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WATERSHED APPROACH TO THE MANAGEMENT OF COMMON PROPERTY: THE MAKILING FOREST RESERVE EXPERIENCE

WATERSHED APPROACH TO THE MANAGEMENT OF COMMON PROPERTY: THE MAKILING FOREST RESERVE EXPERIENCE[1]

by

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INTRODUCTION

The management of forest resources in the Philippines has been besieged by a lot of problems which resulted to the progressive and rapid denudation of the natural forest cover. At present, the remaining old growth forests in the country is estimated to be just around 1 M hectares left of what used to be more than 15 M hectares of virgin forests some three decades ago (NRMP 1992).

The identified causes of forest destruction includes illegal logging shifting cultivation ("kaingin" making), forest occupancy, overgrazing, and conversion of forests to other uses just to mention a few. To solve the problems, the government through the Department of Environment and Natural Resources (DENR) and other agencies has launched so many programs investing a lot of money and other resources. So far, the country has only managed to make little advances in the front of forest protection efforts against forest destruction forces. This can be attributed to a number of factors among which the approach to resource management (problem analysis, planning and implementation) could rank as one of the top culprits.

It has long been recognized in the country that natural resource management essentially require a holistic and systematic approach to achieve sustainability. Yet, in the actual exercise, the ghost of the forest as an ecosystem is oftenly lost amid the ambiguity of defining the boundaries of the system and the fragmented procedures which are incompatible with the systems approach.

For a long time, forest management in the Philippines has been based on management units with boundaries usually delimited by political boundaries of towns and/or provinces within which it is located. This created confusions in the operationalization of a systems approach because natural resource systems boundaries are usually not the same as the political boundaries. The management units based on political subdivisions are more often than not mere aggregations of portions of many natural systems which are distinct from one another. Hence, the decisions made of what is inappropriately perceived as a system become invalid and inappropriate for many parts of the management unit.

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Furthermore, the interrelationships between various components (i.e., biophysical and socioeconomic) become more difficult to describe. Consequently, the systems properties and behaviors, and the linkages between the different systems also become too hard to describe. With these limitations, it is impossible to probe deep into the heart of the many problems of forest management in the country and therefore come up with the appropriate solutions. That is why many of our forest management problems are still unchecked inspite of the huge amount of resources already spent in trying to solve them.

Forest occupancy, illegal logging and many other problems of forestry in the Philippines are complicated systematic problems. They need to be dealt with a systematic approach such as the watershed approach. An approach that would permit a thorough analysis of the various components, behavior and properties of the system for a clear understanding of the biophysical and socioeconomic processes taking place within and even outside the system.

This paper presents a case study on and some arguments for the applications of the watershed as a unit of forest management (i.e., for problem identification and analysis) in the Philippines. The study was conducted by an interdisciplinary team of scientists from the University of the Philippines at Los Baños (UPLB) under the joint leadership of the College of Forestry and the ERMP-Institute of Environmental Science and Management.

THE WATERSHED APPROACH

A watershed is defined as a land-based ecosystem with a fixed geographic boundary and is drained by a river and its tributaries (Brooks, et. al, 1991). As an ecosystem, it contains plants, animals and numerous non-living components.

Fellizar (1989) aptly described a watershed in many ways. It is a surface area that drains water, sediment and dissolved materials to a common point along a river. It is a producer of goods and services essential to mankind. It is an integrated system for the transformation of solar energy, rainfall, other environmental factors, labor and capital into timber and non- timber forest products.

From the above definitions, watershed management entails integrated approach to the planning and management of watershed resources. It is an approach which recognizes that a watershed is a complex conglomeration of various interrelated subsystems such as forest production subsystem, parks and recreation subsystem, agroforestry subsystem, range subsystem and water subsystem. It recognizes further, that a watershed is linked to the lowland, the marine and aquatic ecosystems, and to the much broader socioeconomic systems.

Thus, with watershed approach, the issues on sustained production of various competing goods and services can be adequately analyzed and addressed. Conflicting uses can be harmonized by a common goal of sustaining the productivity and protection of the watershed.

With watershed approach, it is easy to identify all the watershed "stakeholders" and hence, a lot less difficult to generate their constructive and maximum participation in management planning and implementation. Finally, the impacts of any activity or management alternative on all sectors within and outside the watershed can be easily accounted for and evaluated using the watershed approach. Watershed properties such as streamflow and soil erosion, are highly affected by most biophysical characteristics and socioeconomic features of the watershed. Hence, watershed properties are excellent parameters for evaluating the different management options.

THE AGROECOSYSTEM APPROACH

The watershed approach requires a systematic and holistic approach to the understanding and description of the properties and behavior of a watershed as influenced by land use management activities and other environmental factors. In this study, agroecosystems analysis was used as proposed by Conway (1985).

Agroecosystem analysis is an interdisciplinary workshop procedure of objective setting, systems definition, and pattern analysis to generate key questions/issues for research and development guidelines (Figure 1). This procedure allows those with stakes on a particular resource base to level off their knowledge and understanding of the different factors which influence the behaviors and properties of the system such as productivity, stability, sustainability and equitability.

The objectives are usually a direct and explicit statement of the common visions and perceptions of what need to be done insofar as the management and development of a resource base are concerned. It should not dwell on self-serving motives hidden within a framework of ambiguity.

System definition involves the identification of systems, system boundaries and system hierarchies. Systems could be biophysical and/or socioeconomic in nature. Usually, the biophysical systems such as watershed are easier to identify compared to socioeconomic system whose boundaries oftentimes go beyond the physical boundaries. System hierarchies are important in the description and analysis of the interrelationship among the various systems identified.

Pattern analysis are procedures for the description of the interrelationships of various system components and their impacts on the behaviors and properties of the system. There are at least four (4) major analytical procedures available, namely: spatial, temporal, flow and decision-making.

Spatial pattern analysis deal with geographically-referenced information which are adequately represented in maps or thematic overlays. Temporal analysis describes trends, and seasonal changes which are best illustrated by graphs. Flow pattern analysis are suitable for describing the flows and transformations of materials, energy, products, money, information and others which are important in identifying cause and effect phenomena. Decision-making analysis aims to explain/ describe the decision-making process from the lowest to the highest level of systems hierarchies.

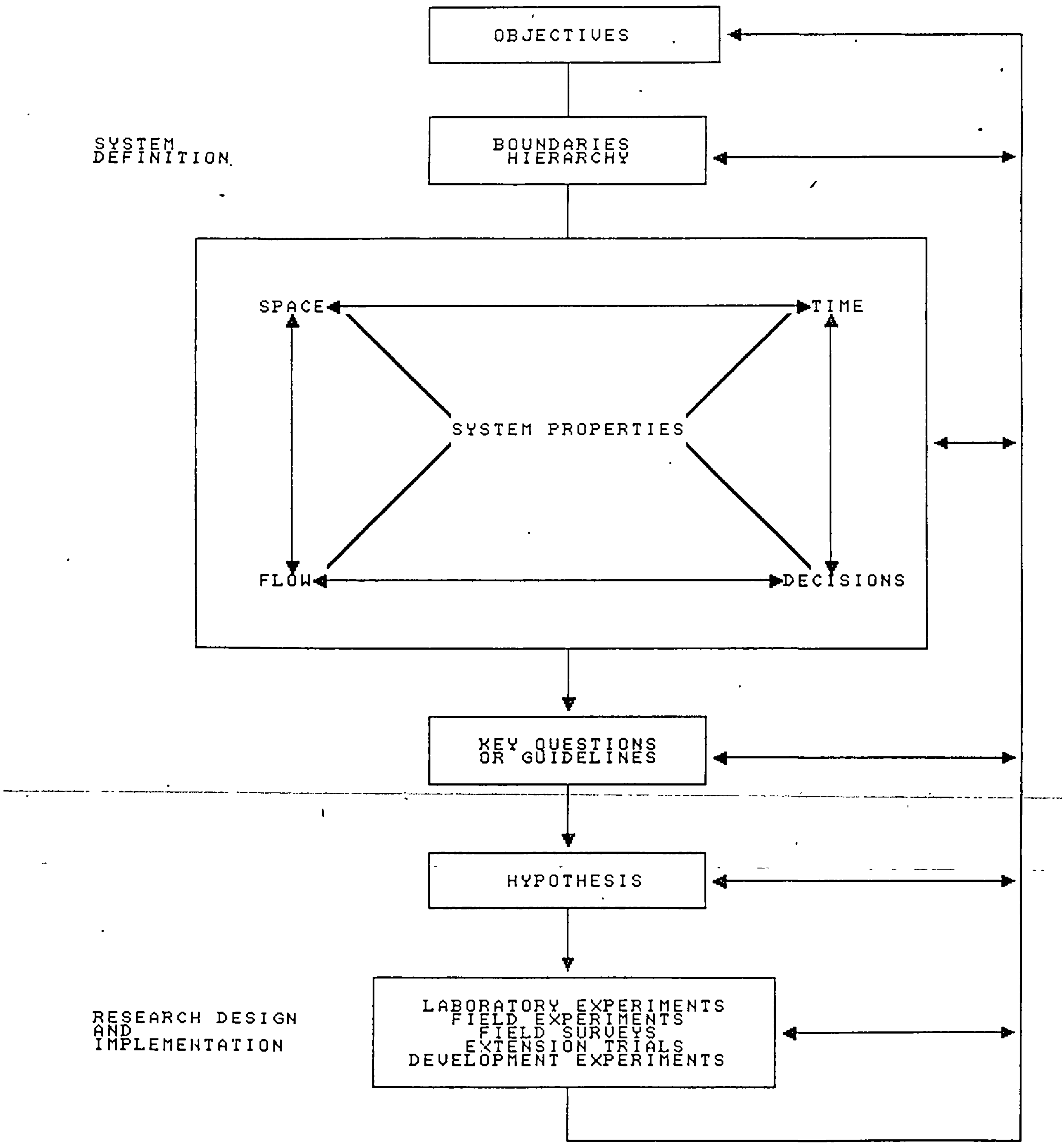

Figure 1. Procedure for agroecosystem analysis.

THE MAKILING FOREST RESERVE EXPERIENCE

1.0 The Objectives

This study was designed to identify key questions and issues relevant to the solution of existing problems. It was also meant to generate information which are vital to the formulation of management and development plans.

Specifically, the study was aimed to moving closer to, if not, finding the exact solutions to the problems of forest occupancy and encroachment into the MFR. The study was also designed to find out how the MFR can be effectively protected against other unauthorized resource users. The current state of the watersheds in the MFR in terms of their biophysical properties as affected by existing land uses was also addressed.

2.0 The System

The MFR was divided into six major watershed zones: Zone 1 - Molawin/Maralas Watershed; Zone 2 - Dampalit Watershed; Zone 3 - Puting Lupa/Tigbi Watershed; Zone 4 - Sipit/Sto. Tomas Watershed; Zone 5 - Cambantoc Watershed; and Zone 6 - Maitim Watershed. Communities of forest occupants (settlers) are found in each of the watersheds.

Thus, the macro agroecosystem analysis was done for each watershed zones, and micro agroecosystem analysis was performed for communities. The pattern of analysis for space, time, flow and decisions were done for both watersheds and communities.

For the watersheds, climate, soil, hydrology, vegetation, forest occupants, administration and management strategies were some of the important factors analyzed. For the communities, the analysis was focused more on socio-demographic properties, land tenure system and perceptions on resources conservation.

3.0 The Analysis

As previously presented, the entire study was conducted by a team of biophysical and socioeconomic specialists from the University of the Philippines at Los Baños. The team collected, collated and analyzed all available relevant information on the MFR. The results of the team's analysis was then presented in a workshop participated in by representatives from the various concerned parties ("stakeholders"). During the workshop, issues, research and development priorities were identified.

3.1 Spatial Patterns

3.1.1 Area and Location

The MFR is a 4,244 ha forest reservation located between 14°06' - 14°11' north latitude and 121°09' - 121°15' east longitude. It is approximately 65 km south of Metro Manila. The MFR lies within the municipalities of Los Baños, Bay and Calamba in the province of Laguna and Sto. Tomas in the province of Batangas (Figure 2).

3.1.2 Watershed Zones

Six major watershed zones were identified in the MFR all of which drain to Laguna de Bay (Figure 3). Zones 1 and 6 are within Los Baños, Zone 2 in Los Baños and Calamba, Zone 3 in Calamba, Zone 4 in Sto. Tomas, and Zone 5 in Bay.

3.1.3 Climate

The climate in the MFR has two pronounced seasons; wet from May to November and dry during the rest of the year. An average annual rainfall of 2397 mm fall over the MFR. The mean annual temperature ranges from 24°C to 30°C.

3.1.4 Drainage

Zone 1 has the highest drainage density (i.e., stream length per unit area) of 26.1 km/km^2 which makes it the best drained zone. The least drained zone is Zone 4 with a drainage density of 15.6 km/km^2. Comparative drainage properties are shown in Table 1.

3.1.5 Topography

The MFR has a generally rugged terrain (Figure 4). More than 75% of the area are over 400 m above sea level (asl). The minimum elevation is about 20 m asl and the maximum is 1,130 m asl. Zones 2, 3 and 4 have mean elevations more than 500 m asl while Zones 1, 5 and 6 have mean elevations below 500 m asl. Zones 2, 3 and 4 also have steeper mean slopes of more than 45% compared to the mean slopes of Zones 1, 5 and 6 of less than 45%. The favorable topography of Zone 1, 5 and 6 makes it very attractive to forest occupancy and cultivation compared to the other zones.

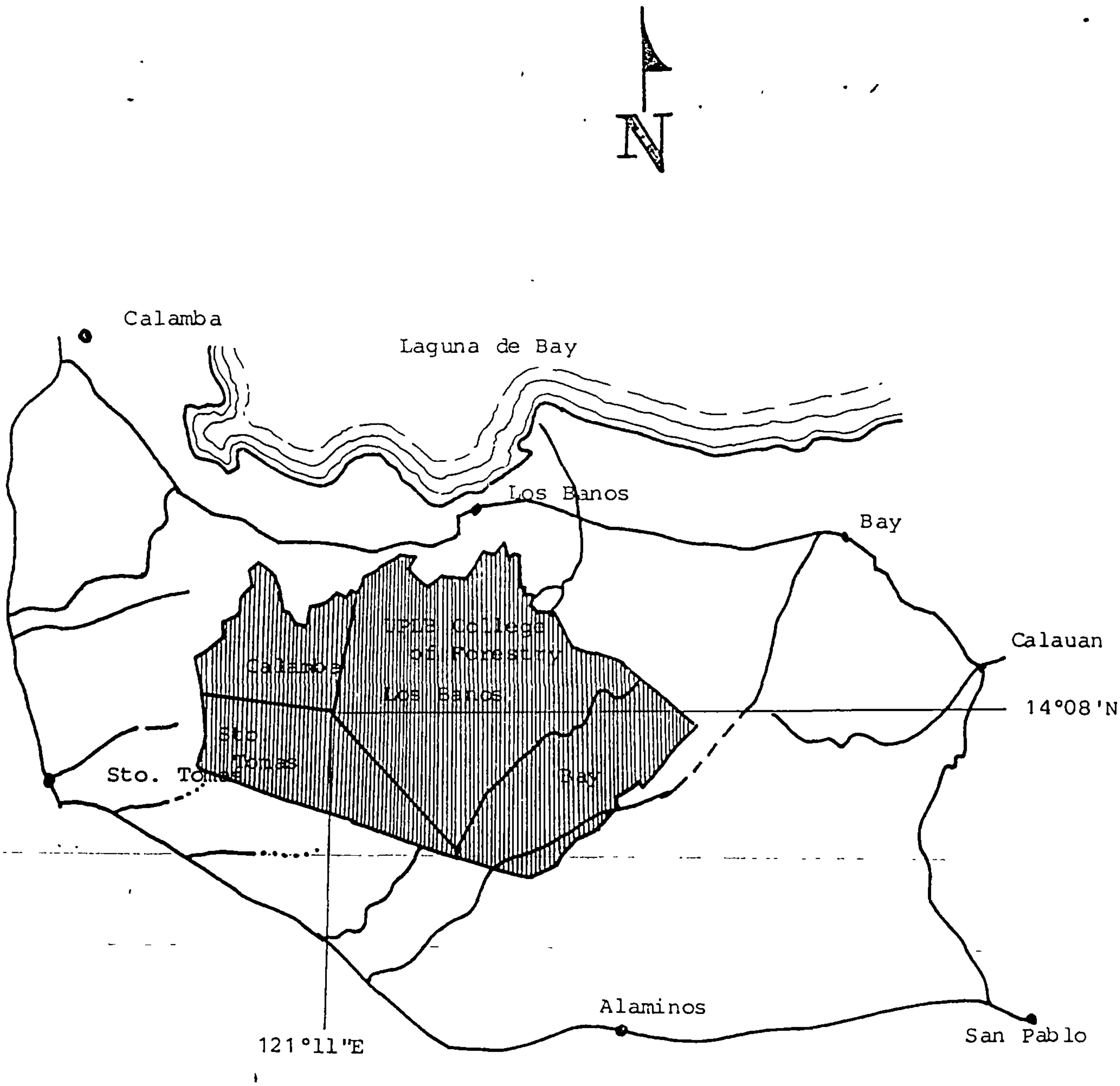

Figure 2 Location map of the Makiling Forest Reserve (MFR).

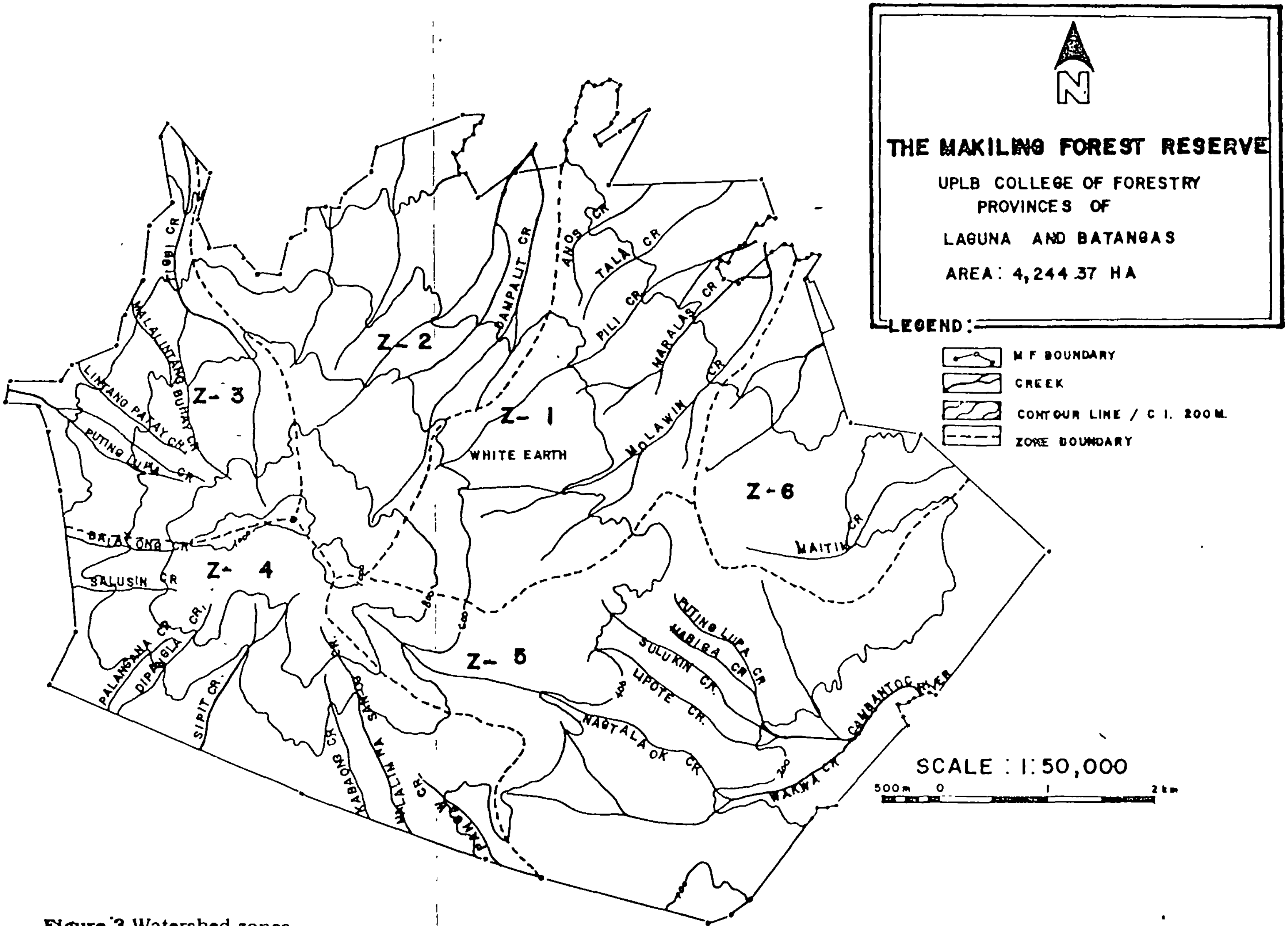

Figure 3 Watershed zones.

Table 1. Comparative drainage properties of various zones.

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
Area (ha)	722.5	769.8	456.9	677.0	1276.7	341.5
No of streams	11	8	7	10	20	8
Total length of streams (km)	18.88	14.55	10.95	10.57	26.80	7.50
Stream density ($No./km^2$)	15	10	15	15	17	23
Drainage density (km/km^2)	26.1	19.0	23.5	15.6	21.0	21.0
Constance of channel maintenance (km)	0.04	0.05	0.04	0.06	0.05	0.05

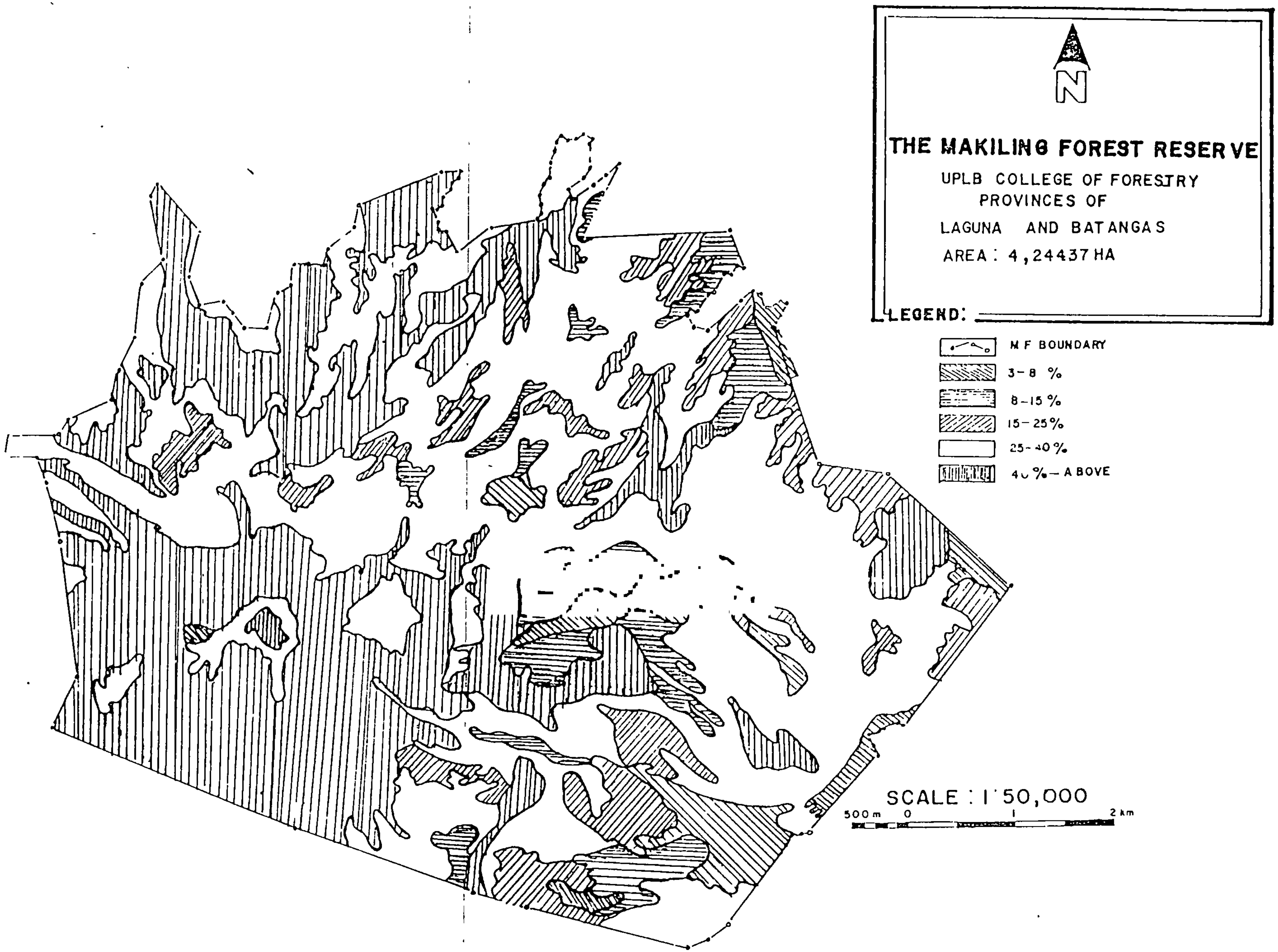

Figure 4 Slope map.

3.1.6 Soil

There are four (4) soil series identified in the MFR, namely: Lipa, Macolod, Gulugod and Makiling of which Macolod is the predominant series (Khan 1969). Soil sample analysis have indicated relatively fertile soils in most part of the MFR.

3.1.7 Vegetation

The MFR is a rich depot of numerous endemic and exotic plant species from grasses to trees. Mixed dipterocarps and other hardwoods dominate the forest cover under which many flowering plants and ferns thrive richly.

3.1.8 Land Use

Forest and brushlands still dominate the MFR inspite of the increase in the conversion of forests stands into cultivated areas, grasslands, and settlement areas (Figure 5). Approximately, only 2,200 ha of natural forests remain today. More than 800 ha at present is grassland while around 500 ha are cultivated.

3.1.9 Goods and Services Provided by the Watersheds

Figure 6 shows the forest products and services provided by the watersheds to the people within and around the watersheds. The more important examples are timber and water, wildlife resources, food crops, outdoor recreation and educational facility, and forage.

3.1.10 Population and Settlement Pattern

3.1.10.1 Distribution

Figure 7 shows the spatial distribution of settlers in the MFR. The 1991 census of forest occupants (Torres and Rebugio, 1991) reported a total of 245 households in the MFR. This translates to about 1,225 individuals at an average of five (5) members per household. The most populated zone is Zone 5 where occupants are centrally clustered in the relatively flat portions of the watershed. In other zones, the occupants do not settle deep into the center of the

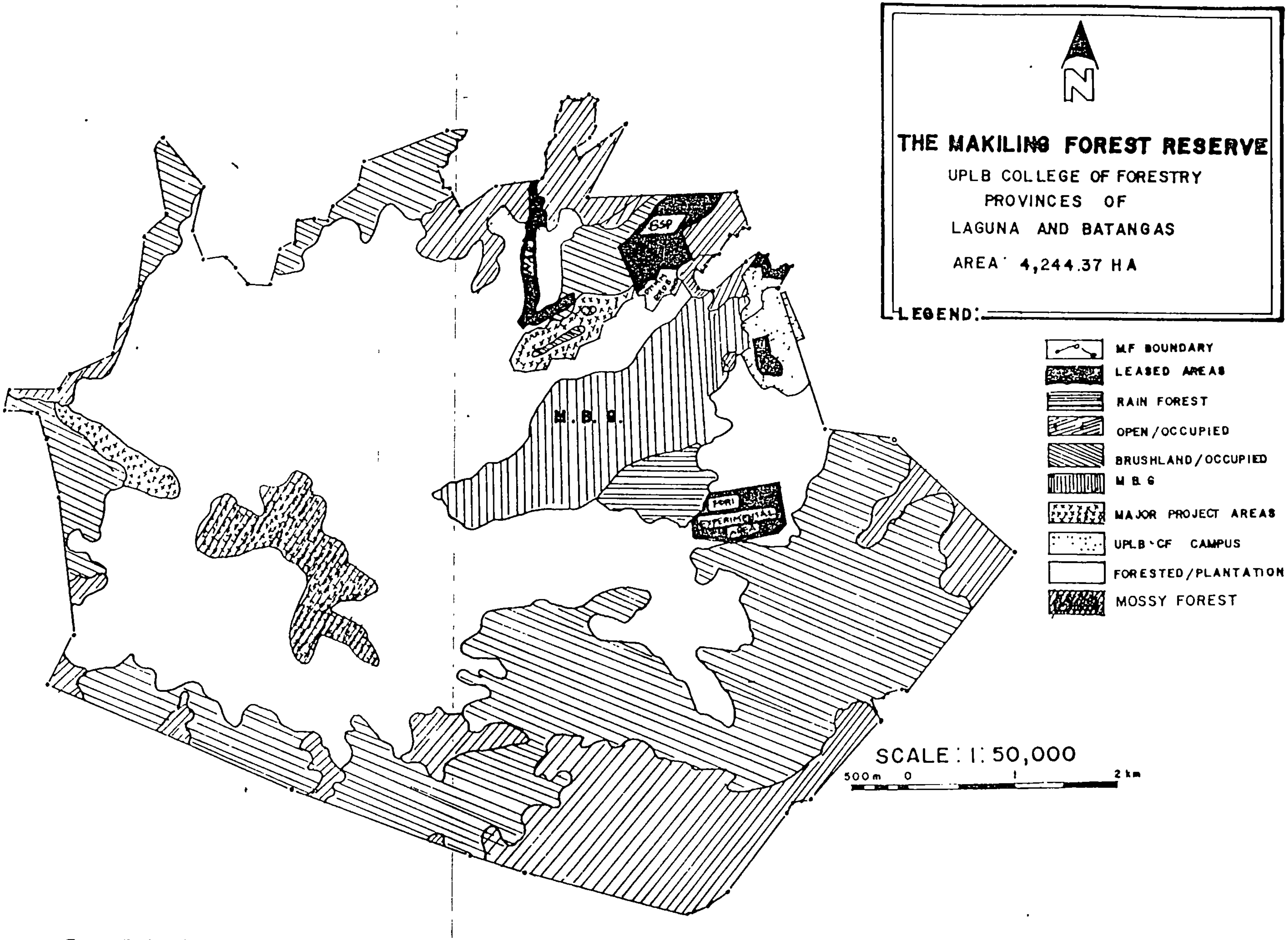

Figure 5. Land use map.

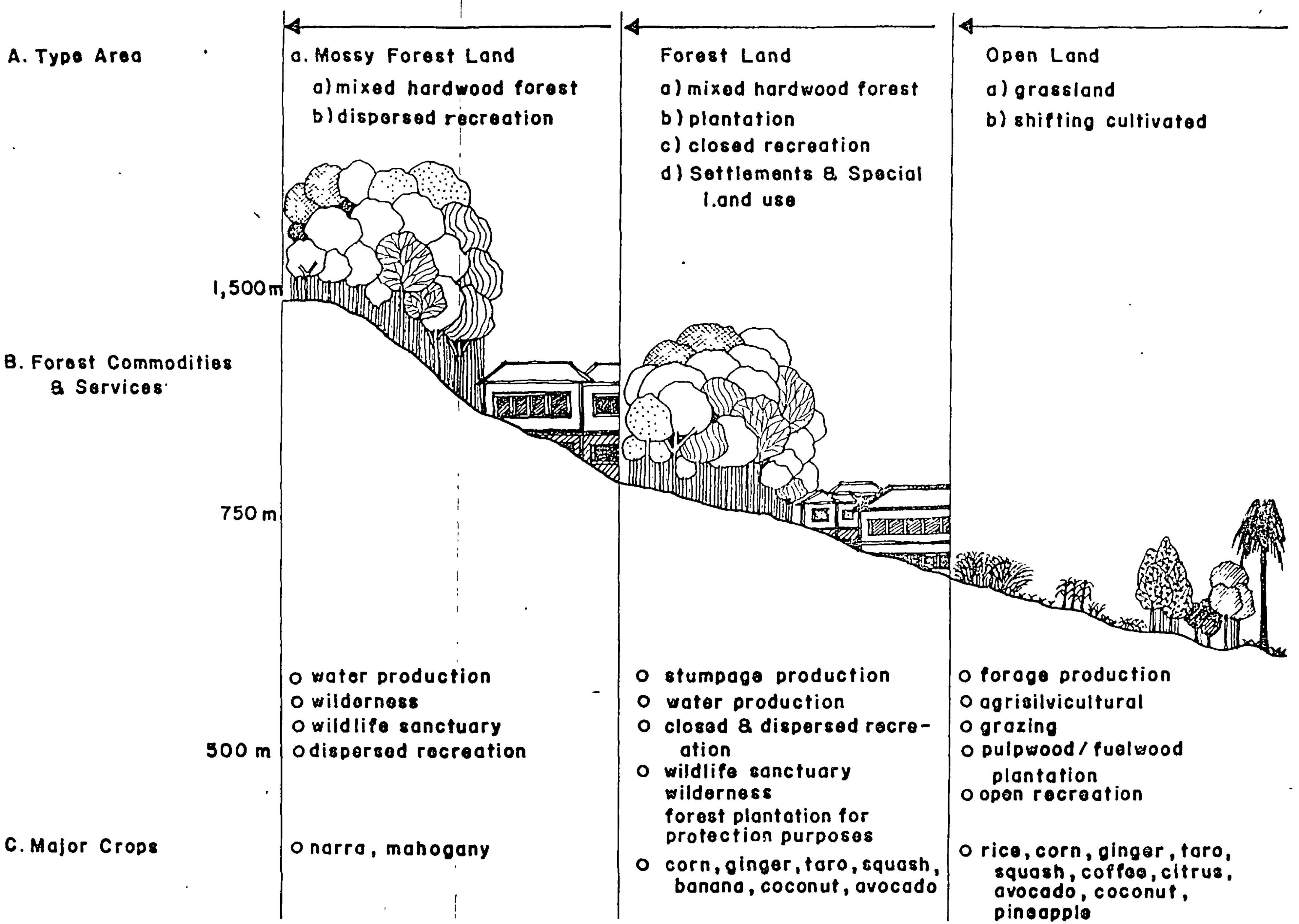

Figure 6. Transect indicating goods and services provided by MFR.

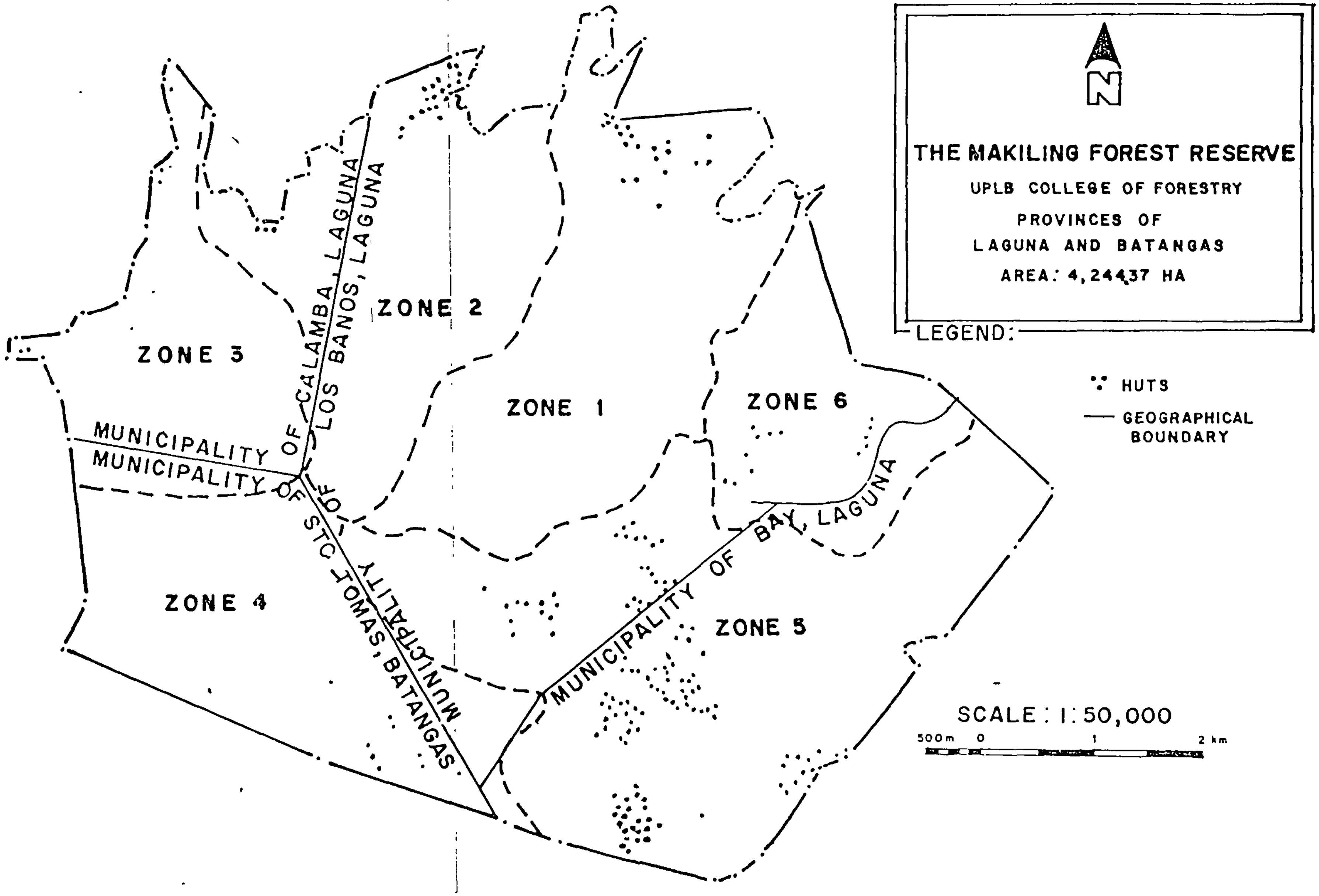

Figure 7. Settlement patterns (Torres and Rebugio 1991).

watersheds but rather stay close to the boundaries of the MFR obviously because of the proximity to the roads and the rugged topography towards the center of the watersheds.

3.1.10.2 Household Information

A census of the settlers in 1991 by Torres and Rebugio reveals that the average household size is five. Majority of the settlers who came from the surrounding communities are literate whose main reason for migrating to the MFR is to earn a livelihood. Farming is their primary occupation. Mallion and Dizon (1990) reported that happy and peaceful life, good health and long life, financial stability, sufficiency in basic food, and education are the top priority values for the occupants.

3.1.10.3 Social Services

Zone 5 is the only zone delivered with social services. It has a four-classroom school building which is very inadequately staffed and supplied. It has a chapel where one mass is held yearly. Their major source of water are natural springs and streams. They do not have electricity and have to travel or walk at least five (5) km to reach a health service facility.

3.1.10.4 Income and Occupation

About 83% of the occupants earn their living by farming. The rest are employed by the government, hired by other farmers, work in construction or business and service oriented jobs. The average household income is approximately ₱ 16,458 annually.

3.1.10.5 Farm Acquisition and Practices

The most common mode of farm acquisition is by forest clearing upon the belief that the MFR is a free-access resource to anyone. They strongly believe that they have all the rights to do anything with the land they occupy. Most of them even sell their rights as if they truly own the land. This reflects their strong feeling of land tenure security which is manifested in the perennial crops most of them plant. They usually intercrop cash crops with perennials.

3.2 Temporal Patterns

3.2.1 The MFR Administration

The MFR was originally proclaimed as a reserve in 1910. Since then, it has gone through a number of changes in administrator and in management objectives. For example, it was made a national park 42 years after it was declared a forest reserve in 1910. Administration also changed hand a lot from the Bureau of Forestry, to the Commission of Parks and Wildlife, to the University of the Philippines to the National Power Corporation and finally back to the University of the Philippines. These changes might have destabilized rather than stabilize the conservation and management of the MFR.

3.2.2 Land Use Dynamics

Of special interest was the conversion of natural forests to cultivated areas. Based on available records from 1968 to 1989, there was a decrease in the cultivated areas as well as in the forested areas. This could be explained by the abandonment of the already unproductive farms which eventually become grasslands and the difficulty of opening up new farms in the higher and steeper areas.

3.3 Flow Patterns

3.3.1 Migration

The influx of people to the MFR continuously aggravates the problem of kaingin-making (slash and burn). Majority of these migrants are from the surrounding farms. Aside from illegal farming many of them are involved in unauthorized harvesting of timber and non-timber forest products.

3.3.2 Marketing of Produce

Selling of products from farms inside the MFR is usually not a problem because of high demands from surrounding towns and markets. In addition, marketing is facilitated by the presence of many wholesalers and retailers in the area.

3.3.3 Water Resources

As the human activities in the MFR intensify, water resource conservation becomes more and more critical. While only about 20% of the people inside MFR rely on streams for their daily water needs, almost all the communities around the MFR depend on the surface and groundwater coming from the MFR watersheds. Hence, activities inside the MFR should be limited to those which will not cause significant degradation of surface and groundwater quality and quantity. Specifically, this should be a big concern for Zones 1, 3, and 4 which currently maintain water intakes that supply water in the nearby municipalities. But for Zone 1, this will be much more critical because of the projected shortage of water by year 2000 (Table 2.)

3.3.4 Soil Erosion and Sedimentation

Like water resources, soil will also be heavily affected by increasing human activities in the MFR. Through the erosion process, the cultivated areas become poor and the water in the streams silted that brings various kinds of pollution problems in the lowland communities. Zone 5 exhibits the highest average soil erosion potential among the six zones because of its least forest cover and high incidence of cultivation. About 80% of Zone 5 has moderate to very high erosion potential. On the other end, Zone 1 has the lowest average erosion potential because it has the largest area covered by natural and plantation forests (Table 3).

Table 2. Available and required groundwater by municipality around MFR (NWRC 1982).

Town	Inflow	Potential max No. of wells[1]	Demand[2] ($x10^3$L/day)	No. of wells required[3]
Alaminos	8,992	30	6,004	10
Bay	15,677	240	7,619	85
Calamba	31,738	265	38,209	245
Calauan	16,009	160	9,120	60
Los Baños	11,455	80	14,706	130
Sto. Tomas	8,985	20	13,528	10
Tanauan	10,593	50	25,954	35

[1] No. of wells includes shallow and deep wells
[2] Demand figures projected for year 2000
[3] No. of wells required in the year 2000

Table 3. Erosion hazard potential distribution (ha.).

Erosion Class	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Total
1	-	92.6	71.7	252.3	115.7	-	532.3
2	94.9	16.2	13.9	67.1	559.1	67.1	818.3
3	11.6	-	-	34.7	354.2	85.6	486.1
4	412.3	614.8	350.5	309.0	143.5	121.7	1,951.8
5	203.7	46.3	20.8	-	44.0	64.8	379.6
6	-	-	-	13.9	60.2	2.8	76.4
Total	722.5	769.9	456.9	677.0	1,276.7	341.5	4,244.5

3.4 Decision-Making Patterns

The MFR is under the control, jurisdiction and administration of the University of the Philippines at Los Baños. The lead unit is the College of Forestry who coordinates with other concerned university units for the sustainable management of the MFR. When it comes to special uses, another university unit is in charge of making decisions, the University Land Property Committee. Although a representative from the College of Forestry sits as a member of the Committee, such an arrangement is still awkward and ambiguous.

As far as forest occupants are concerned, there exists no formal institutional linkages/relationships with the university.

Likewise, the administration of the MFR in the past years had no formal linkages with local government units (LGUs) within and around the reservation. Lately however, the administration has started involving the LGUs in taking some actions to protect MFR from further deterioration.

The administration has also shifted from a more bureaucratic to a more participatory approach to planning and management decision making.

The university has the authority to make management decisions yet cannot do so decisively due to the pressures of various stakeholders who may not have legitimate authorities/rights but are part and parcel of the entire watershed system. This was further limited by the lack of adequate biophysical and socioeconomic information about the properties and behaviors of the MFR as a system.

3.5 System Properties

A summary of the characteristic features by watershed zones is presented in Table 4. It can be noted that the six (6) watershed zones are distinct from one another on the basis of a number of biophysical and socioeconomic features. Hence, the watershed zones also differ as far as watershed (system) properties are concerned.

The major factor influencing the sustained productivity and equitability of use in Zone 1 is the pressure of various leases involved in research and development projects. These MFR users do not seem to be fully aware of its responsibilities in maintaining the productive capacity of the area they use.

Table 4. Comparative watershed zone characteristics.

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
1. Land Area (has)	722.51	769.84	456.86	676.95	1276.74	341.47
2. Elevation						
(a) Highest Elevation	1040	1143	1143	1143	1060	449
(b) Elevation of Furthest Point	70 - 80	20 - 40	40 - 60	400	20 - 40	120 - 140
(c) Elevation of Nearest Point	100 - 120	200	360 - 380	320	360 - 380	240 - 260
3. Dominant Slope (s)	>40% ; 26 - 40%	>40% ; 26 - 40%	26 - 40% ; > 40%	>40% ;	4 - 8% ; 16 - 25% ; 26 - 40% ; > 40%	26 - 40% ;
4. Vegetative Cover						
(a) Mossy Forest	-	6.55%	10.75%	8.76%	3.94%	-
(b) Residual Forest	69.43%	73.47%	65.45%	48.26%	21.61%	41.48%
(c) Brushland	11.46%	11.80%	18.23%	26.85%	43.85%	36.09%
(d) Open/Cultivated	19.11%	8.18%	5.50%	16.23%	30.57%	22.43%
5. Land Uses						
(a) Forested	64.43%	80.02%	76.02%	57.02%	25.55%	41.48%
(b) Water-source (intakes)	5 intakes	2 intakes	1 intakes	1 intakes	None	None
(c) Plantation Areas	existent	existent	x	existent	existent	x
(d) Grassland Areas	x	x	present	present	x	x

Table 4. Comparative watershed zone characteristics.

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
(e) Special Uses/ Other Uses	BSP NAC MBG Makiling Rainforest Park UPCF Campus Housing Areas	PGI (1 drill site)	none	none	PGI Drill-site Nursery (7)	ERDB Experimental site
(f) Kaingin Areas	present	present	present	present	present	present
(g) Settlement Areas (1990) No. of Houses	40	24	12	8	146	15
(h) Project Areas	(2) Coconut Gene Bank, Agroforestry	none	1 (Hydro-ecology)	none	MEDF and other projects	ERDB
6. Access Roads	present	-	-	-	present	-
7. Problems	research and development projects	settlements	farming, quarrying, mining	agricultural expansion	settlement, farming, geothermal drilling	farming

In Zone 2, the productivity and equitability of resource use are threatened by the unregulated settlements by migrating lowlanders. A problem which is aggravated by the increasing cost of acquiring land in the lowland communities adjacent to Zone 2.

Zone 3 is beset by farming, mining and quarrying activities. These are mostly erosive land uses which not only endanger the long term productivity of Zone 3 but also brings a lot of siltation problems downstream. It creates a condition of inequitability in terms of benefits and costs both in favor of the upland users to the disadvantage of the lowland communities.

In Zone 4, the problem is more on expansion of lowland agriculture into the uplands. A typical situation where forested areas are converted to plantation of coconuts and other agricultural crops.

In Zone 5, the major problems are settlement, farming and geothermal drillings. This zone has the smallest area of remaining old growth forests which is a result of intensive land clearings in favor of farming. At present, new clearings are still taking place. Geothermal drillings on the other hand, continuously operates in the watershed without even an active cooperation and coordination with the UPLB.

In Zone 6, farming is a big problem that can adversely affect the sustainability of the watershed. Its proximity to the expanding lowland communities in the municipality of Bay is exerting pressure on those individuals who cannot compete with the lowland population for good paying jobs.

3.6 Key Questions/Issues Identified

Based on the watershed features and properties described, the following questions and issues were identified during the workshop:

3.6.1 Key Questions for Research

1. ***What resources found in the MFR need to be protected, and which may be accessed and managed by the community together with the UPLB Administration?***

Research Hypothesis:

There are resources in the MFR which have valuable educational, scientific and ecological values and every effort must be made to protect them, and there are areas which may be utilized by the community on a sustainable level.

Actions Required:

An assessment or inventory of resources in the MFR must be carried out using the techniques of aerial photogrammetry, land use mapping, area zonification, and parcellary survey.

Justification:

Data on resources inventory are basic for the formulation of appropriate conservation and development plans for the MFR as well as in policy and decision-making.

2. ***What policy options should be adopted to solve human settlement and tenurial problems among settlers and users of the resource?***

Research Hypothesis:

The tenurial arrangement for each of the types of settlers and users is likely to differ. This therefore necessitates the identification of different tenurial options for the current resource users.

Actions Required:

There is a need to identify the various resource users in the MFR and analyze who they are, where they are farming, the extent of resource utilization, the nature of production systems, and the extent of economic dependence on the MFR.

Justification:

Tenure is a critical factor for resource conservation. Hence, there is a need to work out viable options specific to each particular type of user and location (i.e., watershed zone).

3. ***Are the farming systems being adopted by the farmers in the MFR ecologically destructive? Are they economically the best use of the land given the environmental constraints?***

Research Hypothesis:

The present farming systems of settler-farmers in the MFR cause soil erosion and other ecological disturbances, not only in the area but in downstream communities as well. The long run profitability of the land cannot be sustained with the present land use practices.

Actions Required:

A survey of the farms (occupants, location, and selected characteristics) and economic and environmental impact assessment of the farming systems being adopted in the area will be carried out.

Justification:

An empirical basis for determining whether the farming systems in the MFR are ecologically destructive and economically profitable will help determine alternative farming systems suited to the varying land conditions in the MFR.

4. ***What is the maximum land retention limit for each farm family in the MFR?***

Research Hypothesis:

There is a specific maximum land area that will provide economic and financial returns which would be adequate enough to sustain an average farm family in the MFR.

Actions Required:

The economic and financial returns of a given unit of farm land will be estimated.

Justification:

The maximum land retention limit is significant in formulating the necessary policy for land allocation, and in determining equitable land distribution among the MFR occupants. The study must ensure that economic returns are being realized without bringing about environmental degradation in the area.

3.6.2 Key Questions for Development

What steps must be taken immediately to preserve the remaining resources and to prevent the current problems of encroachment from worsening?

Guidelines:

1. Consider the potential of the existing and surrounding communities as partners in enforcing forest protection. This is known as a social fencing strategy and it requires community organization activities.

2. Explore the possibility of linkages with the concerned local government units as allies in protecting the area.

Working Hypothesis:

1. Involvement of the settled communities and local government units (as stakeholders) will facilitate protection efforts in the area.

2. Continuous encroachment will gradually fade away with the community acting as the guardian of the area.

Actions Required:

1. Community organization to generate interest, appreciation and participation in the protection and conservation of the MFR.

2. Tapping the existing communities to serve as the buffer zone or social fence.

3. Establishment of formal linkages with LGUs.

4. Conduct intensive information, education and communication campaign in the area and nearby communities.

CONCLUSIONS

Watershed approach to forest management is a viable approach to achieve sustainability of productive and protective benefits of a forest in an equitable manner. It sets a framework wherein the boundary, components and properties of an ecosystem are properly identified, described and understood. Through the watershed approach, the usually competing objectives of the different forest subsystems can be harmonized. The approach could also facilitate an accurate identification, measurement and evaluation of the impacts of various management strategies and decisions on the entire forest ecosystem and the systems (biophysical and socioeconomic) outside its boundaries.

Watershed approach is consistent with the systematic and holistic approach. Using watershed as the unit of management, the sustainability, protectivity, stability and equitability of a forest ecosystem can be thoroughly examined. As demonstrated in the case study for the MFR, the identification of problems, issues and concerns are relevant to the formulation of an effective research and development plan. It was shown how the watershed approach and the agroecosystems analysis brought to fore the key problems and issues which relates to the distinct features and properties of the different watershed zones.

REFERENCES

Brooks, K.N., P.F. Ffolliott, H.M. Gregersen and J.L. Thames. 1991. Hydrology and the management of watersheds. Iowa State University Press. Ames, Iowa.

Conway, G.R. 1985. Agroecosystems analysis. Agricultural Administration 20: 31 - 55. Elsevier Applied Science Publisher, Ltd., England.

Cruz, R.V.O., H.A. Francisco and C.S. Torres. 1991. Agroecosystems analysis of Makiling Forest Reserve, Philippines. Environment and Resource Management Project (ERMP). Philippines.

Fellizar, F.P.Jr. 1989. Watershed as a unit for integrated resource management. Policy paper presented during the FDC Policy Seminar, July 13, 1989, UPLB-College of Forestry, College, Laguna, Philippines.

Khan, M.M. 1969. Some properties of the forested soils of Mt. Makiling and its vegetation. UP at Los Baños (Ph.D. Dissertation), College, Laguna, Philippines.

Mallion, F.K. and J.T. Dizon. 1990. A study of the occupancy in the Makiling Forest Reserve. Forestry Development Center, UP at Los Baños, College, Laguna, Philippines.

Master Plan for Forestry Development. 1990. Department of Environment and Natural Resources. Quezon City, Philippines.

NRMP. 1992. Monitoring and verification mid-year report. Policy Action No. 5"Preserve remaining old growth forests and the biodiversity contained therein". Policy Monitoring and Assessment, Natural Resources Management Program -WINROCK International. USAID/Philippines.

NWRC. 1982. Rapid assessment of water supply sources. National Water Resources Council Report No. 36 Vols 22,24.

Torres, C.S. and E.N. Rebugio. 1991. Census of household occupants in Makiling Forest Reserve. Institute of Forest Conservation and Institute of Environmental Science and Management, UP at Los Baños, College, Laguna, Philippines.

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