

6-5-7 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.

(1) Necessary Volumes of Felling

1) Population

The population of the Model Area tends to increase due to the migration plan as well as to natural increase. The present populations at three locations in the Model Area (including scattered populations) stand 18,269 at Dupax in the Magat River Valley, 11,293 at South Dupax, and 19,994 at Kasib in the Cagayan River Valley, totalling 49,556.

There were 531 families who came to settle in this area for I.S.F. The present plan assumes one such family averaging five members totalling 2,655. (See I.S.F. Plan)

2) Forecast of Timber Demand

The Model Area is not a totally secluded remote area since it has national and provincial roads running inside the area and electrification is relatively advanced. Taking this into consideration, the demand is forecast for timber and fuelwood.

1 Fuelwood

According to a FAO/Unesco survey, consumption of fuelwood in migratory farming areas and relatively densely populated areas is 0.5–0.9m³/year person. Based on this, the demand for fuelwood was calculated with respect to I.S.F. settlers and other local residents.

Fuelwood demand:

I.S.F. Settlers: 531 families × 5 members × 0.9m³ = 2,400m³/year

Other residents: 46,500 persons × 0.2m³ = 9,300m³/year

Totalling 11,700m³/year

(6-year total 70,200m³)

2 Timber

Housing in the Model Area is made of timber, bamboo, coconut (leaves), bricks, concrete (blocks), cogon, tarahibu. There are no statistics available on which to project the future demand for timber and, therefore, 30% was assumed as the amount of felling for timber in the total forest production.

(2) Selection of Felling Locations

1) Limits of elevation

The Forest Resources of Region 2, a report points out that access is difficult to Dipterocarp forests in the mountains of over 800 meters in elevation and they do not have much in stock for an economic forest. The report also states that Mossy and Submarginal Forests in the mountains of more than 800m in elevation are not suited for economic development and, therefore, should be preserved as Protection Forest for water resources conservation.

Aerial photo interpretations of the Model Area and forest resources surveys also confirm these statements, so that in this project, felling is limited to those located below 800m.

2) Access road

Based on the topographic map and aerial photo interpretations, forests of less than 800m were surveyed for roads including walkways, while access was examined in relation to the respective forests for which felling was planned based on the Forest Road Plan so as to determine forests for timber and fuelwood production.

3) Consideration for Felling

After felling, vegetation growths are expected to replace rather quickly. In felling, care must be taken 1 not to cut adjacent trees; 2 to be selective so as to keep such crowns that protect the ground surface; 3 to avoid steeply sloped areas; 4 not to damage the underlying vegetation. By further considering the evaluations of the Forest Information Table, the cutting rate was set at 10%.

(3) Survey of Forest Resources

To size up the volumes of forest resources in the Model Area, the survey was conducted at 11 locations using the dendrometer, with the results as shown in Table 6-21.

Table 6-21. Volumes of Forest Resources per hectare in the Model Area

Plot No.	Species	m ³ /ha
1	Mixed	140.40
2	"	237.60
3	"	234.00
4	"	113.90
5	"	70.20
6	"	212.65
7	"	249.50
8	"	210.60
9	"	228.20
10	"	214.20
11	"	248.00
total		2,159.25
average		196.30

The average volume per hectare of 196.30m³ is based on the total trunk volume including barks. To determine the effective volume, the following formulas applicable to Northern Luzon were employed:

Dipterocarpaceae $Vm^3 = 0.00005203 (D^2 H)$

Non Dipterocarpaceae $Vm^3 = 0.00005109 (D^2 H)$

where: D: DBH, cm

H: Commercial Height, m

The effective volume coefficient: 0.65

The effective volume per hectare, therefore, is: $196.30\text{m}^3 \times 0.65 = 127\text{m}^3/\text{ha}$.

For fuelwood, $196.30\text{m}^3/\text{ha}$., a total trunk volume, is assumed as the effective volume. Branches and twigs are considered for use as fuelwood. By assuming their percentage as 0.5625% (the value derived from the survey in Paraguay), 10% for cutting rate, and the areas of forests specified for timber and fuelwood production, the volumes of branches and twigs are calculated as follows.

- Volume of branches and twigs from timber production forests:
 $1,354\text{ha.} \times (196.30\text{m}^3 \times 0.5625) \times 0.1 = 14,950\text{m}^3$
- Volume of branches and twigs from fuelwood production forests:
 $1,952\text{ha.} \times (196.30\text{m}^3 \times 0.5625) \times 0.1 = 21,554\text{m}^3$

(4) Timber and Fuelwood Production Plans

Based on the above results, plans for production of timber and fuelwood were formulated as shown in Tables Plans by Compartment and Sub-Compartment are attached as ANNEX 7, 8.

Table 6-22. Timber Production Plan

Parcel	Cutting method	Area (ha)	Species	Percentage of selective cutting (%)	Volume* (m ³)
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 6-23. Fuelwood Production Plan

Parcel	Cutting method	Area (ha)	Species	Percentage of selective cutting (%)	Volume (m ³)	Volume of branches and twigs (m ³)	
						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

(5) Production Period

The Reforestation Plan and I.S.F. estimate that the fuelwood demand in the Model Area will be met locally in a six years time. Assuming, therefore, six years for production, demand and production in the Model Area are compared in volume in Table 6-24, which shows that there will be enough production to meet the demand.

With respect to timber, existing forests are capable of supplying 17,195m³ in effective volume, but subsequently it requires reforestation which takes at least ten years to get ready for supplying. When timber of 17,195m³ is to be produced over ten years, volumes of branches and twigs will be reduced and, therefore, the plan calls for that much larger volume for production than that of consumption.

Table 6-24. Comparison of Demand and Production in Volume

Timber (m ³)		Fuelwood (m ³)			
Production	Demand	Production		Total	Demand
		Full stem length	Branches and twigs		
17,195	17,195	38,318	36,504	74,822	70,200

Note: Timber means merchantable volume without bark and fuelwood volume with bark.

(6) 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.

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

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

– 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.

(7) 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.

Since this present plan addresses the wood supply for local residents of the Model Area, large volume logging in a short period of time is unlikely so that the use of heavy machines like a tractor should be avoided in logging and instead, working cattle commonly observed in the area can be used for a short-distance haul as far as a vehicle road.

In felling, attention should be paid to the following.

– To ensure safety,

– To predetermine the direction of cutting so as not to hurt the remaining trees unnecessarily.

– To predetermine the order and direction of cutting so as to help reforestation and hauling operations.

(8) Disposal Method

The timber and fuelwood production plans are intended for local residents of the Model Area. It is desirable that disposal of tree stand by local residents for their own use be made only on application and when the application is granted,

officials from the Forestry Office in charge be on hand as the cutting takes place to make sure that it is done properly.

6-5-8 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 promotion 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.

(1) Classifications and Specifications of Forest Road

Forest roads are classified in two types: main road and work road. The main road is a trunk road serving a whole parcel or several Compartments while the work road is logistical and temporary in nature and minimal in length, and serves other ancillary activities while they are under way.

The roads are basically for truck traffic and further specifications are worked out accordingly paying due consideration to the local conditions such as terrains, geology, socio-economic factors. The standard specifications for the Main Road call for a longitudinal grade of 9% at maximum and a curve radius of 15m at the least.

Bridges and drainage facilities should be made as simple as possible; a submerging type for bridges and stone work and log work for drainage.

For maintenance, care must be taken to prevent erosion and wash-out of road surface and shoulders due to torrential precipitation during the rainy season.

(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 and Table 6-25.

Table 6-25. Forest Road Planning (by Parcel)

Parcel	Compartment	Length km		Parcel	Compartment	Length km	
		Main Forest Road	Working Forest Road			Main Forst Road	Working Forest Road
I	5	4.8	2.0	IV	41 ~ 44	6.3	6.8
	6	2.8	2.0		46		4.5
	6		1.3		46		3.5
	9		2.8		48		5.0
	10	1.0	2.5		52 ~ 55	5.8	8.5
	11		9.0		56	4.3	4.5
	11		0.8		Sub-total		16.4
Sub-total		8.6	20.4	V	59, 61	6.0	
II	17		6.0		60		3.5
	19		2.7		65		5.3
	22 ~ 23	4.8	1.3		71		1.3
	22 ~ 23		1.8		72		7.5
Sub-total		4.8	11.8		75		3.8
III	26 ~ 27	8.8	3.3		78		1.8
	26 ~ 27		1.8	81		1.0	
	30		4.8	82		3.3	
	30		0.6	Sub-total		6.0	27.5
	35		1.3				
	36		1.8	Total		44.6	110.4
	38		4.3				
Sub-total		8.8	17.9	Grand total			155.0

6-5-9 Conservation of Soil and Water

(1) 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.

Civil engineering work should be undertaken during the dry season and planting work immediately before the start of the rainy season. Work is done in a realistic manner commensurate with location conditions, and local labor force is fully utilized.

1) 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.

2) Execution of work

Hillside work concerns collapsed land, bareland, and grassland with such hazards. For areas with high potential for land collapse, work involves reshaping of slopes as necessary, making steps, and planting as well as natural vegetation covers.

Major existing stream works in the study area include one dry masonry dam (Nabitagan Dam: catchment area 3,000ha.; length 70m; height 10m; built in 1979; concrete covered dry masonry work heavily damaged) and three mixed masonry dams (located at Dupax; catchment area 300ha.; length 10m; height 1m-1.5m; built in 1985-86; no undercutting at the water apron which is concrete but filled up with sands in a year's time). Since these materials are easily available, stream works should be less vulnerable to breakage, longer in life, and leaving much allowance in design.

For this purpose, basic research needs to be done on rainfall, stream flow volume, stream bed gradient, etc. to determine a design, size, and materials for stream work.

Round gravels are commonly observed in this region but from the percentage of void due to resistance resulting from sliding, debris is more effective and their voids are filled up by mortar to make the body of a dam.

To prevent undercutting, the water apron is to be concrete. Spur jetties are either piles, wicker or wire wicker. For retaining wall work, land fill to prevent overflow and a cylinder dam and stone work for undercut slopes are applied.

(2) Soil and Water Conservation Plan

The Soil and Water Conservation Work Plan is as shown in Table 6-26. It is planned to start with a Sup-Compartment with the highest land collapse/slide potential moving in the order of potential ratings. This project basically addresses areas with H and M ratings but considering changes in forest conditions over years and intensity of land use, even areas with L rating can be dealt with as need be.

Scopes and quantities as given in the table are provided as guidelines and it takes more specific planning for actual work.

Table 6-26. 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.

6-5-10 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 6-22.

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.

(1) Scenic Forestry

To work out specific forestry activities in accordance with the purpose of this protection forest, zoning was made as follows and activities were specified for the respective zones.

1) Reforestation Zone

This is where grassland is turned into forest by reforestation. Reforestation is done in a manner not only to prevent disasters associated with mountainous areas but remembering simultaneously to pay due attention to landscaping.

Namely, for where there is a fear of loss of soils in the steep slopes, compound storied forests are appropriate as a type of forests resistive to land collapses while other flat areas are planted in an ordinary manner.

2) Scenic Forest Zone

This is a zone where scenic values of forests are to be emphasized. Tending (involving removal of vines and bushes, cutting of branches) and thinning of trees are required for maintenance.

3) Recreation Zone

Facilities to be located here include a vehicle road, parking lots, a playground, rest places, a swimming pool, an administration office. The zone is maintained as a part of the protection forest and kept attractive enough to visitors.

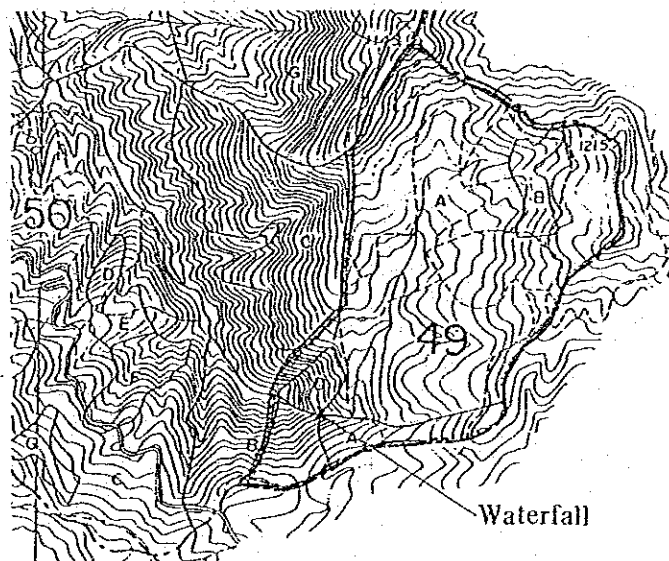


Fig. 6-22. Location of Parks and Outdoor Recreation Area

(2) Facilities

Of the walkway running from the existing provincial road at a mountain peak to the neighborhood of the waterfall, the portion that runs along the ridges is made a vehicle road, a 4-meter wide light-gravelled road. Walkways are to be built in three routes: one running straight to the waterfall, another making a detour while commanding a grand view of the waterfall and thirdly a circulating route among trees.

The vehicle road will be lined with flower trees. Walkways will also feature flower trees as appropriate. The parking lots, playground, swimming pool, and the administration office will be built on a flat land along the ridges so that they can serve also as a meeting place for vistors. Rest places will be located in the vicinity of the waterfall. At vista points, hand rails and benches will be installed.

Table 6-27. Representative Flower Trees

Species	Flowering mon.	Period mon.	Tree Crown m	Color	Tree Height m
Fire Tree	2 ~ 3	2 ~ 3	5 ~ 7	red	10
Golden Shower	3 ~ 5	3 ~ 5	5 ~ 7	yellow	10
Dapdep	3 ~ 5	summer time	5 ~ 7	red	10
African Tulip	3 ~ 5	summer time	5 ~ 6	red	10
Banaba	3 ~ 6	summer time	3 ~ 5	purple	3 ~ 8

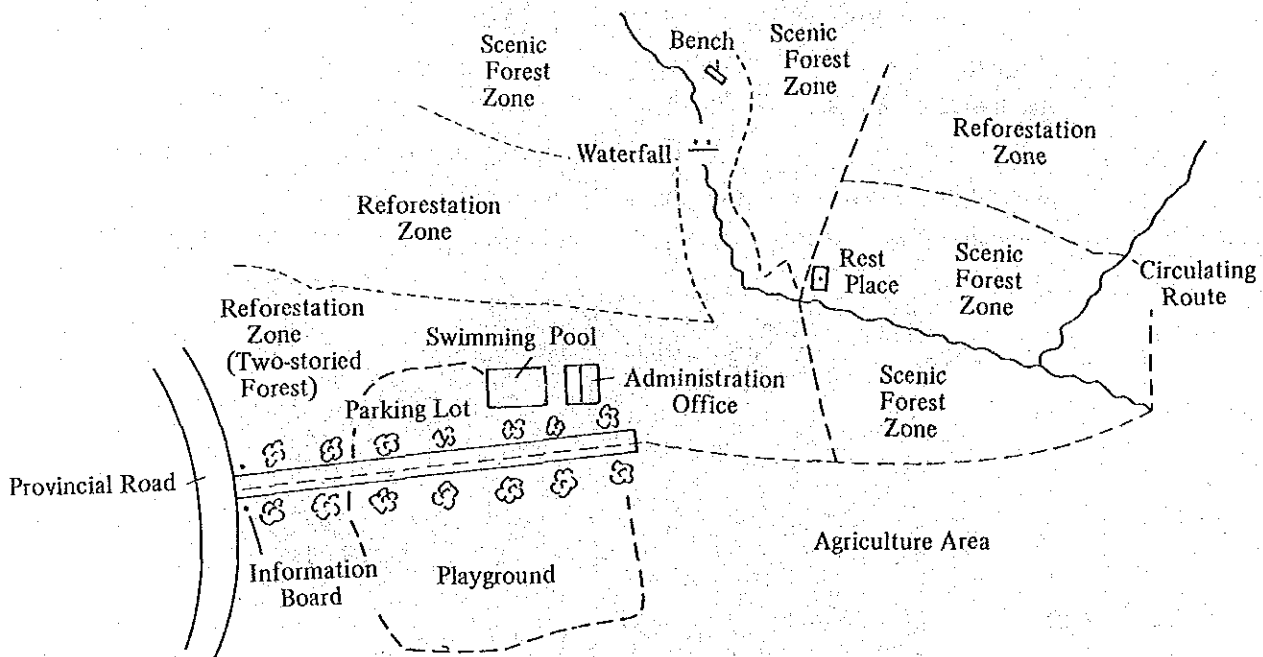


Fig. 6-23. Sketch of the Parks and Outdoor Recreation Area

6-5-11. 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.

Generally rattan grows in the mountains of up to 2,000m in Cagayan and Nueva Vizcaya Provinces, although there are variations depending on species. By genus, *Clamus* 48, *Daemonoropo* 14, *Karthalsia* 5, and *Plectocomia* 2, totalling 69, are observed. There are some kinds which grow 6 to 10 meters in a 10 to 15 years time, big enough for harvesting.

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.

1) Rattan Production Forest

Rattan production is included in I.S.F. Additionally, rattan production is planned for 3,306 ha. of the timber and fuelwood production forests.

2) Rattan Production Plan

The following formula is applicable to rattan production.

Formula:

$$AAC = \frac{A \times Av}{r} \times f$$

where: AAC = annual allowable cut in lineal meters

A = forested area in hectare

AV = average stand per hectare

r = rotation period or 15 years

f = recovery factor of 85%

The following are given for computation.

A = 3,306 ha.

Av = 100 lineal meters*

r = 15 years

f = 85%

$$AAC = \frac{3,306 (100)}{15} \times 0.85 = 18,734 \text{ lineal meters}$$

* Previously the rattan reserve for Dip.-Residual Forest was given as 413 lineal meters/ha. for those of 2cm or more in diameter. But diameters vary from less than 1cm to as much as 10cm depending on species so that from a practical standpoint, 100 lineal meters is generally accepted as Av and therefore it is applied here also.

Therefore, rattan production timber and fuelwood forests are assumed as 18,734 lineal meters.

6-5-12. Forest Protection

While improving preventive measures against various types of damages to forests, efforts will be made to institutionalize such preventive programs to ensure healthy growth of forests.

(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. Specific programs were planned as follows.

1. Setting of Fire (Arresting) Line

As forested areas expand continuously in space, so does the possible extent of damages from fire. Fire lines can be set up to keep the forested area from spreading too widely for control of forest fires. Their planned locations and length are given in Table 6-28.

Table 6-28. Location and Length of Fire Line

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

2. Planting of Fire Retardant Tree Species

Along the fire lines, fire retardant trees like yamane and teak will be planted on both sides for a width of 20m or wider. This is included as part of the reforestation plan.

3. 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 6-29. (Figures 6-24, 25 and 26).

Table 6-29. 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.

4. Patrol

To supplement the surveillance operations, forests will be patrolled by a mobile task force group equipped with communications device and residents are cautioned against forest fires.

(2) Insect/Disease Control

At present, damages from insects and diseases are not a serious problem but the risk increases proportionately as forested areas increase, so that preventive measures should be worked out in time.

Meteorological damages are caused by wind-fall of trees, landslides of forestland due to torrential rains, etc. For damages done, proper care should be taken by appropriate regeneration and tending to suit the actual conditions. At the same time, preventive measures should be taken, creation of a protection forest zone being one of them.

Diseases and insect damages include those from Giant Ipil-Ipil yellow leaf disease and insects like *Ips caligraphus* for *P. kesiya*, and *Hypsipyla* sp. for mahogany. By timely surveillance, early detection and early control can be accomplished.

(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.

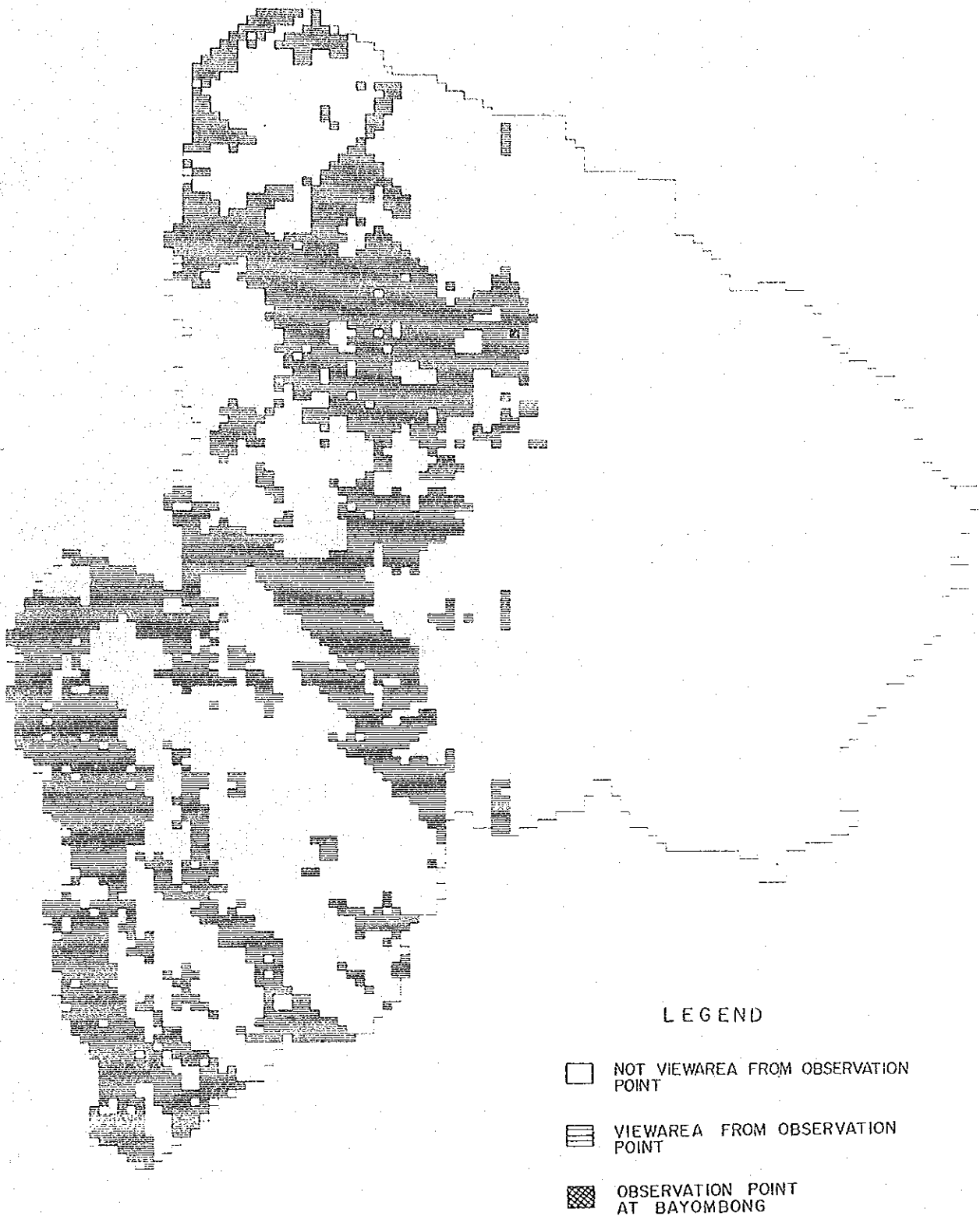


Fig. 6-24. Exposure (1)

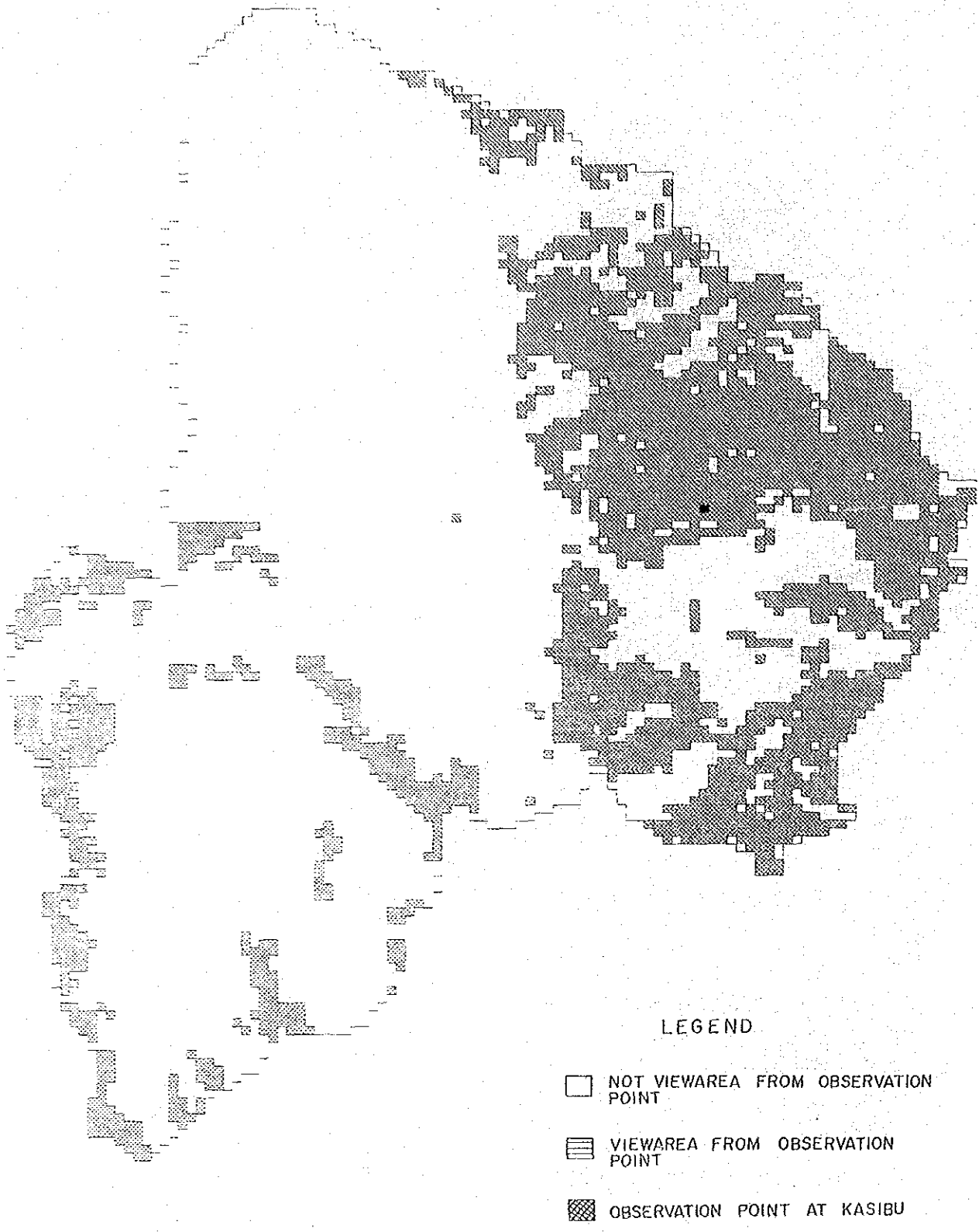


Fig. 6-25. Exposure (2)

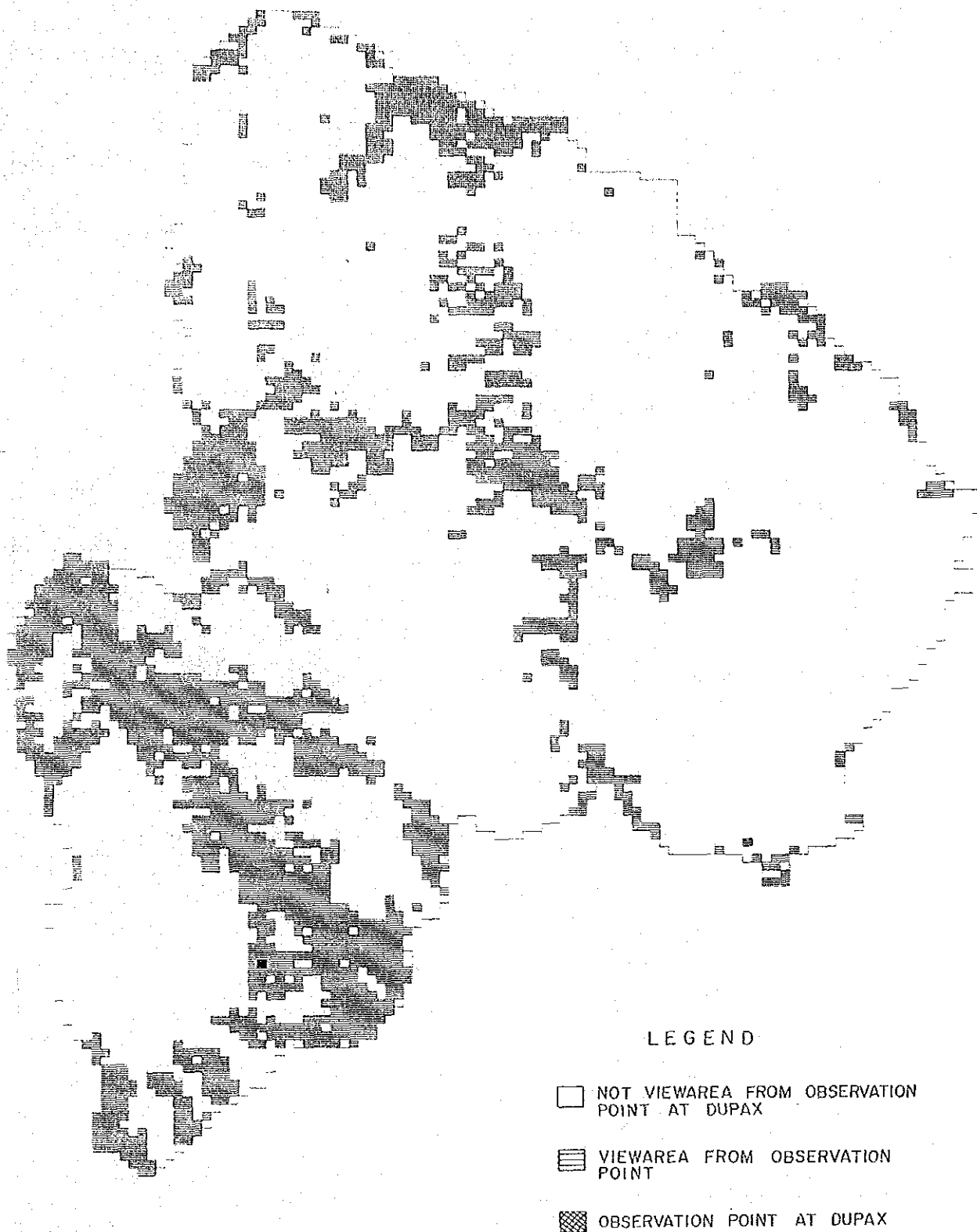


Fig. 6-26. Exposure (3)

6-5-13. 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.

(1) Establishment of Reforestation Technology

① Reforestation Performance Survey

Purpose	Evaluation of Suitability
Tree species to be surveyed	All planting tree types
Survey location	One per parcel
Survey area	1,000m ² (40m x 25m) per species
Survey period	At the time of planting, once every year thereafter.
Survey Method	Height for every tree; Breast height (or at root) diameter measurement for 3 year olds, same order (direction) of measurement for each plot.
Recording	Field survey results are recorded in the field book in the formats as shown below. The data then are transferred to the Record Book for keeping.

Reforestation Performance Record Book

Polt No.	Tree species	Date of planting	Height	Slope	Direction	Soil	Previous vegetation	Soil preparation

Date of survey	No. of pieces	Height			Diameter (at breast height or at root)			Remarks
		Highest	Lowest	Average	Max.	Min.	Average	
								Diseases, tending, etc.

Reforestation Performance Field Book

Plot No.		Tree species		Survey date	Weather	Name of surveyor
Survey tree No.	Tree height		Diameter (at breast height or at root)		Remarks	

② Weeding Survey by Weeding Method

Purpose	Effective tending
Tree species to be surveyed	All planting tree types
Survey location	2 locations per tree species
Survey area	5,000m ² (100m x 50m), of which 1,000m ² (40m x 25m) for tree height measurement
Survey period	At the time of bush cutting; tree height measurement at the time of planting, and once every year thereafter.
Survey method	Amount of labor needed by method; Tree heights for every 1,000m ² fixed plant to be surveyed according to Field Book format.

Weeding Survey Field Book (Labor amount by method)

Plot No.		Tree species		Date		Weather		Name of surveyor
Weeding method		Labor needed		Last cutting		Bush type		Bush height
Tools		Slope				Remarks		

Weeding Survey Field Book (Tree height measurement)

Plot No.		Tree species		Date		Weather		Name of surveyor
Weeding method		Times of bush cutting and dates			Bush height (Ave.)			
Survey tree (No need to fix)				Tree height	Remarks			

Weeding Survey Summary Table

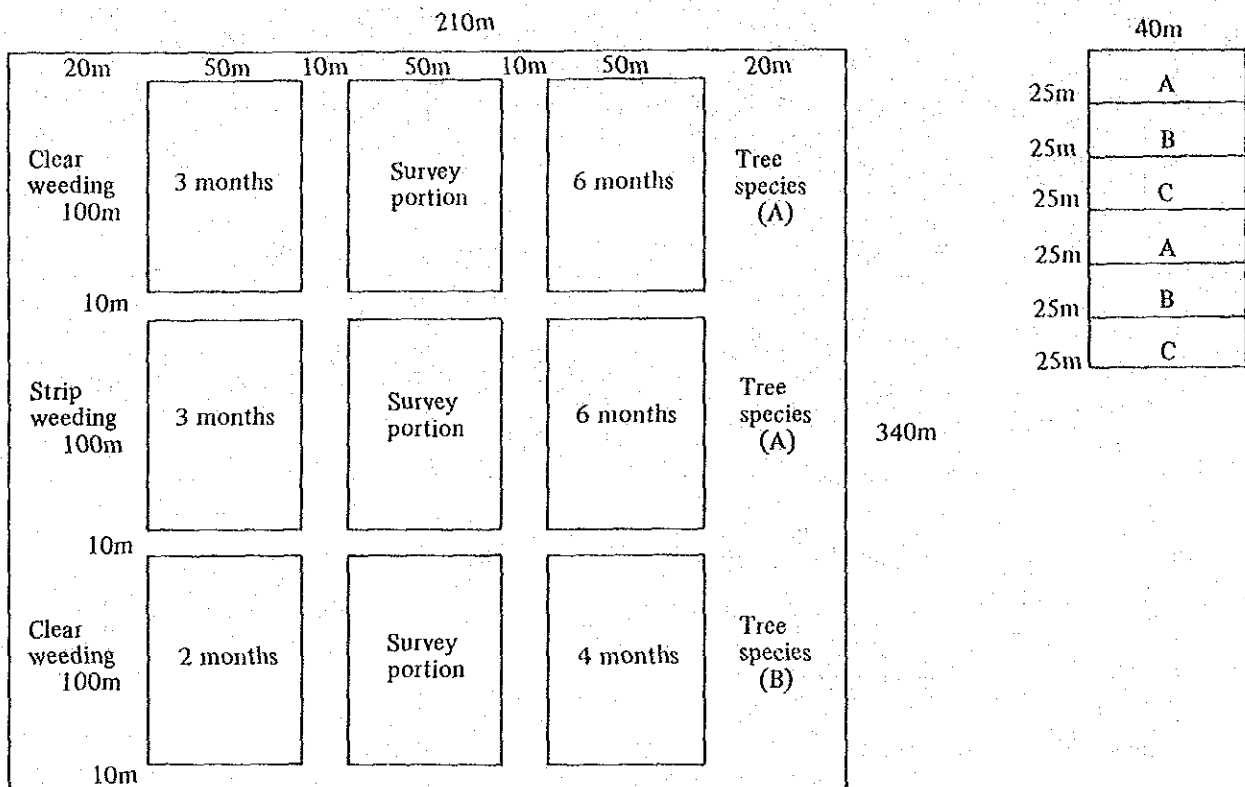
Plot No.	Tree species	Method	Labor (persons/ha)	Remarks

Survey of the Relation between Weeding Period and Production Tree Growth

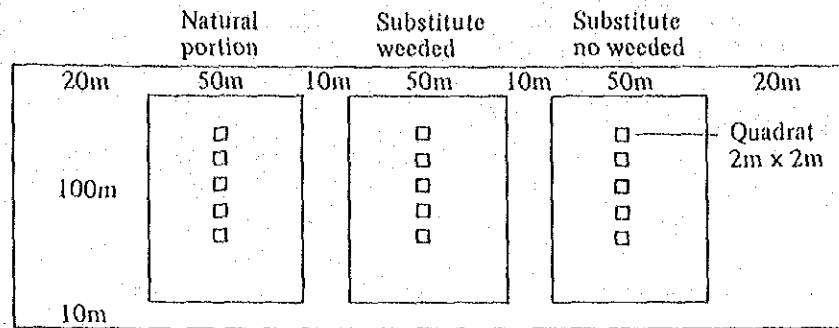
Plot No.	Tree species	Method	Interval	Average tree height	Bush height	Dead tree ratio	Remarks

Example of Test Site Location

1. Weeding Test Site (Periods in numbers of months)
2. Reforestation Performance Test Site (A, B, C : Tree type)



3. Natural Regeneration Test Site



③ Protection against Forest Fires (Research)

1. Preventive measures

- a. Planting of fire retardant trees – Yamane, Teak, (mango)
- b. Development of fire lines (tree belts) – Terrains (ridge lines, riversides), methodology (wind directions, force)
- c. Fire reservoirs

2. Creation of fire fighters corps – Recruitment, (watch station, fire extinguishing equipment)

3. Patrol – Early detection, mobility, communications

4. Education, publicity – Call for cooperation by responsible administrators, planting festivals, athletic meetings, poster contests.

(2) Natural Regeneration Technology Development

Keeping track of young growths

The survey to keep track of young growths will be conducted at sites chosen for typical terrains, geology, soils, as well as for cooperation and management convenience.

In the survey site, two zones are set, one for natural growth and the other for clearing. The latter has two sub-sections, one for brush cutting and the other for non-brush cutting.

The size of the survey site is 50m x 100m in which five 2m x 2m sections are made and, for each section, records are taken of tree species, generation and loss of young growths, growth by height. A survey is made regularly once a year and survey records are kept.

Natural Regeneration Survey Field Book

Compartment sub-compartment		Survey date		Name of surveyor	
Portion		Plot No.			
Tree species	No. of trees last surveyed	No. of trees	Balance	Average tree height	Remarks

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

6-6-1. 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.

6-6-2. Contents

1) Conditions for site selection

I.S.F. sites are selected on the following conditions.

1. It is least prone to soil erosion, land collapses/slides.
(ANNEX 8; I.S.F. Information Table)
2. Existing cultivated land is applicable in principle but those of scattered small lots are excluded from the standpoint of forest management (particularly with respect to forest fires).
3. The average gradient is less than 25%, including those of less than 18% (the maximum for cultivated land).
4. It is in proximity of a vehicle road and easily accessible.
5. Water supply is ensured for household and irrigation.

The sites selected accordingly are listed in Table 6-30. For details, refer to Map No. TM-4:1, 2, and FM-13:1, 2, ANNEX 10, and I.S.F. Plan Table.

Table 6-30. Existing Vegetation by Parcel

Parcel Vegetation	I	II	III	IV	V	Total (ha)
1	36.95	42.97	84.80	41.11	82.70	288.53
2				18.01	14.83	32.84
3						
4	54.88	189.74	265.70	65.66	149.24	725.22
5			7.02			7.02
6	271.39	781.04	342.35	346.33	638.21	2,379.32
7			5.19			5.19
Total	363.22	1,013.75	705.06	471.11	884.98	3,438.12

* Vegetation types include the following.

4 and 5, originally classified under Kaingin, they are categorized as MC₁ and MC₂.

- | | |
|---|--|
| 1. Logged-over, Secondary (NL) | 5. Permanent Cropland (MC ₂) |
| 2. Reproduction and Bushland (NR) | 6. Grassland (include Pasture) (G) |
| 3. Mossy Forest (NY) | 7. Built-up Area (B) |
| 4. Seasonal Cropland (MC ₁) | |

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 6-31. For details, refer to ANNEX 10, and The I.S.F. Plan Table.

Table 6-31. 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

3) Points to note

The climate of the Model Area falls in Type III as defined earlier with no conspicuous seasonal changes, a spell of relatively dry weather from November to April, the rest of months being wet.

For selection of trees for planting and items for production under these climatic conditions, the Philippine Agriculture Fact Book & Buyers' Guide (Published by Philippine Almanac Printers, Inc.) was referred to and partly quoted in Table 6-32.

From the marketing standpoint, the selection should consider the fact that, the whole country ranging widely in latitude from 4° to 22°, harvesting periods of the same item can vary greatly from one place to another, so that it is important to follow not only the neighborhood market but markets in other regions for their latest trends.

1. Cultivation

Individual families have 1.5 ha. each for cultivation. Living within this site, they raise crops basically for their own consumption and possibly some for marketing.

Since settlers are supposed to have experience of crop growing, there is no need to go into detail here.

In addition to the technical guidance provided under the various I.S.F. programs (Forest Occupancy Management, Commercial Tree Farming, etc.) efforts should be made cope with diseases and insects, improve yields, and rationalize management.

By planting bamboos around a home, for example, they help supply materials for such craft work like baskets.

2. Fruit trees, rattan, coffee

Fruit trees chosen for planting in the plan are mango, citrus, cashew, and banana. For their quantities and mixing ratios, refer to Table 6-37.

Rattan and coffee are planned to be raised inside the forests. It will be necessary to keep the crown density at 70% to allow reasonable amounts of sunlight and shades.

The plan allows larger spaces for fruit tree planting in areas with no or little forestland.

3. Timber, fuelwood

Fuelwood is for charcoal and firewood which are essentials for settlers for living. To meet the local need for fuelwood as such, the plan assumes 0.04 ha/family/year (5 members/family) and 0.24 ha. over 6 years (for 6th year cutting) for reforestation of fuelwood forests.

The balance will be applied to reforestation of timber forests. Reforestation technology will be as mentioned in the relevant sections of the Forest Management Plan.

4. Livestock

Presently, cattle are raised on the grazing land at a rate of 4 to 5 ha. per head. The rate can be raised to 1.5 ha. by improving the productivity of grassland and efficiency of management.

For 10% of the land, shading trees (forage trees) will be planted along the contour lines or in clusters to prevent soil erosion. At the same time, tending (pruning) will be done to help the production of fuelwood and fodders.

4) Yearly Plans

Yearly plans are shown in the following tables. For cultivation, however, plans were not made because of the differences in household compositions and production items.

Table 6-33: Reforestation Areas of Timber and Fuelwood Forests

Table 6-34: Planting Areas of Fruit Trees

Table 6-35: Planting Areas of Rattan and Coffee

Table 6-36: Planting Areas of Shading Trees and Forage Trees

Table 6-37: Basis for Computation of Required Amounts of Seedlings

Table 6-38: Required Quantities of Seedlings for Timber and Fuelwood Forests

Table 6-39: Required Quantities of Seedlings for Fruit Trees

Table 6-40: Required Quantities of Rattan and Coffee

Table 6-41: Required Quantities of Seedlings for Shading Trees and Forage Trees

Table 6-32. Planting Calendar: Climate Type III

	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Rice:													
Lowland				—————									
Palagad													
Upland		—————							—————				
Corn:													
Dry season								—————					
Rainy season		—————											
Third crop										—————			
Peanut:													
Dry season							—————						
Rainy season		—————											
Third crop										—————			
Beans:													
Batao			—————										
Bountiful bean			—————							—————			
Cowpea or kibal			—————							—————			
Kadios			—————										
Mungo			—————					—————					
Patani (climbing)			—————							—————			
Seguidillas			—————							—————			
Sitao			—————							—————			
Soybean			—————							—————			
Tapiian			—————							—————			
Peas		—————								—————			
Vegetables:													
Leafy:													
Cabbage		—————								—————			
Cauliflower		—————								—————			
Celery	—————									—————			
Lettuce		—————								—————			
Mustard		—————								—————			
Pechay		—————								—————			
Spinach		—————								—————			
Fruit:													
Ampalaya			—————							—————			
Chayote			—————							—————			
Cucumber			—————							—————			
Eggplant			—————							—————			
Melon (ordinary)			—————							—————			
Mrskmelon			—————							—————			
Okra	—————									—————			
Patola			—————							—————			
Squash			—————							—————			
Sweet pepper			—————							—————			
Tomato			—————							—————			
Epo		—————								—————			
Condol				—————						—————			
Watermelon				—————						—————			
Root:													
Sweet Potato		—————								—————			
Carrot				—————						—————			
Gabi			—————							—————			
Garlic			—————							—————			
Ginger			—————							—————			
Irish Potato				—————						—————			
Radish				—————						—————			
Sinkamas				—————						—————			
Cassava				—————						—————			
Others:													
Tapiian			—————							—————			
Talinum			—————							—————			
Arrowroot			—————							—————			
Kutchai			—————							—————			
Beets				—————						—————			
Endive				—————						—————			
Onion (big bulb)				—————						—————			
Onion (small bulb)		—————								—————			

Table 6-33. Reforestation Areas: Timber Forests and Fuelwood Forests

(unit: ha.)

Year	Parcel	1st		2nd		3rd		4th		5th		6th		7th		8th		9th		10th		Total
		Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family	
	I	8.80	0.16	8.80	0.16	8.80	0.16	8.80	0.16	8.80	0.16	11.00	0.20	11.00	0.20	11.00	0.20	11.00	0.20	11.00	0.20	98.26
	II	25.12	0.16	25.12	0.16	25.12	0.16	25.12	0.16	25.12	0.16	31.40	0.20	31.40	0.20	31.40	0.20	31.40	0.20	31.40	0.20	276.32
	III	17.60	0.16	17.60	0.16	17.60	0.16	17.60	0.16	17.60	0.16	22.00	0.20	22.00	0.20	22.00	0.20	22.00	0.20	22.00	0.20	104.19
	IV	11.84	0.16	11.84	0.16	11.84	0.16	11.84	0.16	11.84	0.16	14.80	0.20	14.80	0.20	14.80	0.20	14.80	0.20	14.80	0.20	132.28
	V	21.60	0.16	21.60	0.16	21.60	0.16	21.60	0.16	21.60	0.16	27.00	0.20	27.00	0.20	27.00	0.20	27.00	0.20	27.00	0.20	231.45
	Sub-total	84.96		84.96		84.96		84.96		84.96		106.20		106.20		106.20		106.20		106.20		932.50
	I	2.20	0.04	2.20	0.04	2.20	0.04	2.20	0.04	2.20	0.04	2.20	0.04	2.20	0.04	2.20	0.04	2.20	0.04	2.20	0.04	13.20
	II	6.28	0.04	6.28	0.04	6.28	0.04	6.28	0.04	6.28	0.04	6.28	0.04	6.28	0.04	6.28	0.04	6.28	0.04	6.28	0.04	37.68
	III	4.40	0.04	4.40	0.04	4.40	0.04	4.40	0.04	4.40	0.04	4.40	0.04	4.40	0.04	4.40	0.04	4.40	0.04	4.40	0.04	26.40
	IV	2.96	0.04	2.96	0.04	2.96	0.04	2.96	0.04	2.96	0.04	2.96	0.04	2.96	0.04	2.96	0.04	2.96	0.04	2.96	0.04	17.76
	V	5.40	0.04	5.40	0.04	5.40	0.04	5.40	0.04	5.40	0.04	5.40	0.04	5.40	0.04	5.40	0.04	5.40	0.04	5.40	0.04	32.40
	Sub-total	21.24		21.24		21.24		21.24		21.24		21.24		21.24		21.24		21.24		21.24		127.44
	I	11.00	0.20	11.00	0.20	11.00	0.20	11.00	0.20	11.00	0.20	11.00	0.20	11.00	0.20	11.00	0.20	11.00	0.20	11.00	0.20	111.46
	II	31.40	0.20	31.40	0.20	31.40	0.20	31.40	0.20	31.40	0.20	31.40	0.20	31.40	0.20	31.40	0.20	31.40	0.20	31.40	0.20	314.00
	III	22.00	0.20	22.00	0.20	22.00	0.20	22.00	0.20	22.00	0.20	22.00	0.20	22.00	0.20	22.00	0.20	22.00	0.20	22.00	0.20	220.59
	IV	14.80	0.20	14.80	0.20	14.80	0.20	14.80	0.20	14.80	0.20	14.80	0.20	14.80	0.20	14.80	0.20	14.80	0.20	14.80	0.20	150.04
	V	27.00	0.20	27.00	0.20	27.00	0.20	27.00	0.20	27.00	0.20	27.00	0.20	27.00	0.20	27.00	0.20	27.00	0.20	27.00	0.20	263.85
	Total	106.20		106.20		106.20		106.20		106.20		127.40		106.20		106.20		106.20		106.20		1,059.94

Table 6-34. Planting Areas: Fruit Trees

(unit: ha.)

Year	Parcel	1st - 4th year						5th year						1st-5th year Total									
		Mango		Citrus		Cashew		Banana		Cashew		Banana			Sub-total								
		Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family	Year	Ave./family
	I	7.00	0.13	1.50	0.03	1.00	0.02	0.50	0.01	10.00	1.18	6.81	0.12	1.50	0.03	1.00	0.02	0.50	0.01	9.81	0.18	49.81	
	II	26.00	0.17	5.50	0.04	3.50	0.02	2.00	0.01	37.00	0.24	26.78	0.17	5.50	0.04	3.50	0.02	2.00	0.01	37.78	0.24	185.78	
	III	19.50	0.09	2.00	0.02	1.50	0.01	1.00	0.01	14.00	0.13	9.17	0.08	2.00	0.02	1.50	0.01	1.00	0.01	13.67	0.12	69.67	
	IV	18.00	0.11	2.00	0.03	1.00	0.01	0.50	0.01	11.50	0.16	8.46	0.11	2.00	0.03	1.00	0.01	0.50	0.01	11.96	0.16	57.96	
	V	18.50	0.14	4.00	0.03	2.50	0.02	1.50	0.01	26.50	0.20	19.43	0.14	4.00	0.03	2.50	0.02	1.50	0.01	27.43	0.20	133.43	
	Total	69.00		15.00		9.50		5.50		99.00		70.65		15.00		9.50		5.50		100.65		496.65	

Table 6-35. Planting Area: Rattan, Coffee

(unit, ha)

Year Parcel	1st-4th year			5th year			1st-5th year
	Rattan	Coffee	Sub-total	Rattan	Coffee	Sub-total	Total
I	5.91	1.48	7.39	5.91	1.48	7.39	36.95
II	6.88	1.72	8.60	6.88	1.69	8.57	42.97
III	13.57	3.39	16.96	13.57	3.39	16.96	84.80
IV	6.58	1.64	8.22	6.59	1.64	8.23	41.11
V	13.22	3.31	16.53	13.27	3.31	16.58	82.70
Total	46.16	11.54	57.70	46.22	11.51	57.73	288.53

Table 6-36. Planting Area: Shade Trees, Forage Trees

(unit; ha)

Year Parcel	1st-5th year			6th-10th year			1st-10th year
	Year	Ave./ family	1st-5th year Total	Year	Ave./ family	6th-10th year Total	Total
I	0.83	0.02	4.15	0.82	0.01	4.10	8.25
II	2.36	0.02	11.80	2.35	0.01	11.75	23.55
III	1.65	0.02	8.25	1.65	0.02	8.25	16.50
IV	1.11	0.02	5.55	1.11	0.02	5.55	11.10
V	2.03	0.02	10.15	2.02	0.01	10.10	20.25
Total	7.98		39.90	7.95		39.75	79.65

* Planting areas computed as 10% of grazing area.

Table 6-37. Basis for Computation of Necessary Seedling Volumes

1. Seedlings for Timber Forest

Tree species	No. of trees/ha	Reforestation per unit area under study	Maturity	Volumes	Remarks
	pieces	%	year	m ³ /ha	
Pinus kesiya	1,667	approximately 20	30	283	No. of seedling computed as 10% more of those per ha.
Molave	2,500	approximately 20	40	380	
Mahogany	1,111	approximately 20	40	386	
Narra	2,500	approximately 20	80	386	
Teak	833	approximately 20	80	319	

2. Seedlings for Fuelwood, Shade Forest

Tree species	No. of trees/ha	Reforestation per unit area under study	Maturity	Volumes	Remarks
	pieces	%	year	m ³ /ha	
Giant ipil-ipil	1,667	100	6	94	1. No. of seedling computed as 10% more of those per ha.

3. Seedlings for Fruit Trees, Rattan

Tree species	No. of trees/ha	Reforestation per unit area under study	Remarks
	pieces	%	
Mango	50	approximately 70	No. of seedling computed as 10% more of those per ha.
Citrus	600	approximately 15	
Cashew	150	approximately 10	
Banana	600	approximately 5	
Rattan	200	approximately 80	Sprout regeneration method.
Coffee	800	approximately 20	

Table 6-38. Necessary Seedling Timber, Fuelwood Forests

(unit: pieces)

Tree Species	Parcel	Year										Total	
		1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year	10th year		
Pinus kesiya	I	3,227	3,227	3,227	3,227	3,227	4,034	4,034	4,034	4,034	4,034	3,762	36,033
	II	9,212	9,212	9,212	9,212	9,212	11,515	11,515	11,515	11,515	11,515	9,212	101,332
	III	6,454	6,454	6,454	6,454	6,454	8,068	8,068	8,068	8,068	8,068	6,454	71,213
	IV	4,342	4,342	4,342	4,342	4,342	5,427	5,427	5,427	5,427	5,427	4,342	48,508
	V	7,921	7,921	7,921	7,921	7,921	9,901	9,901	9,901	9,901	9,901	7,921	84,875
	Sub-total	31,156	31,156	31,156	31,156	31,156	38,945	38,945	38,945	38,945	38,945	30,401	341,961
Melave	I	4,840	4,840	4,840	4,840	4,840	6,050	6,050	6,050	6,050	6,050	5,643	54,043
	II	13,816	13,816	13,816	13,816	13,816	17,270	17,270	17,270	17,270	17,270	13,816	151,376
	III	9,680	9,680	9,680	9,680	9,680	12,100	12,100	12,100	12,100	12,100	10,004	106,804
	IV	6,512	6,512	6,512	6,512	6,512	8,140	8,140	8,140	8,140	8,140	7,634	72,754
	V	11,880	11,880	11,880	11,880	11,880	14,850	14,850	14,850	14,850	14,850	8,497	127,297
	Sub-total	46,728	46,728	46,728	46,728	46,728	58,410	58,410	58,410	58,410	45,594	512,874	
Mahogany	I	2,150	2,150	2,150	2,150	2,150	2,688	2,688	2,688	2,688	2,688	2,507	24,909
	II	6,139	6,139	6,139	6,139	6,139	7,674	7,674	7,674	7,674	7,674	6,139	67,330
	III	4,301	4,301	4,301	4,301	4,301	5,377	5,377	5,377	5,377	5,377	4,446	47,459
	IV	2,893	2,893	2,893	2,893	2,893	3,617	3,617	3,617	3,617	3,617	3,325	32,325
	V	5,279	5,279	5,279	5,279	5,279	6,599	6,599	6,599	6,599	6,599	3,776	56,567
	Sub-total	20,762	20,762	20,762	20,762	20,762	25,955	25,955	25,955	25,955	20,260	227,890	
Narra	I	4,840	4,840	4,840	4,840	4,840	6,050	6,050	6,050	6,050	6,050	5,643	54,043
	II	13,816	13,816	13,816	13,816	13,816	17,270	17,270	17,270	17,270	17,270	13,816	151,976
	III	9,680	9,680	9,680	9,680	9,680	12,100	12,100	12,100	12,100	12,100	10,004	106,804
	IV	6,512	6,512	6,512	6,512	6,512	8,140	8,140	8,140	8,140	8,140	7,634	72,754
	V	11,800	11,800	11,800	11,800	11,800	14,850	14,850	14,850	14,850	14,850	8,497	127,297
	Sub-total	46,728	46,728	46,728	46,728	46,728	58,410	58,410	58,410	58,410	45,594	512,874	
Teak	I	1,612	1,612	1,612	1,612	1,612	2,015	2,015	2,015	2,015	2,015	1,880	18,000
	II	4,603	4,603	4,603	4,603	4,603	5,754	5,754	5,754	5,754	5,754	4,603	50,634
	III	3,225	3,225	3,225	3,225	3,225	4,031	4,031	4,031	4,031	4,031	3,593	35,582
	IV	2,169	2,169	2,169	2,169	2,169	2,712	2,712	2,712	2,712	2,712	2,543	24,236
	V	3,958	3,958	3,958	3,958	3,958	4,948	4,948	4,948	4,948	4,948	2,831	42,413
	Sub-total	15,567	15,567	15,567	15,567	15,567	19,460	19,460	19,460	19,460	15,190	170,865	
P, K, M, N, N, T	I	16,669	16,669	16,669	16,669	16,669	20,837	20,837	20,837	20,837	20,837	19,435	186,128
	II	47,586	47,586	47,586	47,586	47,586	59,483	59,483	59,483	59,483	59,483	47,586	523,448
	III	33,340	33,340	33,340	33,340	33,340	41,676	41,676	41,676	41,676	41,676	34,458	367,862
	IV	22,428	22,428	22,428	22,428	22,428	28,036	28,036	28,036	28,036	28,036	26,293	250,577
	V	40,918	40,918	40,918	40,918	40,918	51,148	51,148	51,148	51,148	51,148	29,267	438,449
	Sub-total	160,941	160,941	160,941	160,941	160,941	201,180	201,180	201,180	201,180	157,039	1,766,464	
Giant ipu-ipu	I	4,034	4,034	4,034	4,034	4,034	5,034	5,034	5,034	5,034	5,034	4,704	46,204
	II	11,515	11,515	11,515	11,515	11,515	14,386	14,386	14,386	14,386	14,386	13,515	131,376
	III	8,068	8,068	8,068	8,068	8,068	10,086	10,086	10,086	10,086	10,086	9,212	89,408
	IV	5,427	5,427	5,427	5,427	5,427	6,784	6,784	6,784	6,784	6,784	6,293	60,577
	V	9,901	9,901	9,901	9,901	9,901	12,376	12,376	12,376	12,376	12,376	11,515	112,376
	Sub-total	38,945	38,945	38,945	38,945	38,945	48,586	48,586	48,586	48,586	45,945	454,968	
Grand total	I	20,703	20,703	20,703	20,703	20,703	24,871	24,871	24,871	24,871	24,871	19,435	210,332
	II	59,101	59,101	59,101	59,101	59,101	70,998	70,998	70,998	70,998	70,998	59,483	592,538
	III	41,408	41,408	41,408	41,408	41,408	49,744	49,744	49,744	49,744	49,744	34,458	416,270
	IV	27,855	27,855	27,855	27,855	27,855	33,463	33,463	33,463	33,463	33,463	28,036	283,139
	V	50,819	50,819	50,819	50,819	50,819	61,049	61,049	61,049	61,049	61,049	29,267	497,855
	Grand total	199,886	199,886	199,886	199,886	199,886	240,125	240,125	240,125	240,125	157,039	2,000,134	

Table 6-39. Necessary Seedlings for Fruit Trees

		1st - 4th year					5th year					(unit: pieces)
Year	Parcel	Mango	Citrus	Cashew	Banana	Sub-total	Mango	Citrus	Cashew	Banana	Sub-total	1st-5th year
												Total
I		385	990	165	330	1,870	374	990	165	330	1,859	9,339
II		1,430	3,630	577	1,320	6,957	1,472	3,630	577	1,320	6,999	34,827
III		522	1,320	247	660	2,749	504	1,320	247	660	2,731	13,727
IV		440	1,320	165	330	2,255	465	1,320	165	330	2,280	11,300
V		1,017	2,640	412	990	5,059	1,068	2,640	412	990	5,110	25,346
Total		3,794	9,900	1,566	3,630	18,890	3,883	9,900	1,566	3,630	18,979	94,539

Table 6-40. Necessary Seedlings for Rattan, Coffee

		1st - 4th year			5th year			(unit: pieces)
Year	Parcel	Rattan	Coffee	Sub-total	Rattan	Coffee	Sub-total	1st-5th year
								Total
I		1,300	1,302	2,602	1,300	1,302	2,602	13,010
II		1,513	1,512	3,026	1,513	1,487	3,000	15,104
III		2,985	2,983	5,968	2,985	2,983	5,968	29,840
IV		1,447	1,443	2,890	1,449	1,443	2,892	14,452
V		2,908	2,912	5,820	2,919	2,912	5,831	29,111
Total		10,153	10,153	20,306	10,166	10,127	20,293	101,517

Table 6-41. Necessary Seedlings for Shade, Forage Trees

		(unit: pieces)		
Year	Parcel	1st - 5th year	6th - 10th year	1st - 10th year
		S, F tree	S, F tree	Total
I		1,521	1,503	15,120
II		4,327	4,309	43,180
III		3,025	3,025	30,250
IV		2,035	2,035	20,350
V		3,722	3,704	37,130
Total		14,630	14,576	146,030

6-7 Matters of Implementation for Forest Management Planning

6-7-1 Total Input Necessary Requirement for the Management Plan

Work Volumes Based on Forest Management Plan

Program	Type of work	Volume	Remarks
Reforestation	New planting	10,055 ha	
	Tending	41,748 ha	
	Natural regeneration	86 ha	
	Natural regeneration (Selective cutting area)	3,306 ha	
Seedling production	New planting	19,400 ha	
	I. S. F.	2,343 ha	
Total		21,743 ha	
Timber production	Timber	17,195 m ³	
		38,318 m ³	
Total		55,513 m ³	
Forest road	Main forest road	44.6 km	
	Forest work road	110.4 km	
Total		155.0 km	
Soil conservation	Stream work	63 unit	
	Hillside work	8.5 ha	
Parks & recreation		255 ha	
Special forestry	Rattan	18,734m	
Forest protection	Forest fire	All areas	
	Disease	ditto	

6-7-2 Schedule for Implementation

A suggested schedule for activities proposed in this plan is given in Table 6-42. The schedule covers the first six years. (For years thereafter, the work volumes will be based on the average of those for the remaining area.)

Table 6-42. Scheduling (Example)

Year	Volume	Contents
Preparation		<ol style="list-style-type: none"> 1. Assignment of agency and personnel 2. Preparation of implementation plan 3. Technical training 4. Arrangement of labor and materials 5. Setting of nurseries, seedling production (enough to supply first year)
First year	New planting 500ha	<ol style="list-style-type: none"> 1. Harvesting survey (cutting location and volume) 2. Selection of reforestation (location, area survey) 3. Seedling production 4. Training of labor force 5. Forest road clearance
Second year	New planting 700ha	Similarly afterwards; necessary improvements to be made
3rd, 4th, 5th year	New planting 1,000ha	Same as above
6th—10th year	New planting 5,855ha	Necessary adjustments in work volume. Harvesting and thinning under G.1-1 to be considered

6-7-3 Manpower Requirement by Activity

Work force to meet the work volumes as described in 6-7-1 is anticipated in Table 6-43.

Table 6-43. Estimated Labor Force

Program	Type of work	Volume	Labor/unit	Labor volume	Remarks
Reforestation	New planting	ha. 10,055	person/ha. 47.40	persons 476,607	
	Tending	41,748	10.00	417,480	
Sub-total				894,087	
Seedling production	Reforestation	unit;1,000 19,400	person/1,000 5.93	115,042	
	I. S. F.	2,343	5.93	13,894	
Sub-total		21,743		128,936	
Timber production	Timber	m ³ 17,195	person/m ³ 0.02	344	Survey
	Fuelwood	38,318	0.02	766	
Sub-total		55,513		1,110	
Forest road	Main road	km 44.6	person/km 607	27,072	
	Forest work road	110.4	546	60,278	
Sub-total		155.0		87,350	
Forest Conservation	Stream work	unit 63	person/unit 300	18,900	
	Hillside work	8.5 ha.	150 ha.	1,275	
Sub-total				20,175	
Parks & Recreation	Facilities			7,560	
Special forestry	Rattan	18,734m		0	
Forest protection	Forest fire	3 Watch stations patrol	person/per year 32.80	32,800	
Total				1,172,018	*

* About 117,000 persons per year

6-7-4 Yield Prediction

The anticipated yield upon completion of forestry proposed by this plan is estimated below in Tables 6-44 and 45, based on Indonesian data (a tentative yield table and other related documents).

Table 6-44. Timber Production Forest (Long-Term Tree Species)

Tree species	Maturity year	Volume m ³ /ha.	Reforestation area ha.	Total volume m ³	Remarks
Pinus kesiya	30	283	2,850	806,500	Indonesia: Merukushi Pine, Site quality III, 30 years, 189 pecies Dupax: P. kesiya (Reforestation)
Molave	40	380	1,188	451,400	Estimate
Mahogany	40	386	633	244,300	Indonesia: Provisional Harvest Table, site quality II, 40 years, 234 pecies
Narra	80	386	630	243,200	Estimate
Teak	80	319	643	205,100	Indonesia: Harvest Table, Site quality III, 80 years
Total			5,944	1,950,500	Average 328 m ³ /ha.

Table 6-45. Fuelwood Production Forest (Early Maturing Types)

Tree species	Maturity year	Volume m ³ /ha.	Reforestation area ha.	Volumes by Parcel (m ³)					Total (m ³)
				I	II	III	IV	V	
Giant ipil-ipil	6	94	303				15,300	13,200	28,500
Acacia mangium	10	335	983	7,700	39,900		93,500	188,300	329,400
Acacia auriculiformis	10	335	161		16,400		37,500		53,900
Yamane	10	238	2,546	71,900	48,600	95,000	163,700	226,800	606,000
Eucalyptus camaldensis	20	380	118		14,400		19,000	11,400	44,800
Total			4,111	79,600	119,300	95,000	329,000	439,700	1,062,600
Average 258 m ³ /ha.									

