6–3–2 Socio-Economic Environment

(1) Socio-Economic Condition

The model Area is within the province of Nueva Vizcaya. It falls within the Cagayan River Basin and the Magat River Basin. The municipalities (Administrative Districts) of Kasibu, Dupax del Norte Bambang and its vicinities fall within Cagayan River Basin while Dupax del Sur falls within Magat River Basin. Local Populations are formed in 13 Barangays (two of them without captain) in Kasibu, 4 in the Bambang area, 7 in Dupax del Norte, and 8 in Dupax del Sur, each Barangay is represented by a Brangay captain.

According to a 1986 survey, the population was 19,994 in Kasibu, 18,269 in Dupax del Norte, 11,293 in Dupax del Sur, totalling 49,556. There are migrations into the region being planned and, coupled with natural growth, populations are expected to increase.

For transportation, the Model Area is served by a Provincial road running east-west in the northern part and a State road in the western and northern parts. But they are not enough to substantiate the road net work in the area. The Model Area to the west, Bambang area, Dupax del Norte, and Dupax del Sur, are located close to a major highway and therefore closer to markets and economic activities than the rest of the area. Major administrative facilities in the Model Area include Town Halls, one in each administrative district, and Dupax Forest District Office.

Of 48,980 ha., a total of the Model Area, A and D is 13,140 ha., the rest being forestland, of which 53% is grassland and 31.6% defined as Forestland is mostly logged-over or marked by thin stands for which secondary felling is in progress.

With respect to the timber-related industries in Nueva Vizcaya Province in 1985, log production amounted to 90,476m^3 and timber production 15,633m^3. In the Model Area, there is a Kasibu Logging Corporation saw mill. Since 1986, however, when the permits for logging expired the mill's operations have been suspended and felling is limited to household consumption only including fuel wood.

Economic activities in the Model Area, therefore, are limited to agriculture, pasture and grazing I. S. F., kaigin farming, cattle raising, cottage industry of forest product processing like rattan, fuelwood selling, which generate employment to some extent but are slow-paced in general. There are some encroachments of transitory cultivation by local people in the deep of mountains.

(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 6-7. 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-generations, 1 village–200 households/1000persons, 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 infrequent, ₱8,000. Many, ≫ Purchase, tree cutting, Yes, Many (timber, rattan), Often (sometimes), Many (involving housing, farm), 75/25	Small supply, ₱6,200 Many, < Purchase, tree cutting, Yes, but little, Few (rattan), Not often (sometimes), Few (involving farm, road), 0/100	Half supplied, ₱6,150 Many, ≒ Purchase, tree cutting, Yes, About half (rattan, tiger grass) Not often (rare), Many (involving farm, road) 75/25
Attitude	Planting experience, Forestry desired, Expected role of forest Ways to help forest,	Many experienced (fuelwood) Fuelwood, Fuelwood production, Planting, protection management,	Few experienced (timber) Timber, Timber, employment, disaster prevention, Same as left, forest road maintenance,	Many experienced (fuelwood, fruits) Fuelwood, Timber production, disaster prevention, Forest road, planting, protection,
Observation	Types of settlement	Developed, established farm community	In transition to farming community	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. The findings can be summarized as follows.

a) Population is increasing in Barangays due to migration from outside as well as to natural increase.

b) In all Barangays, agriculture, rice growing in particular, is a main source of income with other items being raised varying substantially.

c) Livestock raising is very common though its contribution to income apparently is not so significant, but there are many who wish to have more of livestock and it is expected to contribute to increased income in the future.

d) There are many who wish to expand their farms and grazing land.

e) Woodworking in cottage industry is in wide practicee providing a secondary source of income. There are many who wish to see increased production of materials for wood working.

f) Incomes average ₱5,000. – ₱6,000. Since they wish to see this increased by an average of ₱2,000., the income to support the standard living level can be assumed ₱7,000. – ₱8,000.

g) There are frequent seasonal shortages of water for both household and agricultural use, posing a problem in the living environment. Almost all of them have sustained cyclone damages to housing, farms, and roads. With the most recent damages still fresh in their mind, and prompted by shrinking forests, they show their increasing awareness of forests serving to prevent natural disasters.

h) With respect to forest products, the present demand is greater for fuelwood, which also leads others in the future demands as surveyed (all of those asked anticipated a future increase.). Timber for housing is expected to command no less demand in the future, obviously an indication of its shortages in many Barangays.

i) There are many who have experience of planting. Planting of fuelwood and fruit trees is very much in demand, indicating the importance of agro-forestry as a source of increased incomes.

j) local residents are highly motivated to cooperate for forest development. Specifically, tending of seedlings, road maintenance, and planting work, that are involved in forest development should provide increased employment opportunities giving a further impetus and thus helping to prevent forests from shrinking.

Note: There was one questionnaire survey conducted in the past over a period from December 1980 to February 1981. The survey polled Kaingineros covering the Diadi area, which was a site of a Magat reforestation project, Nueva Vizcaya, and the Atok area along the Baguio–Bontoc Road. (See Progress Report of June 1986.)

The survey differs from the present one in the types of subject people and subject matters, but the forms farming and cattle raising are very similar in both surveys. The findings of this present survey can be said to properly reflect the way people live in the Cagayan River Valley from the mountain foots up into the mountains.

(3) On-going Projects

The projects currently under way in the Model Area are as follows.

Table 6-8. On-going Projects in Model Area

Project Name	Area (ha)	Percent (%)
Plantation Project	2,831	7.5
Integrated Social Forest Project	338	0.9
Pasture Lease Project	2,448	6.5
Total	5,617	14.9

Note: 1) Percentages indicate rates those under Forest Management Plan in the total Model Area (37,743 ha).
2) This area is measured on the map.

A part of the Bayombon area in the north of the Model Area is covered by FMB–MSAPP Project (Magat Small Holder Agroforest Pilot Project). There are some 27,907 hectares that come under IFPP (Integrated Forest Protection Project), of which 20 ha. are designated as Planting Site, 532 ha. Forest Occupancy Management, and 1,597 ha. as Watershed Rehabilitation as well as green belt at three locations and three nurseries. There is a BFD IFPP office at Aritao serving as Forest Projection Pilot Component, Watershed Management and Erosion Control Project.

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 inforation:

In this step, 1/25,000 topographic map, Hydrology/Watershed Classifi-

cation Map, Geomorphology Map, Vegetation/Land Use Map, Soil Texture Map, Geology Map, etc. were prepared.

2) Computer input of data and basic analysis:

Data were captured in two forms as they were fed in the computer: polygones and grid cells. There are five items of data which were input in polygones: watershed (catchment area), geomorphology, vegetation/land use, soil texture, and geology. Elevation is the only item that was input in grid cells. Elevations were captured in approximately 250m x 250m cells, each cell represented by the elevation at the centroid. Based on the elevation data thus stored in the computer, slope analysis and exposures were made.

3) Analysis of natural environment:

From the basic data as input in the computer as above, the natural environment was analysed in terms of individual variables and, furthermore, by correlating such variables, potentials were assessed for soil erosion, land collapse/slide, water retaining capacity, etc.

4) Analysis of forest functions:

By introducing the existing vegetation/land use as additional factors to the findings of the natural environment studies, forest functions to prevent soil erosion and land collapse/slide were evaluated.

(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)

This analysis is an attempt to determine the soil erosion potential by correlating three factors: slopes, soil texture, and rainfall. Evaluation was based on the same weightings as applied to the Wide Area. (Figure 6-11)

2) Hazard of Land Collapse/Slide (2)

This analysis evaluates the hazards of land collapses and slides by correlating slopes, geology, presence of faults, and rainfall. The weightings for the respective variables were the same as applied to the Wide Area. The results are represented in Figure 6-12.

3) Water Holding Potential (2)

This analysis correlated four factors, i.e., slopes, soil texture, geology, and rainfall, to rate the capacity to retain surface water. The same weightings were applied as for the Wide Area. The results are shown in Figure 6-13.

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 results of the analysis are shown in Figure 6-14.

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

Potential / Parcel	Soil Erosion Potential (2)	Hazard of Land Collapse & Slide (2)	Water Holding Potential (2)	Natural Potentials	
				Existing Forest Area	Existing Grass-land 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

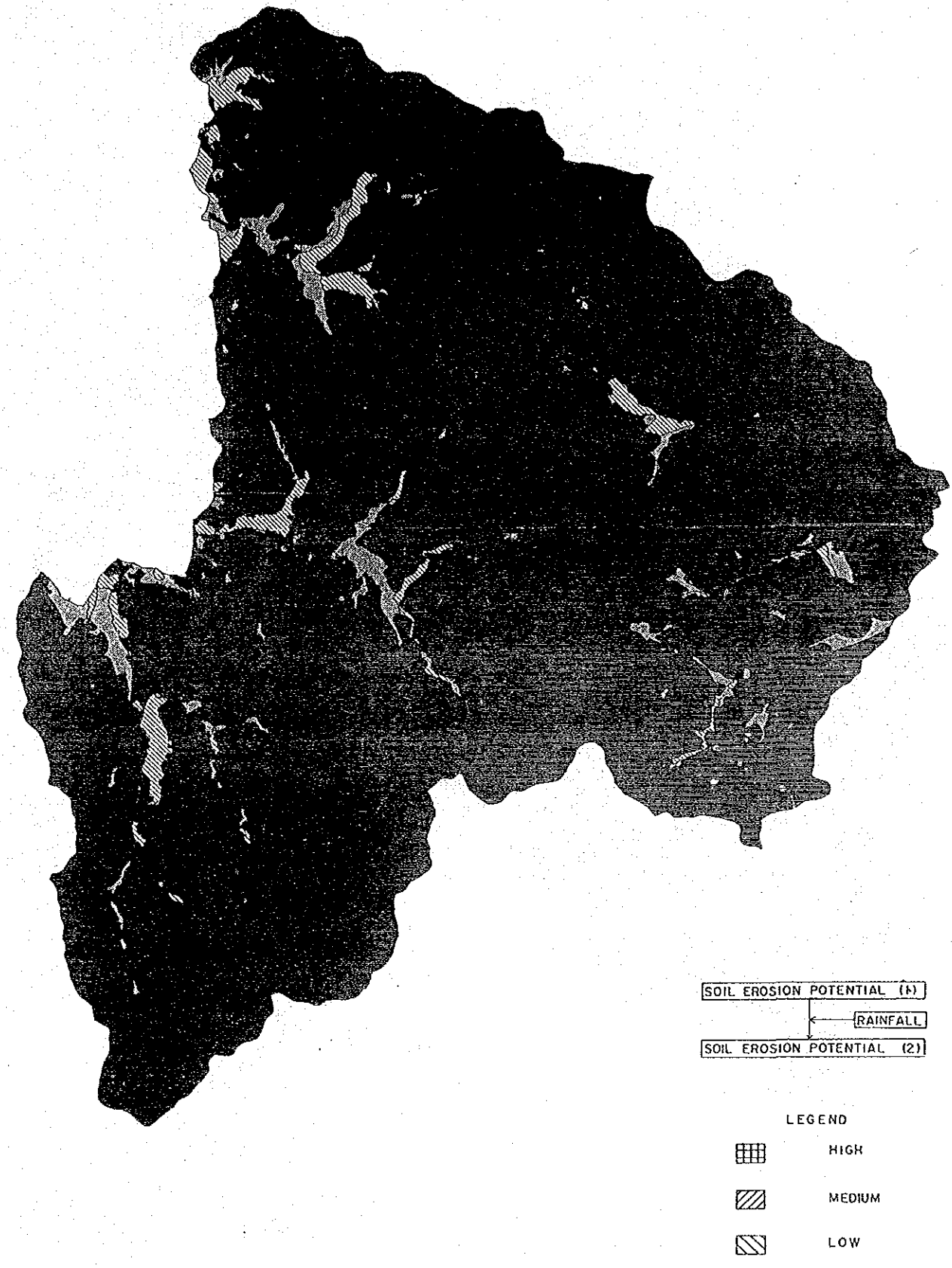

Fig. 6-11. Soil Erosion Potential (2)

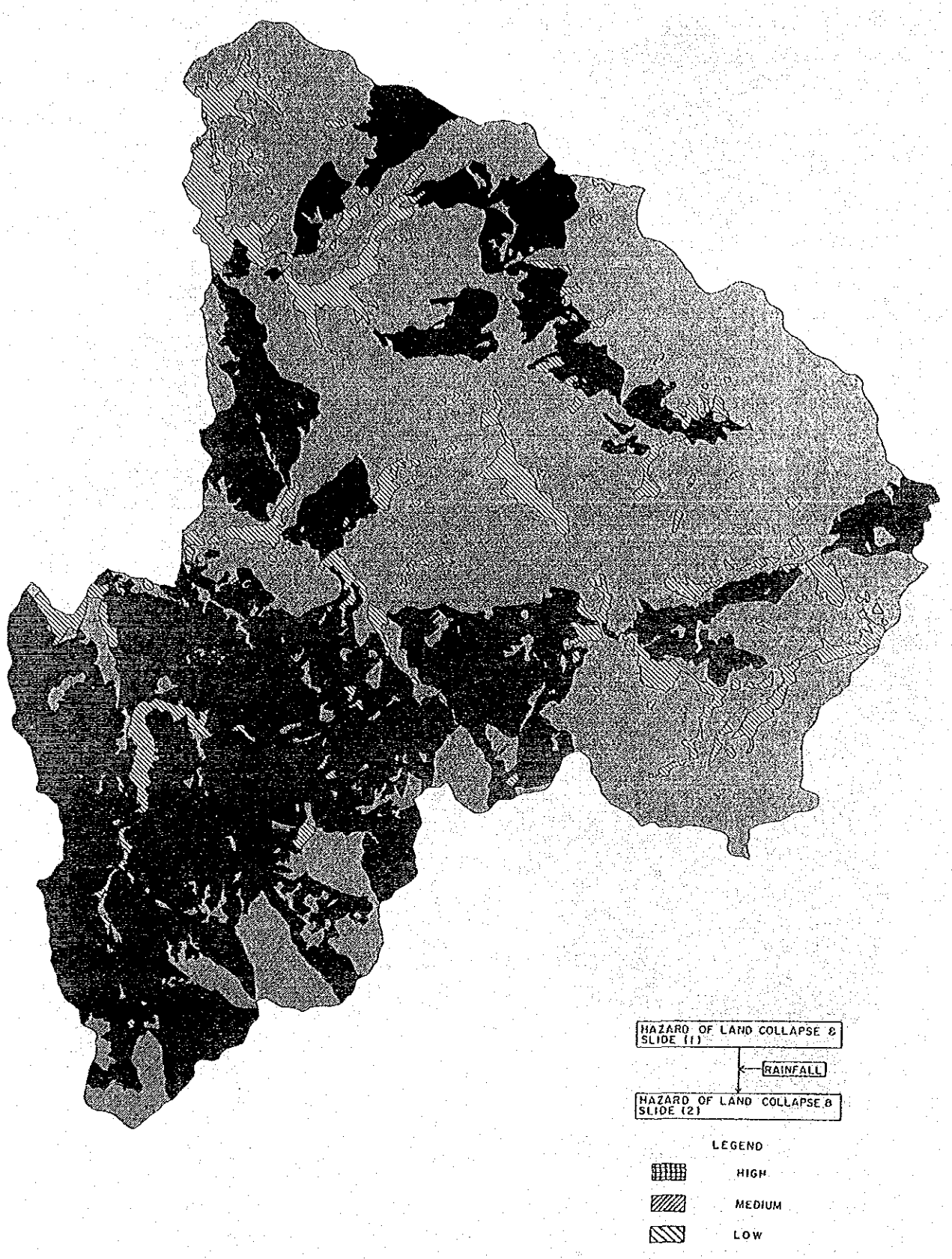

Fig. 6-12. Hazard of Land Collapse & Slide (2)

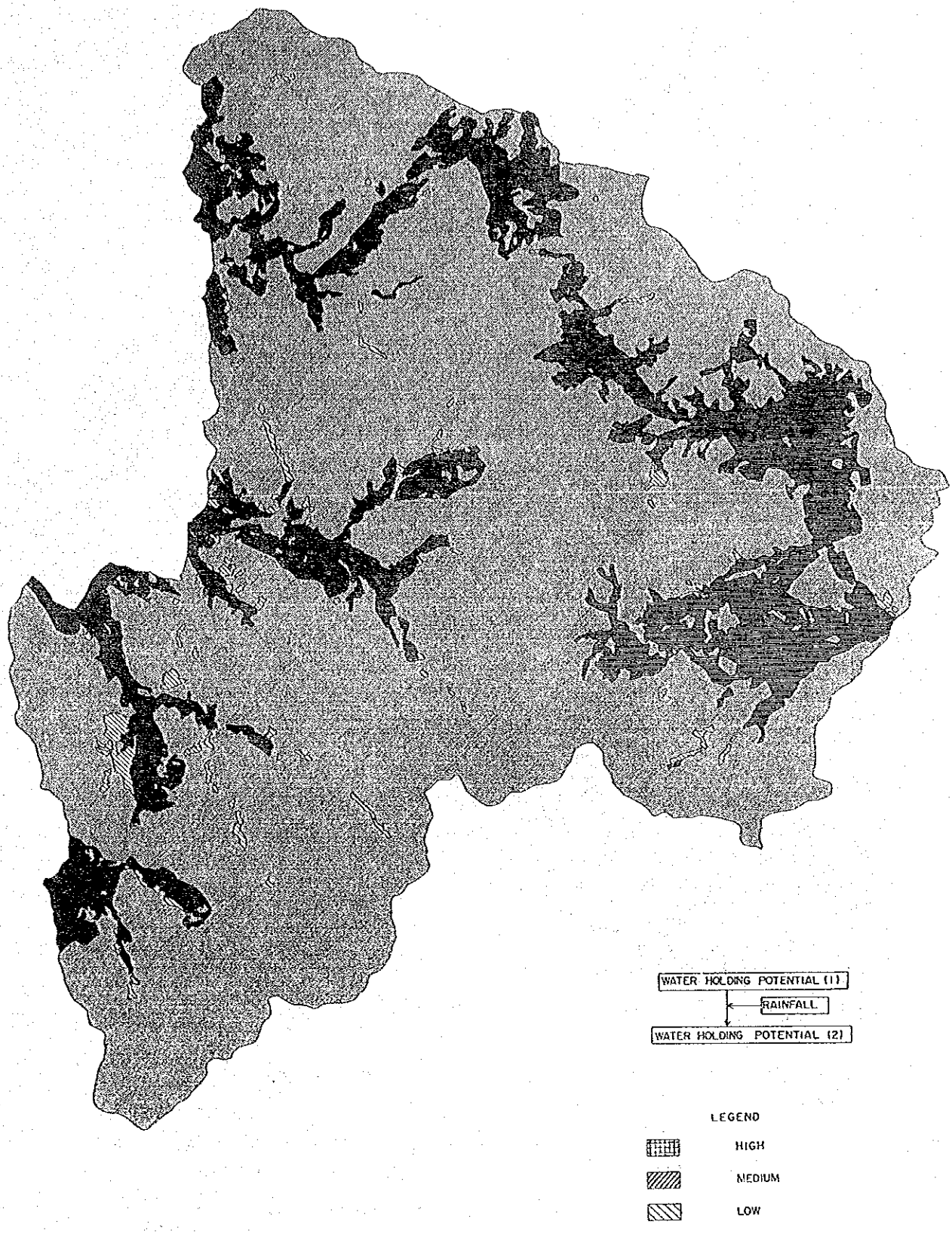

Fig. 6-13. Water Holding Potential (2)

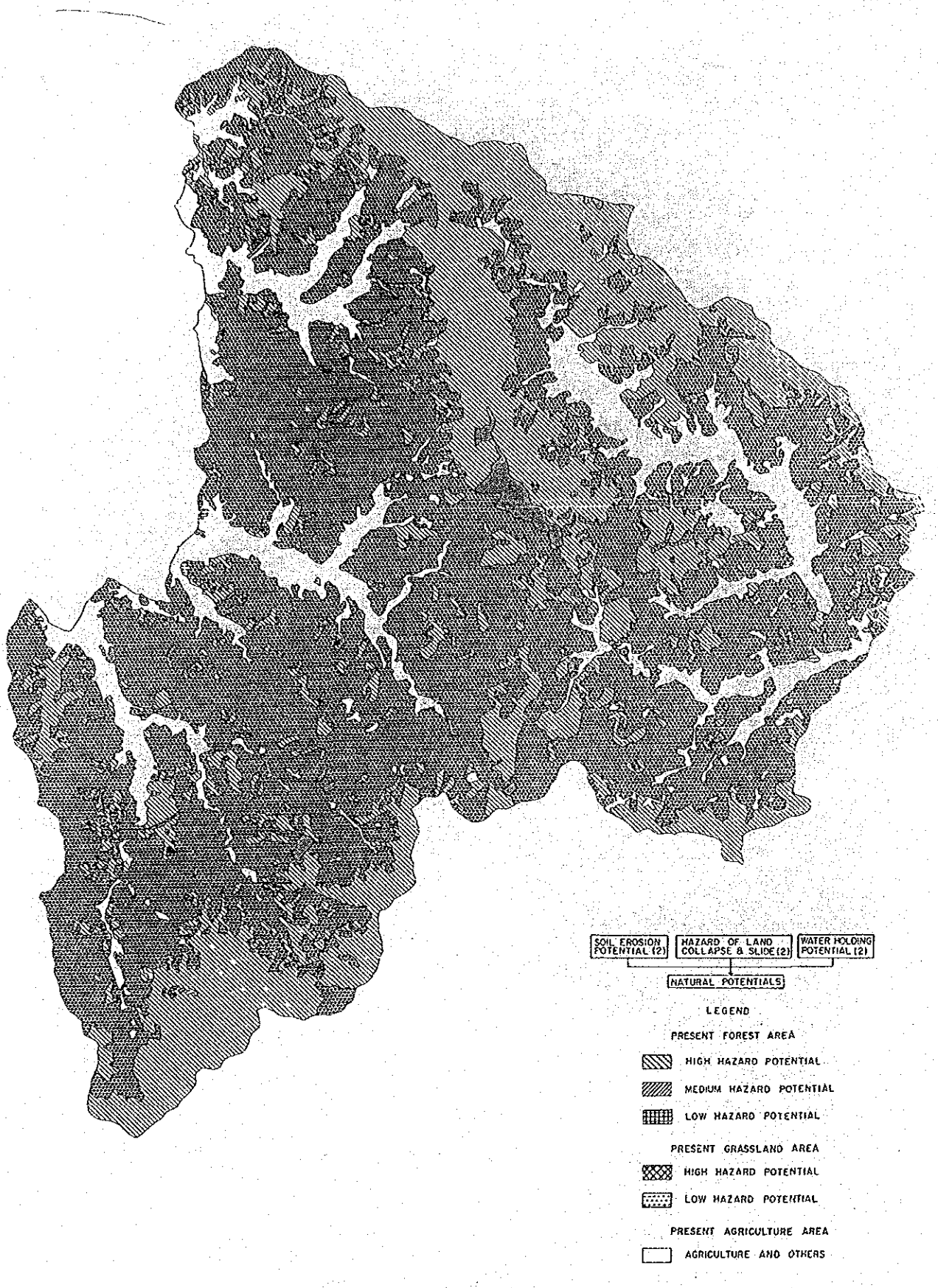

Fig. 6-14. Natural Potentials

(3) Analysis of Forest Functions

By introducing the existing vegetation and land use as additional factors to the results of the preceding analysis of natural environment, the following analyses were made. The studies were based on the same way of thinking and evaluation as for the Wide Area.

1) Integrated Soil Erosion Potential (Figure 6-15)

This analysis evaluates the soil erosion potential under the existing vegetation and land use by introducing the existing vegetation and land use as an additional factor to slopes, soils, and rainfall.

2) Vegetation Impact on Soil Erosion Potential (Figure 6-16)

This analysis evaluates the impact that vegetation can have on the function of forests to resist soil erosion based on the differences as observed between the Soil Erosion Potential (2) and the Integrated Soil Erosion Potential.

3) Integrated Hazard of Land Collapse/Slide (Figure 6-17)

By including the existing vegetation and land use in addition to slopes, geology, presence of faults, and rainfall, the hazard of land collapse/slide under the existing vegetation and land use was evaluated.

4) Vegetation Impact on Hazard of Land Collapse/Slide (Figure 6-18)

This analysis evaluates the impact vegetation has on the function of forests to prevent land collapses and slides based on the differences as observed between Land Collapse/Slide Potential (2) and Vegetation Impact on Land Collapse/Slide.

5) Integrated Water Holding Potential (Figure 6-19)

This analysis evaluates the potential to retain water and to prevent surface water run-off under the existing vegetation and land use by including the existing vegetation and land use in addition to slopes, soil texture, geology, and rainfall.

6) Vegetation Impact on Water Holding Potential (Figure 6-20)

This analysis evaluates the potential of existing forests to conserve water resources based on the differences as observed between Water Holding Potential (2) and Integrated Water Holding Potential.

7) Tree Growth Potential (Figure 6-21)

This analysis attempts to define areas suitable for planting by correlating slopes, soil hardness, and soil depth. It covered Grassland, Logging-in-progress or Logged-over area, and Kaingin as defined in the Existing Vegetation and Land Use Classification.

The results of vegetation impact analysis are summarized by Parcel in the table below.

Forest Function Analysis / Parcel	Vegetation Impact on Soil Erosion Potentials	Vegetation Impact on Land Collapse Slide Potential	Vegetation Impact on Water Holding Potential
I (North of kasibu)	Mostly medium potential	Mostly medium potential	Medium potential in high elevation & low potential in low-land
II (South of kasibu)	ditto	ditto	ditto
III (Bayombong area)	ditto	Area-wise, medium potential dominant. High potential in some parts of ridges.	Low potential in low-lowland; medium potential in mountains.
IV (South of Bayombong)	ditto	Mostly medium potential.	ditto
V (South of Dupax)	ditto	Area-wise, high, medium, low potentials equally distributed.	ditto

Vegetation & Landuse Data in wide area were compiled with the results of interpretation of aerial photographs (taken in 1980–81, scale 1/60,000) and Landsat Data (observed in 1983). On the other hand, Vegetation & Landuse Data in model area were compiled from the results of interpretation of new aerial photographs (taken in 1987, scale 1/20,000) and field survey.

Forest in the model area decreased in this period, and vegetation impact on natural hazard potentical in model area became higher than that in wide area.

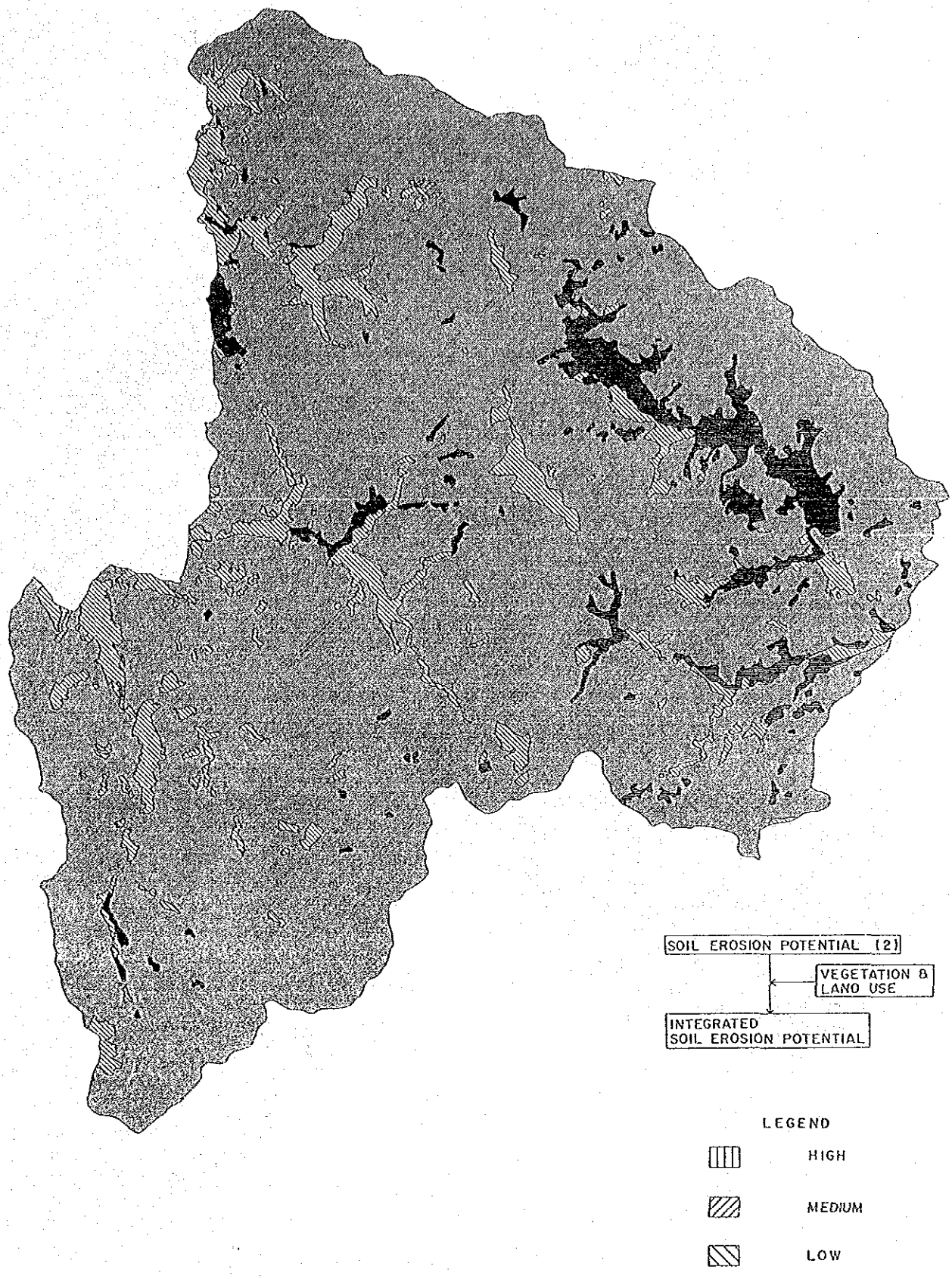

Fig. 6-15. Integrated Soil Erosion Potential

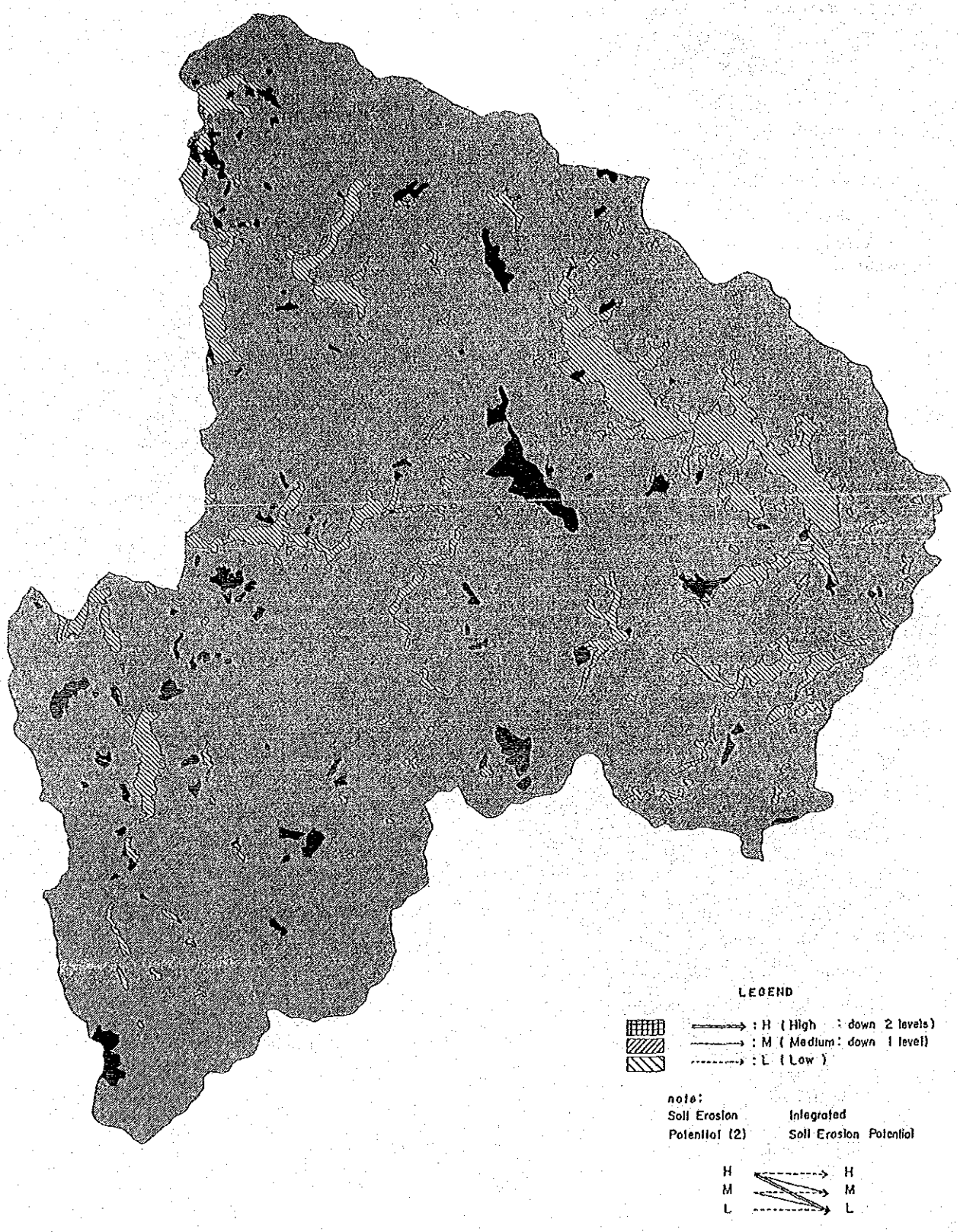

Fig. 6-16. Vegetation Impact on Soil Erosion Potential

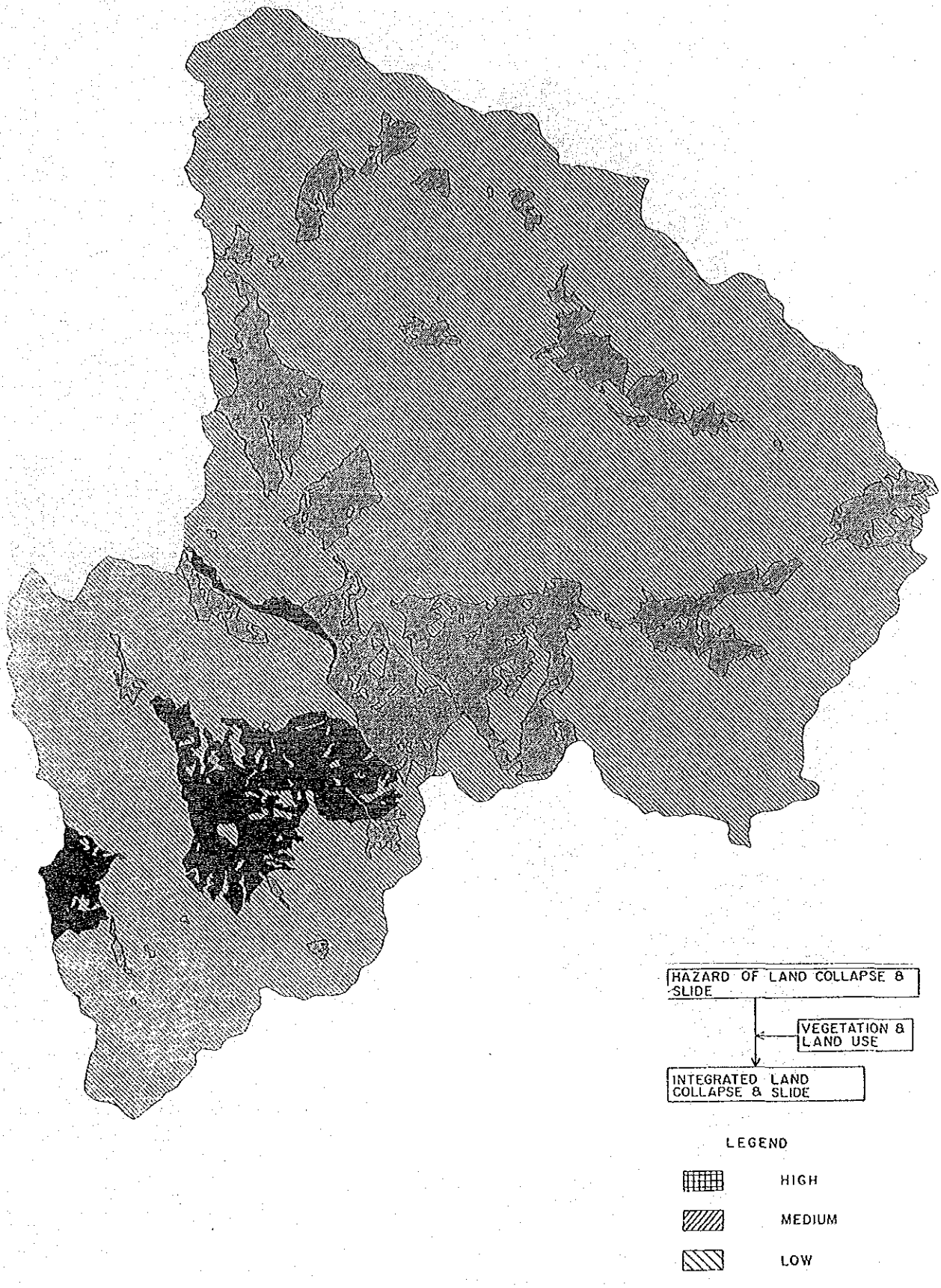

Fig. 6-17. Integrated Hazard of Land Collapse & Slide

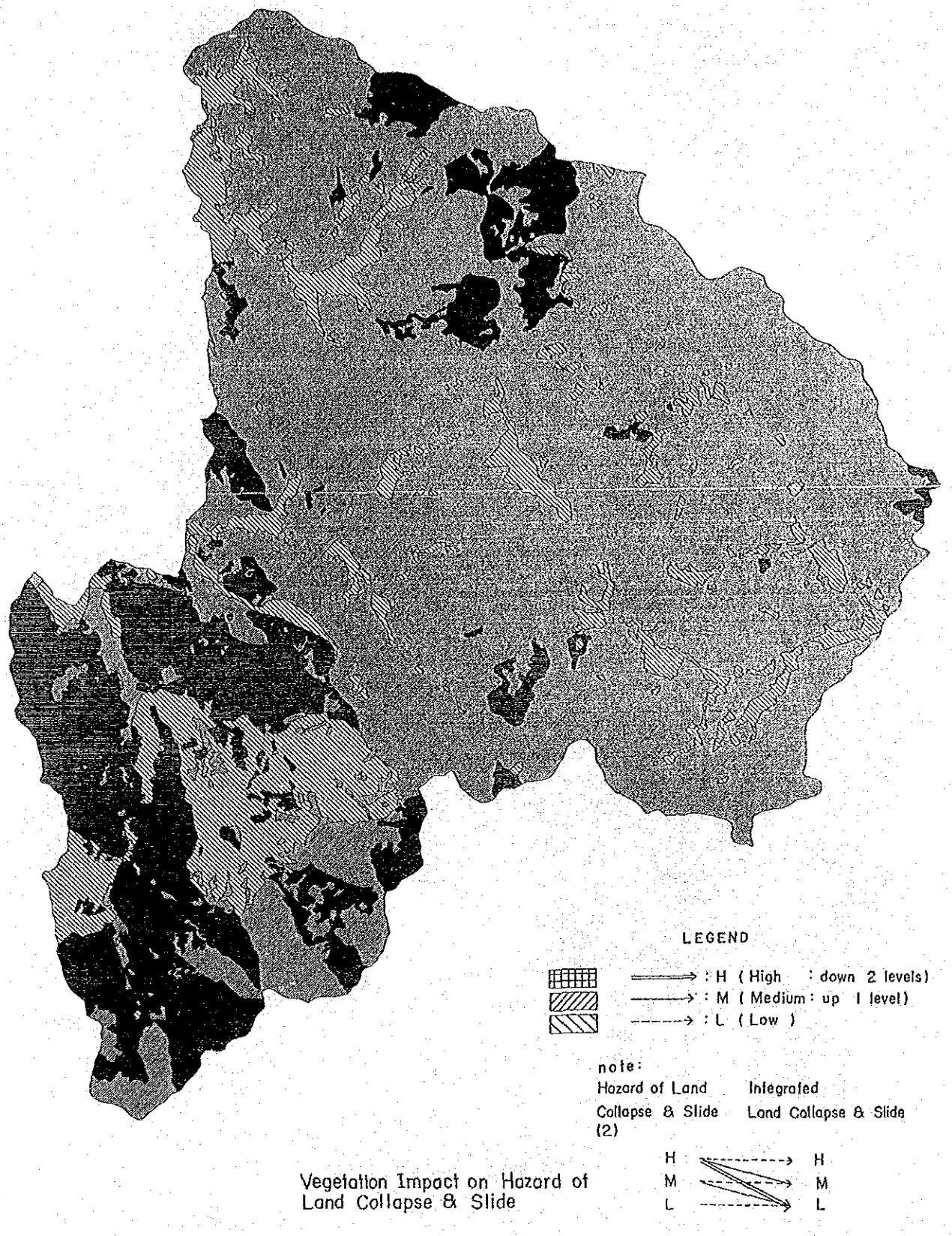

Fig. 6-18. Vegetation Impact on Hazard of Land Collapse & Slide

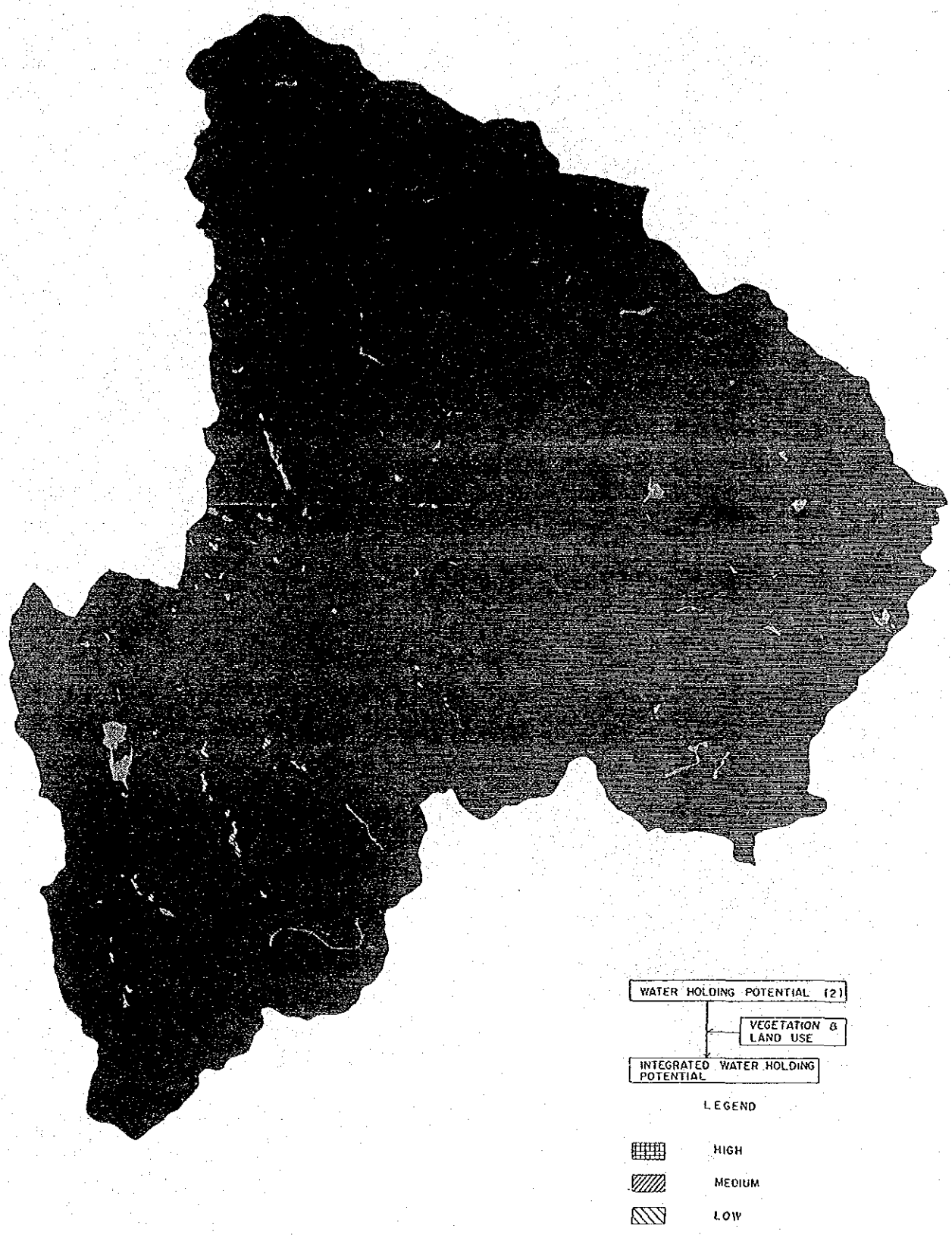

Fig. 6-19. Integrated Water Holding Potential

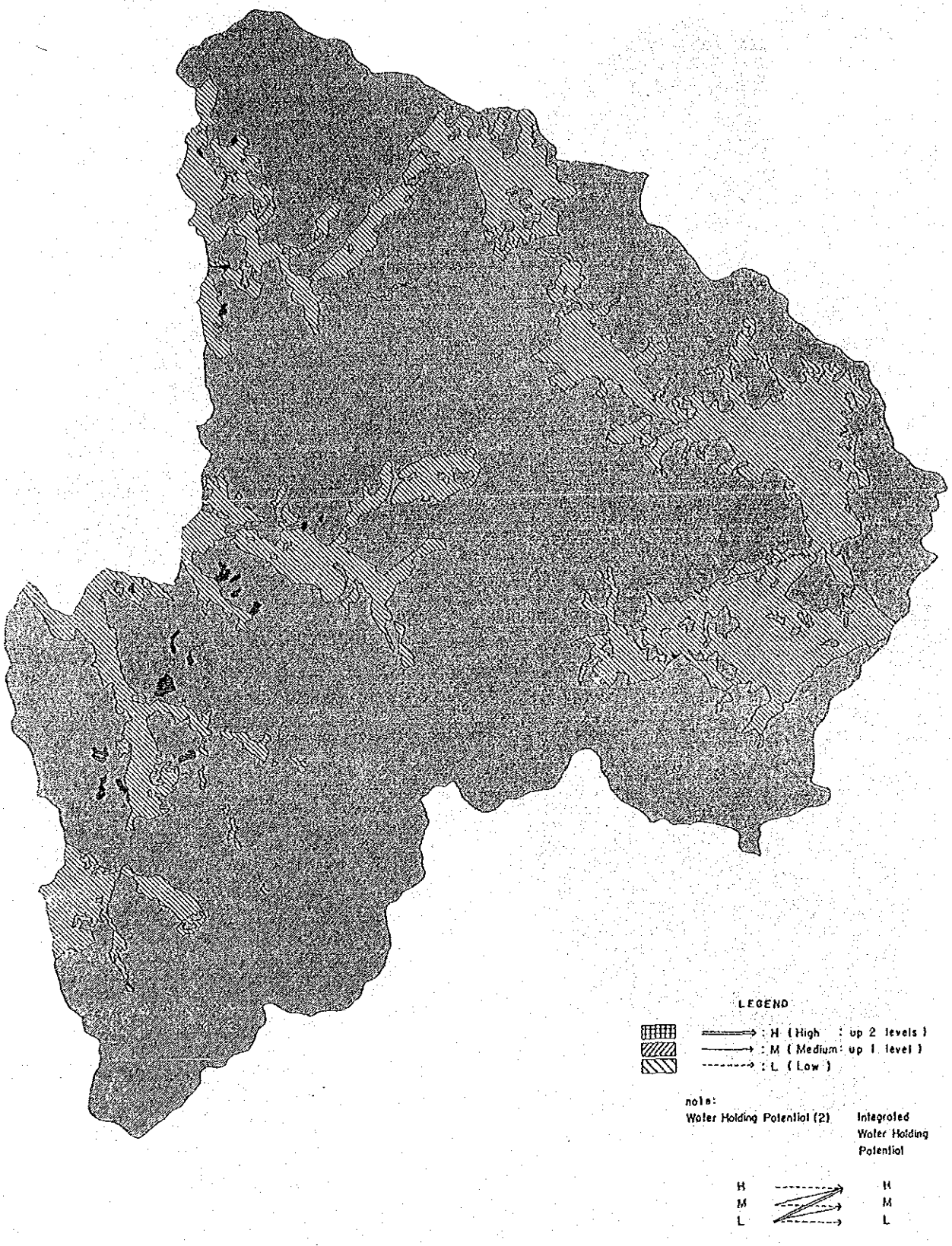

Fig. 6-20. Vegetation Impact on Water Holding Potential

Fig. 6-21. 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 barelands 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_2) is partly to be included in I.S.F. considering the actual conditions, but generally defined as Protection Forest.

Seasonal Cropland (Mc_1) 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 6-9.

Table 6-9. Existing Status and Targets

Existing status (Area for each Vegetation & Landuse)				Targeted Forests (ha)							
				Production forest		Protection forest			Parks & Outdoor Recreation forest	Grazing land	Agroforestry (I.S.F.)
Classification	Symbol	Area	%	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_1	1.336	3.6	584	27						725
Permanent cropland	Mc_2	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 Torget Forest %			100.0	18.4	17.0	23.3	1.5	2.6	0.7	27.4	9.1
				( ) Selective cutting, Watershed 9ha in G 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 6-10. 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. The table is summarily described below.

(1) Parcel

The Parcels correspond to the five Management Units as defined in the Wide Area.

(2) Compartment

Units resulting form integration/division of Study Units and Management Units as defined in the Wide Area. (A total of 82 Compartments)

(3) Sub-Compartment

Units resulting from division of Compartment based on Vegetation/Land Use boundaries. (A total of 723 Sub-Compartments)

(4) Area

To two places of decimals of a hectare with respect to Sub-Compartment.

(5) Elevation

Average elevation in meters with respect to Compartment.

(6) Slope Aspect

The most dominant slope aspect (out of 8 aspects) with respect to Compartment.

(7) Vegetation/Land Use

Classifications of Existing Vegetation and Land Use and their identification numbers.

1 Logged-over, secondary (NL)
2 Reproduction and Brushland (NR)
3 Mossy Forest (NY)
4 Seasonal Cropland (Mc_1)
5 Permanent Cropland (Mc_2)

6 Grassland (including Pasture ((G)

7 Built-up Area (B)

(8) Soil Erosion Potential (2)

Each Sub-Compartment rated by H, M, and L, as follows.

H: Areas with steeply sloped terrains, sandy soils, and much rainfall.

M: Areas with moderately sloped terrains, silty soils, and fairly much rainfall.

L: Areas with mildly sloped terrains, clayish soils, and little rainfall.

(9) Hazard of Land Collapse/Slide (2)

H: Areas with steeply sloped terrains, heavily weathered, and much rainfall.

M: Areas with moderately sloped terrains, moderately weathered, and fairly much rainfall.

L: Areas with sloped terrains, mildly weathered, and little rainfall.

(10) Water Holding Potential (2)

H: Areas with mildly sloped terrains, soils with loose grains and much rainfall.

M: Areas with moderately sloped terrains, soils with fairly compact grains, and fairly much rainfall.

L: Areas with steeply sloped terrains, soils with compact grains, and little rainfall.

(11) Integrated Soil Erosion Potential

Each Sub-Compartment rated by H, M, and L, as follows.

H: Mainly forestland with H rating in Soil Erosion Potential (2)

M: Mainly grassland with M rating in Soil Erosion Potential (2)

L: Mainly farmland with L rating in Soil Erosion Potential (2)

(12) Integrated Hazard of Land Collapse/Slide

Each Sub-Compartment rated by H, M, and L, as follows.

H: Mainly forestland with H rating in Hazard of Land Collapse/Slide (2).

M: Mainly grassland with M rating in Hazard of Land Collapse/Slide (2).

L: Mainly farmland with L rating in Hazard of Land Collpase/Slide (2).

(13) Integrated Water Holding Potential

Each Sub-Compartment rated by H, M, and L, as follows.

H: Minly forestland with H rating in Water Holding Potential (2).

M: Mainly grassland with M rating in Water Holding Potential (2).

L: Mainly farmland with L rating in Water Holding Potential (2).

(14) Vegetation Impact on Soil Erosion Potential

Each Sub-Compartment rated by H, M, and L, as follows.

H: Areas with a strong vegetation impact to prevent soil erosion.

M: Areas with a fairly stron gimpact to prevent soil erosion.

L: Areas with a least vegetation impact to prevent soil erosion.

(15) Vegetation Impact on Hazard of Land Collapse/Slide

Each Sub-Compartment rated by H, M, and L, as follows, with areas in hectares.

H: Areas with a strong vegetation impact to prevent land collapses/slides.

M: Areas with a fairly strong vegetation impact to prevent land collapses/slides.

L: Areas with a least vegetation impact to prevent land collapses/slides.

(16) Vegetation Impact on Water Holding Potential

Each Sub-Compartment rated by H, M, and L, as follows.

H: Areas with highly rated potential for water resource consevation.

M: Areas with fairly rated potential for water resource conservation.

L: Areas with poorly rated potential for water resource conservation.

(17) Tree Growth Potential

Each Sub-Compartment rated by H, M, and L, as follows.

H: Areas with mildly sloped terrains, and soft and deep soils.

M: Areas with moderately sloped terrains, and fairly hard and fairly thin soils.

L: Areas with steeply sloped terrains, and hard and thin soils.

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 Forestry Classifications and Work Standards

Forestry operations are organized in major grouping so as to standardize the the work process for better efficiency thus maximizing the utility of forests. For this project, the following classifications are made:

(1) Timber Production Forest

For this type of forests, emphasis is on timber production while their public functions are fully maintained. Except for forests specified for certain types of forestry such as fuelwood production, I.S.F., grazing land, those other parts of forest lands where the growth of a forest can be expected with certainty by renewal and nursing of trees fall into this category in principle. But until afforestation reaches a stage when it can meet the local needs for timber and fuelwood, harvesting from Logged-over, secondary forest will be necessitated.

Therefore, to ensure that supply, Logged-over, secondary forest below 800 m in elevation amounting to 3,306 ha. will be made subject to selective cutting up to 10%.

(2) Fuel-wood Production Forest

While taking into account the production by I.S.F., fuel-wood production will be made in keeping with the levels of local needs. For those forest lands not suitable for afforestation of timber-type trees due to the natural conditions, one way is to plant initially fast growing types of trees to improve the land conditions and, depending on the results, replace them with timber type trees.

(3) Protection Forest

The Protection Forest is subject to the specific restrictions for the purposes of prevention of public hazards, promotion of the welfare of populace, and protection of other industries. This project addresses three types of Protection Forest: Watershed, Wilderness Area, and Mossy Forest.

1) Watershed

Approximately 8,800 ha. of Logged-over, secondary forest, excepting those set aside for supplying of timber and fuel wood for local people, are categorized under this classification 9 ha. of Grassland is an area intended for a forest conservation work. Felling is banned in principle for this category. But when necessary single tree selective cutting is allowed up to 20% and in that instance unproductive trees (decayed trees, damaged trees) and over-matured trees should be selected on priority basis.

2) Wilderness Area

Most Reproduction and Bushland, except for 33 ha. including I.S.F., falls into this group.

3) Mossy Forest

Mossy Forest as a whole is defined for Wilderness Area and Mossy Forest as above, felling is banned in principle and so are undergrass/land cutting, grazing, cultivation too.

(4) Parks and Outdoor Recreation Area

A scenic area of about 255 ha. with the only waterfall that exists in this planning area is set aside for future parks and outdoor recreation. Tree cutting is prohibited in principle except when needed for scenic and other relevant reasons.

(5) Grazing Land

There are a total of about 22,000 ha. of Grassland in the Model Area, of which one half is defined as Grazing Land.

(6) I.S.F. (Agroforestry)

Greatly increased I.S.F., is envisioned for development of regional industry and enhanced welfare of local populstion. Specific approach to I.S. F. is dealt with separately.

6–5–5 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 Cropland that are not included in I.S.F. are planned for planting. Of the areas that 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 6-11. Tree types are identified for the respective planting sites in the same table (ANNEX 5, 6). The selection of tree types was made for the respective blocks on the basis of such data as Tree Growth Potential, and Slope, for standard tree species given in the Forest Information Table, and the site classifications were represented on the 1/25,000 topographic map.

Table 6-11. Summary of Reforestation Planning Data

Parcel	Numbers of compartment	Regeneration area (ha)			Area of each planting species (ha)										
		Artificial reproduction	Natural regeneration	Total	G·i-i	Am	Aa	Ya	Ec	Pk	Mo	Ma	Na	Te	Remarks
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	203.38	105.81	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	152.62	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 (%)

(2) Regeneration Species and Final Cutting Age

1) Regeneration Species

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.

Fast growing species: Acacia mangium, Giant ipil-ipil, Yamane, Acacia auriculiformis, Eucalyptus camaldlensis.

Long maturity species: Molave, Mahogany, Narra, Teak, Pinus Kesiya.

2) Ages of Maturity

With respect to the fast growing species, Giant ipil-ipil reaches maturity in 6 years, Eucalyptus camaldulensis in 20 years, and the rest 10 years.

Of the longer maturity species, Pinus Kesiya takes 30 years to mature, Molave and Mahogany 40 years, Narra and Teak 80 years.

Table 6-12. 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	Leucaena leucocephala	6 yr.
	Acacia mangium	Am	Acacia mangium	10
	Acacia auriculiformis	Aa	Acacia auriculiformis	10
	Yamane	Ya	Gmelina arborea	10
	Eucalyputus camaldulensis	Ec	Eucalyputus camaldulensis	20
Long maturity species	Pinus kesiya	Pk	Pinus khasya	30
	Molave	Mo	Vitex parviflora	40
	Mahogany	Ma	Swietenia macrophylla	40
	Narra	Na	Pterocarpus indicus	80
	Teak	Te	Tectona grandis	80

(3) Regeneration Methods

Regeneration is made by either planting or natural regeneration.

1) Planting

(a) Selection of Tree Species

Tree-species for planting are to be selected according to the Standard Tree Species Table 6-13, which has been compiled by considering three sets of data, namely, Growth Evaluations redeveloped from regional characteristics analysis, Elevations, and Site Classification (Table 6-14).

Table 6-13. Tree Species Selection

Tree species	Symbol	Tree growth potencial	Forest site classification*	Elevation (m)
Giant ipil-ipil	G.I-I	L (M)	II (I)	under 400
Acacia mangium	Am	L (M)	II (I)	under 1,200
Acacia auriculiformis	Aa	L (M)	II (I)	under 600
Yamane	Ya	M (L)	IV (II)	under 1,200
Eucalyputus camaldlensis	Ec	L (M)	II (I)	under 600
Pinus kesiya	Pk	M (H)	III (IV)	over 500
Molave	Mo	M (L)	III (II)	over 500
Mahogany	Ma	H (M)	IV (III)	under 1,000
Narra	Na	H (M)	IV (III)	under 1,000
Teak	Te	H (M)	IV (III)	under 1,000

* Semi-classifications in brackets

Fast growing species are planted where long maturity types are not good for growing. And depending on the results of such initial planting, it will be attempted to replace them with types good for timber production in the secondary stage. Tree species are to be mixed so as to avoid a single tree species from exclusively occupying too large an area.

Table 6-14. Site Classification

Classification	Topography, Vegetation	Suitable Species	Remarks
I	• Lean ridges-upper hillside steep slope, • Samon	Giant ipil-ipil Yamane Eucalyptus camaldulensis	Surface erosion in rapid progress; soils coarse and immature; not humic and low chemical base contents. Low productivity. Important area for land conservation and high density afforestation with fast maturing species urgently required. Use of fertilizers, solid fertilizers in particular, effective.
II	• Blunt-edged ringes-upper hillside, • Samon	Pinus kesia Yamane Narra Molave	Loss of surface soils due to wash-out from prolonged erosion; exposed inner soil layers; surface accumulation of gravels; formation of clay accumulations due to progress of inner weathering; low basic saturation; little humic contents in upper soils. Poor physical (permeability)/chemical properties; low productivity. Topographicaly, fast drying making pines and fast maturing species suitable. Where solid lower layers are exposed, planting holes collect water to harm roots.
III	• Balanced slope in mid-hillside, • Samon cogon	Pinus kesia Yamane Narra Malave	Relatively thick soil layers; physical, chemical properties fair making pines, long term maturing broad leaf species desirable. At places with much cogon after planting, intensive brush cutting and tending required. During dry season, clay compacts to crack letting water come in through, often casuing land collapse in steep slopes.
IV	• Depressed slopes in mid-hillside Collapsed surface, • Cogon Tarahibu Samon	Mahogany Teak	Young topography; thick soils; physical;chemical properties not bad. High productivity due to topography which allows concentration of nutrients and water. Bleaching due to leacing appearing extensively with a possibility of causing excessive humidity during rainy season. Good for reforestation of long term mature broad leaf species. Careful tending required because of fast vegetation growth. Large contents of swelling clay/minerals likely to cause land collapse in steep slopes.
V	• Mild slopes at piedment • Cogon Tarahibu Samon	Pinus kesia Teak Narra	Physical/chemical properties not so good depending on drainage inside soil layers; excessive humidity during rainy season. Chemically fairly good and not poor in productivity. Reforestation of broad leaf species possible. Deep planting to be evoided by all means; care required to keep planted trees from being pressed by other vegetation.

(b) Numbers of Trees to be planted

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

Table 6-15. 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 camaldlensis	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

(c) Ground Clearance

Since the sites for planting are either grassland or burnt for kaingin, ground clearance is done by clearing or burning. Depending on slope and soil conditions, there is a possibility of land collapses, and therefore extra care must be taken for preservation of forestland.

(d) Time and Method of Planting

In principle, planting is to start in mid-June when the rainy season sets in and to end in November, two or three weeks before the start of the dry season. Planting must be done carefully enough to ensure the survival of planted seedlings and encourage their fast and sound growth.

(e) Compensatory Planting

In case the incidence of dead standing seeldings is so high as to hinder the sound growth of mature stands, their causes are to be found out while compensatory planting is undertaken immediately. For compensatory planting, samplings are preferable over seedlings to ensure their survival.

(f) Tending (Weeding) Method

Tending is performed according to the table below covering areas as computed on the basis of the Tending Standard Table.

Table 6-16. Method of Tending (Weeding)

Species	First year times	Second year times	Third year times
G. 1-1	2		
Am	2	1	
Aa	2	1	
Ya	2	1	
Ec	2	1	
Pk	2	2	1
Mo	2	2	1
Ma	2	2	1
Na	2	2	1
Te	2	2	1

Table 6-17. Weeding Area of Each Parcel

Parcel	Weeding area (ha)
I	5,091
II	5,237
III	8,330
IV	12,335
V	10,755
Total	41,748

The Weeding Standard Table shows the numbers of times of weeding for each successive year after planting, as estimated from the data and information supplied by the Philippine side, reports by Pantabangan reports, Tropical Reforestation Planning Standards (JICA).

(2) Natural Regeneration

In areas where natural regeneration is expected supplementary care will also be taken as necessary including (ground clearance weeding) to help implantation and germination of seeds and soil raking (raking of the surface ground of forestland for the same purpose as ground clearing) to ensure early growth of mature forests. Tending involves weeding according to the status of young growths.

6-5-6 Seedling Production

(1) 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 6-18 below.

Table 6-18. 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

The planned reforestation requires 17,639 x 1000 seedlings and allowing for 10% for contingencies, approximately 1,940 x 1000 seedlings in total annually. Incidentally, the I.S.F. calls for 2,000,000 seedlings for reforestation over the plan period of 10 years and 343,000 fruit trees, both including contingencies, and annual average is 234 x 1000 trees.

(2) Nursery Planning and Operation

1) Reqiurements for nursery siting

Nurseries are to be developed to provide for the required volumes of seedlings. Requirements for siting of nurseries are as follows.

(i) Ecological conditions are similar to those of planting sites.

(ii) Terrains are relatively flat and soils fertile.

(iii) Water is available for irrigation even during the dry season.

(iv) Geographically close to the planting sites.

(v) Labor is available as planned.

The following three sites have been selected as meeting the above requirements.

Kasibu Nursery: Compartment No. 24, Sub-Compartment K

San Fernands Nursery: Compartment No. 32, Sub-Compartment C

Benay Nursery: Compartment 60, Sub-Compartment A

(Above names of nurseries are tentative)

2) Areal sizes of nurseries

The average annual seedling productions based on the reforestation as planned in this project and the I.S.F. by nursery are estimated as follows.

Table 6-19. Seedling Productions by Nursery

(Unit: 1,000 seedlings)

Nursery	Supplying Range	Estimated Avereage Annual Production
Kasibu	Parcels I, II.	554
San Fernando	Parcel III; Compartments 41, 42, 43, 56 of Parcel IV.	645
Benay	Compartments 46, 52 to 55 of Parcel IV; Parcel V.	970
Total		2,174

The above computations were made on the basis of the estimated production volumes assuming pot raising of seedlings, 50% for the land utilization rate and adding 20% for back-up area.

Ancillary facilities to be sited include offices, were-houses, garages. Protection Forest Zones and Smaple Forests are intended for future grounds for raising seedlings and computed allowing for the anticipated expansion as such. The spaces required for the respective purposes by nursery are given in Table 6-20 below.

Table 6-20. Required Spaces by Nursery

Nursery	Area for pot raising of seedlings	Ancillary facilities	Protection & Sample forests	Total
Kasibu	8,700 m^2	1,000 m^2	5,300 m^2	15,000 m^2
San Fernando	10,800	1,000	8,200	20,000
Benay	14,200	1,000	10,800	26,000