Final Cutting Age

The following species have been selected as applicable to regeneration under this plan, considering the natural conditions including soils and the growths of natural stands as well as those to be planted.

Table 6-7. Regeneration Species and Final Cutting Age

	Regeneration Species			Final Cutting Age
	Local Name	Symbol	Scientific Name	
Fast growing species	Giant ipil-ipil	G-i-i	<i>Leucaena leucocephala</i>	6 yr.
	Acacia mangium	Am	<i>Acacia mangium</i>	10
	Acacia auriculiformis	Aa	<i>Acacia auriculiformis</i>	10
	Yamane	Ya	<i>Cmelina arborea</i>	10
	Eucalyptus camaldulensis	Ec	<i>Eucalyptus camaldulensis</i>	20
Long maturity species	Pinus kesiya	Pk	<i>Pinus khasya</i>	30
	Molave	Mo	<i>Vitex parviflora</i>	40
	Mahogany	Ma	<i>Swietenia macrophylla</i>	40
	Narra	Na	<i>Pterocarpus indicus</i>	80
	Teak	Te	<i>Tectona grandis</i>	80

(3) Numbers of Trees to be planted

The numbers of trees to be planted by species are as follows.

Table 6-8. Numbers of Seedlings to be Planted by Each Tree Species

Tree species	Numbers of seedlings to be planted per hectare	Planting interval
Acacia mangium	1,667	2m x 3m
Acacia auriculiformis	1,667	2m x 3m
Eucalyptus camaldulensis	1,667	2m x 3m
Giant ipil-ipil	2,500	2m x 2m
Yamane	1,667	2m x 3m
Pinus kesiya	1,667	2m x 3m
Molave	2,500	2m x 2m
Mahogany	1,111	3m x 3m
Narra	2,500	2m x 2m
Teak	833	3m x 4m

The numbers are estimated as most adequate based on:

- Ipil-Ipil Planting Site Survey, Foreign Forest Consulting Association
- Tropical Forestry: Letters from Pantabangan, Tsutomu Handa
- Tropical Forestry: Forestry in Saba, Akiyuki Oshima
- Report on Forestry Planning Standards Preparation Survey, JICA

### 6-5-5 Seedling Production

#### Seedling Production Volumes by Tree Species

From the sizes of areas to be reforested by species and the numbers of trees to be planted per hectare, the volumes of seedlings required to be produced for this project have been computed as shown in Table 6-9 below.

Table 6-9. Required Volumes of Seedlings by Species and Parcel

(Unit: 1000 seedlings)

Species Parcel	G·i·i	Am	Aa	Ya	Ec	Pk	Mo	Ma	Na	Te	Total
I	0	37	0	504	63	714	449	4	336	45	2,152
II	0	199	81	339	0	421	508	118	304	118	2,088
III	0	0	0	665	0	677	762	288	506	212	3,110
IV	406	466	187	1,247	83	1,820	708	124	308	95	5,344
V	351	936	0	1,589	50	1,120	544	170	120	65	4,945
Total	757	1,638	268	4,244	196	4,752	2,971	704	1,574	535	17,639

### 6-5-6 Wood Production

There is a strong demand on the part of local residents for fuelwood and timber for housing as essentials for living. At the same time, however, in view of the current status of forest resources, there is a need to minimize tree cutting in order to maintain and promote public functions of forests as indicated in the Basic Policy.

Against this background, the plan for production of fuelwood and timber has been worked out as follows.

Table 6-10 (1) Timber Production Plan

Parcel	Cutting method	Area (ha)	Species	Percentage of selective cutting (%)	Volume* (m <sup>3</sup> )
I	Selection	8.30	Mixed	10	105
II	"	78.58	"	"	998
III	"	304.77	"	"	3,870
IV	"	379.57	"	"	4,821
V	"	582.73	"	"	7,401
Total		1,353.95			17,195

\* Volume means merchantable volume (without bark)

Table 6-10 (2) Fuelwood Production Plan

Parcel	Cutting method	Area (ha)	Species	Percentage of selective cutting (%)	Volume (m <sup>3</sup> )	Volume of branches and twigs (m <sup>3</sup> )	
						Fuelwood	Timber
I	--	--	--	--	--	--	92
II	--	--	--	--	--	--	868
III	Selection	1,046.47	Mixed	10	20,542	11,555	3,365
IV	"	91.09	"	"	1,788	1,006	4,191
V	"	814.45	"	"	15,988	8,993	6,434
Total		1,952.01			38,318	21,554	14,950
						74,822	

## (1) Survey Preceding Felling

## 1) Determination of volumes

Prior to felling, a sampling plot is set up for each Sub-Compartment at a location where the forest type is representative, to take inventory. Based on the inventory survey results, volumes are determined at 10% cutting.

– For timber, the following volume formulas applicable to Northern Luzon are employed:

$$\text{Dipterocarp Forest} \quad V_{m^3} = 0.00005203 (D^2 H)$$

$$\text{Non Dipterocarp Forest} \quad V_{m^3} = 0.00005109 (D^2 H)$$

– For fuelwood, production volumes are determined on the basis of a branch and twig volume calculated for a standard tree and percentage in the effective volume to be felled.

## 2) Tree selection

In felling the volumes as determined above, trees to be felled must be selected properly by paying attention to the following.

- To avoid too heavy thinning of crowns so as to protect the ground surface,
- Not to cut trees growing on the steep slopes,
- To choose matured trees, overmatured trees, damaged trees, for preference,
- To mark the selected trees.

## (2) Methods of Logging

Most of the forests for felling have gone through the felling two or three times in the past, thus leaving little stand with large diameters.

## 6-5-7 Forest Road

The forest road is basically an infrastructure for forest management but simultaneously has a great effect on the quality of living environment and pro-



motion of industry and economy of the farming and other outlying communities in the region.

The forest road network is to be developed by taking into consideration the locations of communities and utilizing the existing roads and its routing should be planned not only in conformity with I.S.F. and the reforestation and timber and timber and fuelwood production plans but also with a view to having it serve as a trunk road for regional transportation in the future.

(2) Forest Road Plan

Forest roads were planned for each Parcel and Compartment, including improvement of existing roads, as shown in the Forest Road Plan Chart .

6-5-8 Conservation of Soil and Water

Soil and Water Conservation Work

Locations and scopes of soil and water conservation work for the Model Area have been determined based on the potentials for land collapses and slides and other present conditions as given in the Forest Information Table, considering further their impact, related land use, and the Forest Land Classification of this planning.

Types of work

Type	Description
Hillside work	Stabilize delapidated soil layers of hillsides, hold down the soils, and plant vegetation.
Stream work	Prevent lattice erosion of rivers, build a check dam or a weir to stop sedimentary down-flow.
Retaining wall	Designed mainly to prevent lattice erosion of riversides. For direct protection of a curving riverside theratened by land collapse.
Spur jetty	Designed to prevent lateral erosion by changing directions of flows, reducing force of flow, or narrowing width of flow.

Table 6-11. Soil and Water Conservation Works (by Parcel)

Parcel	Compartment	Sub-compartment	Land-collapse rating	Area (ha)	Type, Scale, Quantity * (m) (km)	Road length (km)	Remarks
I	4	K	M	5	No work	—	
	8	A-E	M	103	Sw 2 unit, (L=20, H=3)	4	
	8	G	M	35	Sw 1 unit, (L=20, H=3)	4	
	8	I	M	68	Sw 1 unit, (L=20, H=3)	4	
II	19	A	M	186	Sw 2 unit, (L=20, H=3), Hw 1	2.2	
	20	M	M	78	Sw 1 unit, (L=30, H=4)	0.5	
	21	B-G-I-K	M	110	Sw 1 unit, (L=20, H=3), Hw 1	0.7	
	23	B-I-L	M	245	Sw 4 unit, (L=20, H=3), Hw 0.5	1.3	
III	25	J	M	51	Sw 1 unit, (L=20, H=3)	—	
	27	F	M	87	Sw 1 unit, (L=10, H=2), Hw 1	0.6	
	31	B-F	M	363	Sw 3 unit, (L=20, H=3), Hw 4	1.1	
	32	A	M	205	Sw 2 unit, (L=20, H=3), Hw 1	—	
	38	C-D	M	111	Sw 1 unit, (L=40, H=4)	0.5	
	39	E	M	42	Hw 1,5	—	Width 10m
	40	E	M	3	No work	—	
IV	47	E	M	570	Sw 4 unit, (L=20, H=3) Sw 2 unit, (L=40, H=4), Sj 0.5	1.3	
	48	H	M	316	Sw 2 unit, (L=20, H=3) Sw 3 unit, (L=40, H=4), Sj 0.5	3	
	49	A	M	331	Sw 1 unit, (L=30, H=3), Hw 1.5	0.7	
	51	B	M	483	Sw 3 unit, (L=30, H=3), Hw 4	1.2	
	52	A	M	231	Sw 2 unit, (L=30, H=3), Hw 1.5	0.7	
	53	A	M	292	Sw 2 unit, (L=30, H=3), Hw 1.5	1.5	
	56	A	M	666	Sw 2 unit, (L=20, H=3) Sw 3 unit, (L=30, H=3), Hw 1.5	1.4	
	58	A-D	M	161	Sw 2 unit, (L=20, H=3), Hw 1	0.2	
V	62	E	M	4	No work	—	
	63	A	H	448	Sw 4 unit, (L=36, H=3), Hw 7 Sw 2 unit, (L=40, H=4), Rw, Sj 3	1.8	
	64	L	H	370	same as above	1.8	Width 10m
	65	A-D	H	410	Sw 4 unit, (L=30, H=3), Hw 2	1	
	65	C	M	20	No work	—	
	67	C-E	M	78	Sw 2 unit, (L=20, H=3)	1.1	
	69	A-D	M	40	No work	—	
	71	A-H	H	322	Sw 3 unit, (L=30, H=3), Hw 1.5	0.2	
	71	I	M	3	No work	—	
	73	F	M	4	No work	—	
	75	D	M	6	No work	—	
	77	A	M	2	No work	—	
	79	H	H	276	Sw 2 unit, (L=20, H=3), Hw 2	1.1	

\* Hillside work -- Hw, Stream work -- Sw  
Spur jetty -- Sj, Retaining wall -- Rw

\*\* Soil conservation work (hill side) area -- 9.00 ha.

#### 6-5-9 Parks and Outdoor Recreation Area

A protection forest for parks and recreation has been located in the vicinity of the southern boundary of this project area at around the waterfall, as shown in Figure 6-4.

It is 255ha. in area covering Parcel IV, Compartment 49, Sub-Compartments A, B, and D, Compartment 50, Sub-Compartments A and B. This is going to be a scenic area with the waterfall as a main feature serving the purpose of health and recreation for local residents, with added recreational facilities.

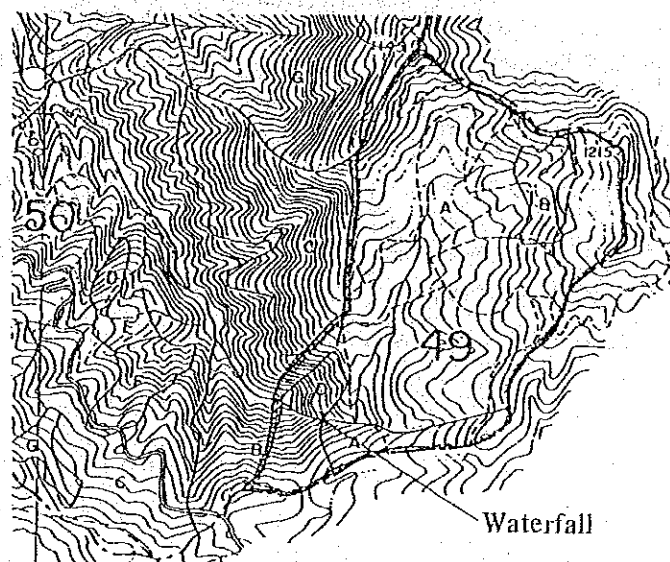


Fig. 6-4. Location of Parks and Outdoor Recreation Area

#### 6-5-10. Minor Forest Production

Minor forest products in the project area include rattan bamboo, and medical plants. A study of documents shows that rattan among others is most promising in terms of reserve as a resource and demand as a product. Therefore, rattan was chosen for planning here.

Resources of poles of 2cm or more in diameter amount to 279 pieces per hectare 1,946m, for Dip. Old Grow Forest and 233 pieces per hectare, 1,448m, for Dip. Residual Forest. So that, if tending and maintenance are properly done, they can be counted upon as a source of sustained supply.

#### 6-5-11. Forest Protection

##### (1) Forest Fire

Forest fires are said to be the number one cause of forest destruction. This project envisions the expanded reforestation and what to do for prevention of forest fires is critical to its success.

Table 6-12. Location and Length of Fire Line

Parcel	Location (Parcels & Compartments)	Length	Remarks
II	17, 18 compartments	2.75 km	10m in width
	22, 23 compartments	2.00	
III	29, 30 compartments	2.25	
	32, 33 compartments	2.75	
	III IV parcels	6.25	
IV	45, 46 compartments	2.00	
	51, 52 compartments	1.50	
	57, 58 compartments	2.50	
	IV V parcels	6.50	
V	61, 62 compartments	1.25	
	71, 72 compartments	2.75	
	79, 80 compartments	1.50	
Total		34.00	

## (2) Watch Station

For early detection of a forest fire, watch stations will be set up at three locations as found most effective by the Exposure analysis done in the basic study of this project. They are operative during the dry season from November to April of the following year.

The locations of fire stations are shown in Table 6-13.

Table 6-13. Places of Watching Station

NO.	Place			Territory of watching station
	Region	Parcel NO.	Compartment NO.	
1	Kasibu	I	9, 10	All of I, II parcels, ridge parts of IV, V parcels.
2	Bayombong	I, III	12, 13, 27	All of III, IV parcels, ridge parts of V parcel.
3	Dupax	V	70, 71, 73	All of V parcel, ridge parts of III, IV parcels.

## (3) Forest Administration

In view of the fact that forests are shrinking due to forest fires and migratory cultivation, this plan put emphasis on protection of forests. In particular, many of the planned areas for reforestation are contiguous to cultivated lands and, therefore, carry that much higher risk of forest fires. Hence the need to strengthen the surveillance particularly during the dry season as clearing and burning are undertaken. At the same time, local residents should be educated on the need to care for forests.

#### 6-5-12. Research Activities

The items of activities that need to be done for now in this project to improve forestry technology and ensure successful results are as follows.

- Establishment of Reforestation Technology
  - Reforestation Performance Survey (to examine suitability of site and species)
  - Weeding (Brush cutting) Method Survey (to find and effective tending method)
  - Protection against forest fires
- Development of Natural Regeneration Technology
  - Keeping track of new growths in natural growth forests.

#### 6-6. Integrated Social Forestry (I.S.F.)

##### (1) Basic Concept

In 1982, the Philippine Government inaugurated I.S.F. (LOI NO. 1260), declaring its objective as "utilization of forest resources for economic and social development of the nation through mobilization of kaingineros and other local residents who will play an important role in food production and forest rehabilitation".

The studies and analyses on forests, forestry, and further on socio-economic environment of the region, as well as the questionnaire survey polling the residents in the Model Area, find that there are strong desire and expectations on the part of the local populace for expanded farmland and grazing land, private planting of fruit trees, increased production of forest products as their cottage industry craft work materials.

Based on these findings, the Forest Management Plan expands on Contribution to Regional Social Development as part of this basic policy and specifically points out the importance of I.S.F. in maintenance of land productivity, environmental conservation and timber and fuelwood supplying.

Thus, the Plan in its basic concept sought areas suitable for I.S.F. in as much as possible, and formulated plans to further improve them.

##### (2) Management Scope and Contents

In view of the living conditions of local residents as found by the Questionnaire Survey and the scopes required by various I.S.F. programs, the individual (family) holding is made less than 7 hectares, which breaks down as follows.

##### 1. Cultivated land -- 1.5 ha.

Residential and farmland for raising agricultural produce with slopes not to exceed 18%. Bamboos to be encouraged for planting around the residential area for supplying of craft work materials.

2. Fruits, rattan, coffee – 1.5 ha.

Such items and types of products as most appropriate for marketing as local specialities are introduced. Medical plants to be planted at the base of a tree.

3. Timber/fuelwood production forest – 2 ha.

To ensure supplies of timber and fuelwood for local residents for their household consumption.

4. Livestock – 1.5 ha.

Basically intended for grazing of working cattle and supplying of fodders. Efforts focus on improved productivity of grassland and effective management. For erosion control and grazing, shading trees (forage trees) to be introduced along the contour lines or in clusters.

The above is summarized in Table 6-14. For details, refer to ANNEX 10, and The I.S.F. Plan Table.

Table 6-14. Areas by Use and Parcel

Parcel Main use	I	II	III	IV	V	Total (ha)
No. of households	55	157	110	74	135	531
Agriculture	82.50	235.50	165.00	222.00	202.50	796.50
Fruits	49.81	185.78	69.67	57.96	133.43	496.65
Timber/ Fuelwood	111.46	413.00	220.59	150.04	263.85	1,059.94
Rattan/ Coffee	36.95	42.97	84.80	41.11	82.70	288.53
Livestock	82.50	235.50	165.00	111.00	202.50	796.50
Total	363.22	1,013.75	705.06	471.11	884.98	3,438.12
Average per household	6.60	6.46	6.41	6.37	6.56	6.47