

IX Plan for Securing Fuelwoods

9-1 Necessity of Measures to Secure Fuelwoods

1. Measures to Secure Fuelwood for Households

Securing fuelwood for households is a life-and-death problem for farmers as forest resources rapidly decrease. Even though the socioeconomic base of agricultural villages is fragile, this problem cannot be neglected as it is.

Principal measures to secure fuelwood for households are to manage customary forests in a normal way of natural forest management by setting model group villages on both the east and west sides of the Reserve and to plant trees in areas around houses, along roads and in footpaths between dry fields. It was determined to establish one model area on each of the east and west sides of the Reserve because the vicinity of the Reserve is too large to uniformly carry out the measure to secure household fuelwood. It was also taken into consideration that whereas many farms cultivated cash crops in Kasungu District, farms were mainly self-sufficient to cultivate cassavas and maize in Nkhotakota District. Moreover, the selection of accessible areas to general people is effective for extending this project. Trees will be planted to secure fuelwood at different sites from ordinary reforestation because there is no suitable space left for reforestation. This is a not optimal but necessary measure in light of actual conditions.

This plan has already been approved by the chiefs of relevant traditional authorities and also agreed to by the heads of the group villages concerned. To carry out the plan effectively, the sustainable and stable supply of fuelwood to households is required for maintaining and improving the lives of local people through their own efforts. For this purpose, reforestation needs to be carried out for the benefit of local people. In this respect, it is essential to make a plan so that they will undertake reforestation at their will. After that, as the second step, it is proper to lead women to master basic techniques for nursery practices and maintenance and tree planting. At the final stage, a reforestation project will be carried out.

2. Improving the Furnace

Improving the furnace should play a major role in saving fuelwood and improving rural life. It is an important theme which can form a single project. Moreover, it is closely related to the consumption of fuelwood and cannot be separated from measures for securing fuelwood. If the thermal efficiency of the furnace triples, the consumption of fuelwood by households will be reduced to one third, and the required area for reforestation will also decrease in parallel.

The necessity for this measure is understood and agreed to by the chiefs of traditional authorities and the heads of relevant group villages. However, a complicated problem is expected to occur in carrying out the measure. This is because the present furnace is flexible to enlarge or reduce component stones and widely applicable in spite of low efficiency. It is deep-rooted as an old local culture to which villagers are accustomed in everyday life. In this respect, it is important to form a consensus among local people as in the case of reforestation.

3. Beneficial Effects of Fuelwood Plantations on Farmers

This plan is expected to bring the following benefits to farmers and villages in addition to

fuelwood.

- (1) Forest by-products will be used at the community level, including fuelwood, fodder (fallen leaves and weeds), self-consumed poles, others, mushrooms and honey.
- (2) Forestry activities will increase employment opportunities, including nursing, planting, forest tending and protection, and the harvesting and processing of forest products.
- (3) The growth of trees will bring environmental benefits to the community, including the maintenance and improvement of soil fertility, the prevention of soil erosion, the conservation of water sources, and the mitigation of microclimate.
- (4) As a project is extensively carried out at several sites, monoculture in a large area can be avoided, and diverse land use and biodiversity will be achieved.
- (5) The participation of farmers, especially women will facilitate the improvement of rural life, the establishment of autonomy of villagers, the establishment of a cooperative system for the Reserve, and the stabilisation of social order.

4. Women's Role Expected in the Plan

Women in farms around the Reserve directly treat fuelwood for households and also take responsibilities for collecting and carrying it.

Prior to the development of this plan, a fact-finding survey of women was carried out in the following respects, and the results of the survey were included in the Progress Report and the Interim Report. Generally, women play a major role.

- (1) Assignments of women in everyday life
- (2) Women's access to and control over agricultural management
- (3) Division of labour by gender in agricultural management.

Women assume a wide range of operations, including housekeeping in everyday life. Roles in a family are clearly divided by gender. It is notable that women are highly aware of fuelwood above all.

However, women's intention and expectation do not necessarily lead to a better life or economic improvement in everyday life. Therefore, a plan for research, education and extension needs to be separately prepared. Specifically, it is effective to make collective efforts for the proper reduction and distribution of labour and technological improvement in groups.

9-2 Model Project Plan

1. Selecting Model Group Villages

Model project areas are a combined area of Makhenjera and Bulumute Group Villages (hereinafter referred to as Area A) and Bumphula Group Village (hereinafter referred to as Area B) as shown in Figs 9-1, 9-2 and 9-3. These villages were chosen for the following reasons.

- (1) They are located on either the east or west side of the Reserve.

- (2) They are in contrast in agricultural management.
- (3) They are located along main roads and have close relations with the Reserve. Accordingly, they are accessible to visitors and highly effective for publicity.

2. Outline of The Model Areas

(1) Area A

This area is located on the east side of the Reserve, belonging to Mphonde Sub-traditional Authority in the Nkhotakota District. It is adjacent to the national road M5. The population density is high. Makhenjera Group Village is based on self-sufficient crop cultivation and rich in customary forests. In contrast with this, Bulumute Group Village, near the centre of Nkhotakota City, is based on cash crop cultivation and extremely poor in customary forests. At the present time, a considerable amount of fuelwood is distributed from Makhenjera to Bulumute, and, therefore, these villages have a close relationship.

(2) Area B

This area is located on the west side of the Reserve, belonging to Chilooko Traditional Authority in the Ntchisi District. It is at a high altitude of 1,500 m. It is between the national road M10 and the road connecting Chipata and Kasungu. Tobacco estates are scattered in the neighborhood. As tobacco cultivation prospers in addition to staples, this area is based on cash crop cultivation. Customary forests which were once abundant have decreased following the expansion of the estates. Tobacco capital performs reforestation in order to secure fuelwood for curing tobacco leaves.

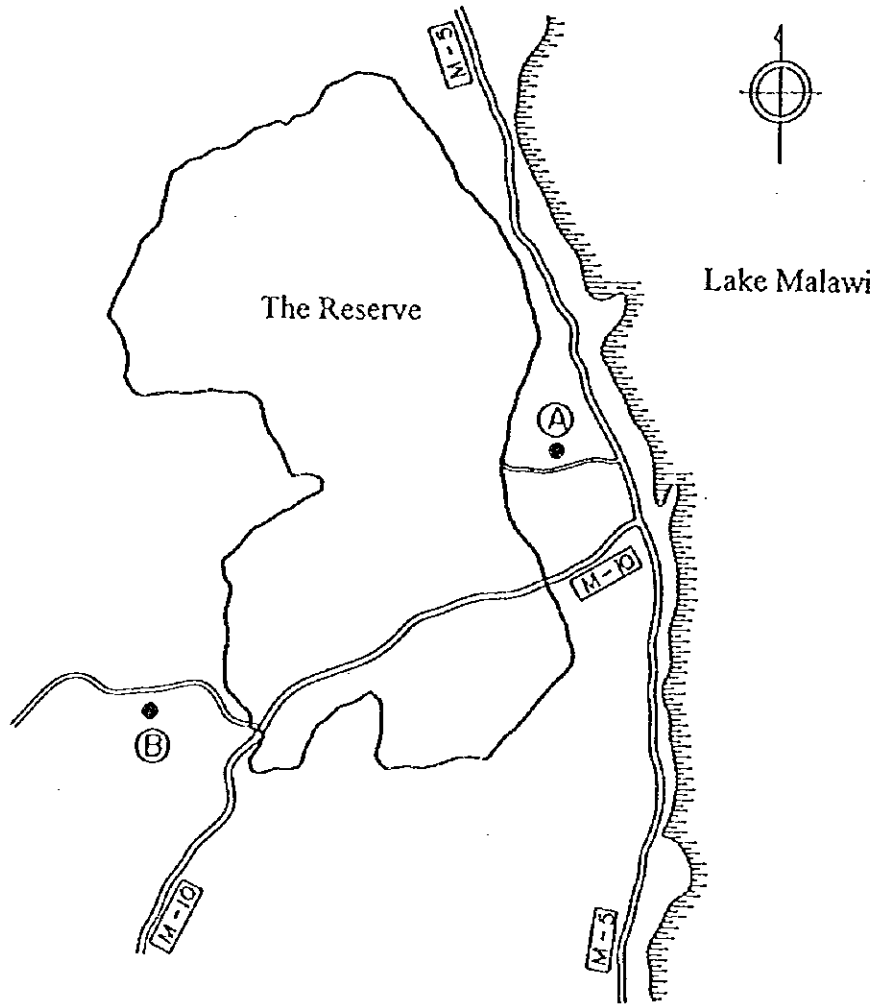


Fig. 9-1 Social Forestry Model Areas

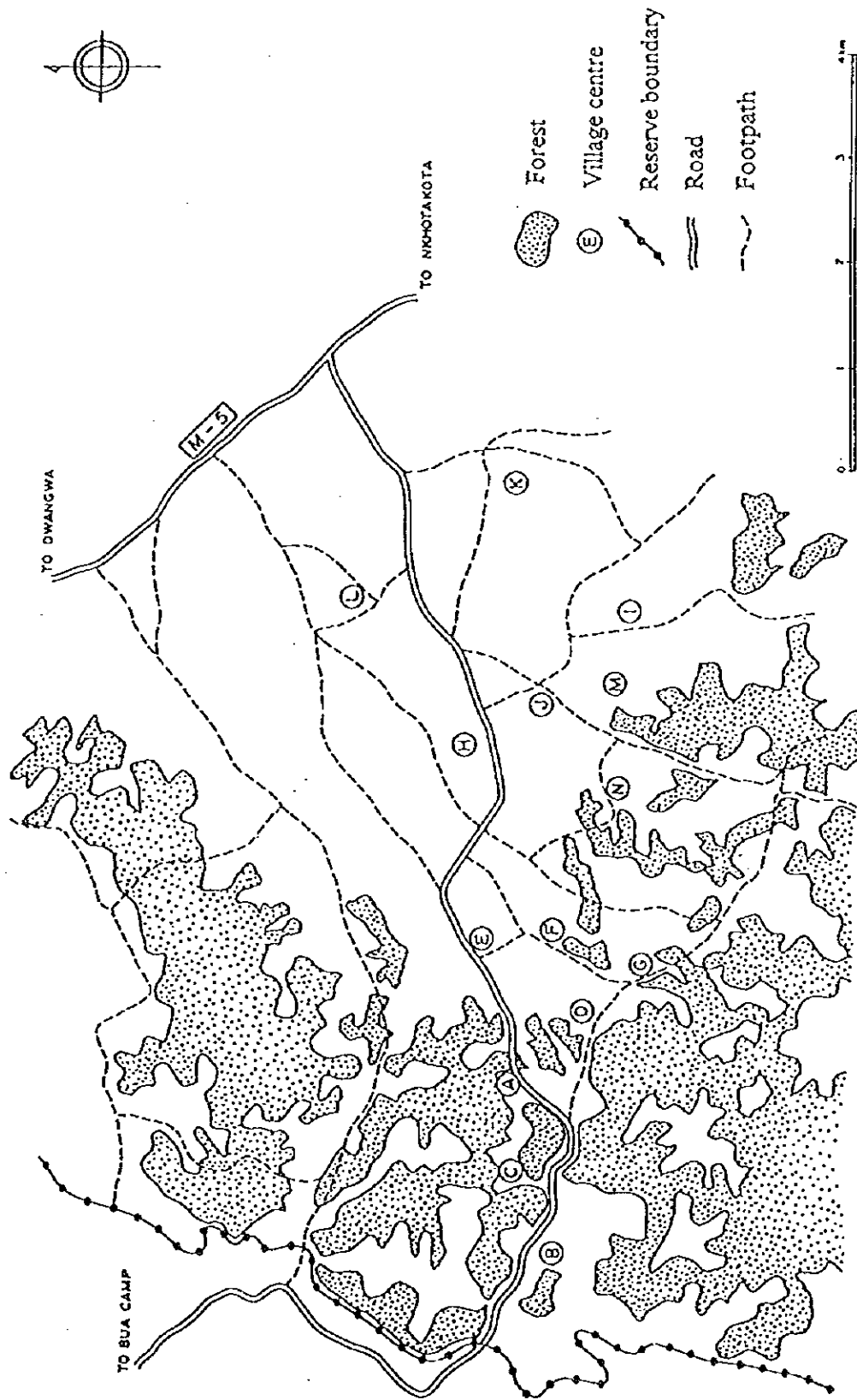


Fig. 9-2 Area A

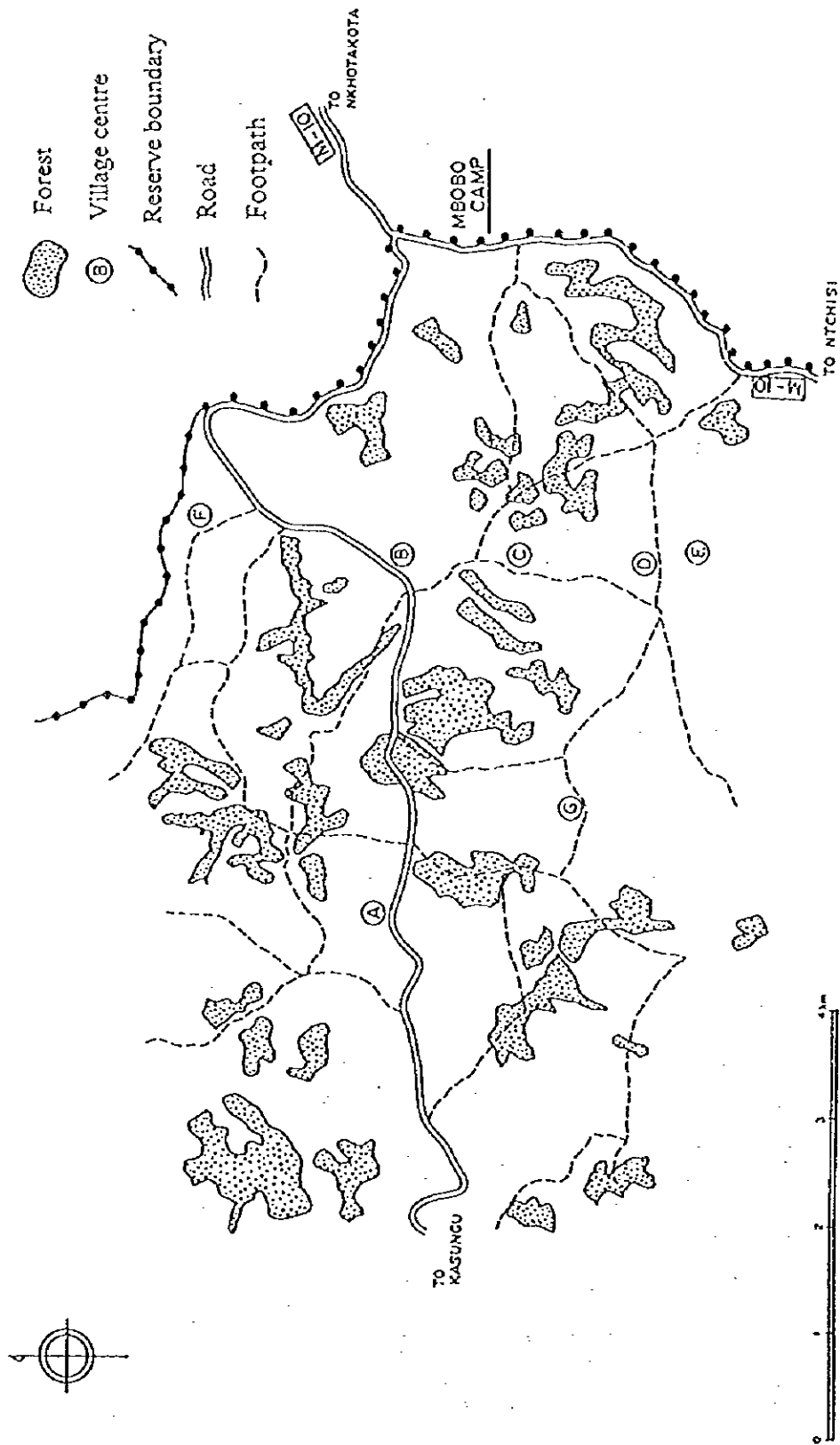


Fig. 9-3 Area B

Names of the Model Group Villages

Makhenjera Group Village

- A. Makhenjera
- B. Tongole
- C. Tenje
- D. Kalilangwe
- E. Malala
- F. Mphozongo
- G. Kapangama

Bulumute Group Village

- H. Mzumara
- I. Chipaka
- J. Bulumute
- K. Mkombozi
- L. Chilubuno
- M. Malembo
- N. Bua

Bumphula Group Village

- A. Bumphula
- B. Chingamba
- C. Mndesi
- D. Mankhaka
- E. Tesamba
- F. Gome
- G. Kapangama

9-3 Current Fuelwood Supply and Demand in the Model Areas

1. Area A

Makhenjera Group Village

- (1) The population is estimated at 2,350 persons, forming 400 households.
- (2) The area of customary forests is 1,750 ha.
- (3) The annual fuelwood demand is 2,000 m³ (400 households by 5 m³).
- (4) The total volume of fuelwood cut in customary forests is 3,035 m³ per year. In detail, 2,000 m³ of fuelwood is consumed at Area A, while 1,035 m³ is supplied to Bulumute (160 fagots per day: one fagot equals 0.02 m³, 51,750 fagots per year).
- (5) Besides customary forests, there are privately owned forests occupying an area of 300 ha. Most of timber from these forests is allocated to some application other than household fuel, and is excluded from the calculation.

Bulumute Group Village

- (1) The population is estimated at 3,000 persons, forming 500 households.
- (2) The area of customary forests is 250 ha.
- (3) The annual fuelwood demand is 2,500 m³ (500 households by 5 m³).
- (4) Timber is supplied from Makhenjera at a rate of 1,035 m³ per year. Moreover, 415 m³ of timber is supplied from other group villages.
- (5) The volume of fuelwood cut in customary forests is 1,050 m³.

2. Area B

Bumphula Group Village

- (1) The population is estimated at 2,500 persons, forming 420 households.
- (2) The area of customary forests is 1,500 ha.
- (3) The annual fuelwood demand is 2,100 m³ (420 households by 5 m³).
- (4) The volume of fuelwood cut in customary forests is 1,975 m³.
- (5) Fuelwood at 125 m³ is supplied from the plantation (65 m³) and from the privately owned forest estate (60 m³).

3. Actual Fuelwood Supply and Demand in the Model Areas

The actual fuelwood supply and demand in the model areas are summarized in Table 9-1.

Table 9-1 Relation of Fuelwood Supply and Demand in the Model Areas (in June 1996)

Unit: Area in hectares and others in m³

Model Area	Estimated Population (Households)	Annual Demand	Customary Forest Area	Growing Stock	Annual Cut Volume	Supply to Other Areas	Supply from Other Areas
Area A:							
Makhenjira	2,350(400)	2,000	1,750	79,147	3,035	1,035	0
Bulumute	3,000(500)	2,500	250	2,047	1,050	0	1,450
Total	5,350(900)	4,500	2,000	81,194	4,085	1,035	1,450
Area B:							
Bumphula	2,500(420)	2,100	1,500	30,920	1,975	0	125

Note: For commentaries on this table, see Table 1 in Attachment.

9-4 Measures to Return Customary Forests back to Normal

1. Transition of customary forests

Together with man-made forests that are to be developed, customary forests will be an important source of fuelwood in the future for households in the model area. To this end, the existing forests should be guided towards a normal state. The following table shows how the forests should be changed during the transition period.

Table 9-2 Transition of customary forests.

Classification	1996	1997-2006	2007
A Area:			
Area (ha)	2,000	75 ha to be converted into man-made forests	1,925
Volume (m ³)	81,194	increase 10m ³ /ha	99,400
Logging volume/yr. (m ³)	4,085	3,630	3,313
B Area:			
Area (ha)	1,500	35 ha to be converted into man-made forests	1,465
Volume (m ³)	30,920	increase 10m ³ /ha	45,415
Logging volume/yr. (m ³)	1,975	1,560	1,514

2. Regulation (Restriction) on Felling Customary Forests

Natural forests will be permanently available to supply fuelwood unless cut volume exceeds annual increment. However, as shown in Table 9-1, forests are generally overcutting.

For these forests to continue to supply fuelwood in the future, it is necessary to return

them back to the normal stands structure. There are various practical ways of doing so. In this plan, return to normal will be induced by the following regulation formula in a 10 year improvement period with a 50 year rotation.

$$E = Z + \frac{V_1 - V_2}{a} \quad \text{where}$$

E : Annual standard cut volume

Z : Annual increment

V₁: Real stock

V₂: Normal stock

a : Induction period

In a special case of a, rotation is regarded as u. Therefore, this formula will change to:

$$E = Z + \frac{V_1 - V_2}{u}$$

Since $V_2 = Z \times \frac{u}{2}$

The $Z = \frac{2V_2}{u}$

Substituting this, $E = Z + \frac{V_1 + V_2}{u}$

3. Relation of Fuelwood Supply and Demand before the Start of Felling of Plantations

Even if reforestation is started, planted trees will not be cut in the next coming five years. The cutting of customary forests alone will be unable to supply a sufficient amount of fuelwood to the households. Therefore, it is planned that only in this period, any deficit will be compensated by dead trees collected from the Reserve, and an increase in supply from other areas.

In the lapse of five years, the harvesting of plantations will start. Then, a sufficient amount of fuelwood to meet the demands in the model areas will be supplied by harvesting both plantations and customary forests, and collecting dead trees from the Reserve.

The supply and demand relation in these five years is shown in Table 9-3.

Table 9-3 Annual Relation of Supply and Demand before the Start of Felling of Plantations

Model Area	Annual Demand (m ³)	Supply (m ³)		
		Customary Forests	Dead Trees on Reserve	Purchase
Makhenjera	2,208	3,500		
Bulumute	2,760	130		
Area A	4,968	3,630	730	608
Area B	2,315	1,560	545	210

Note: For commentaries on this table, see Table 1 in Attachment 21.

The cut volume will increase from 3,050 m³ to 3,500 m³ per year in Makhenjera, while it will sharply decrease from 1,050 m³ to 130 m³ in Bulumute. Similarly, it will decrease from 1,975 m³ to 1,560 m³ in Bumphula.

4. Relation of Fuelwood Supply and Demand after the Start of Felling of Plantations

After the start of reforestation, it is planned to reforest some of the customary forests: i.e., 75 ha of 250 ha in Bulumute and 35 ha of 1,500 ha in Bumphula. The purchase of fuelwood from other areas will be stopped and the use of dead or damaged trees in the Reserve will be reduced after plantations begin to be felled. For these changes, see Table 3 in Attachment 21.

The use of dead trees in the Reserve will be reduced from 2.0 m³ to 1.0 m³ per day in Area A and from 1.5 m³ to 0.5 m³ per day in Area B.

The relation of fuelwood supply and demand after the start of supply from plantations is shown in Table 9-4.

When planting trees around houses, along roads and by footpaths between fields, special measures, including fencing with thorned branches should be taken to prevent cattle, goats, sheep and other small animals from browsing the sprouts.

Table 9-4 Relation of Supply and Demand after the Start of Felling of Plantations

								Unit: m ³
Model Area	Estimated Households	Fuelwood Demand	Customary Forest Area (ha)	Growing Stock	Supply	Supply from Reserve	Cut Volume of Plantations	Total Supply
Area A	1,097	5,485	1,925	99,400	3,313	365	1,807	5,485
Area B	512	2,560	1,465	45,415	1,514	183	863	2,560

Note: For commentaries on this table, see Table 4 in Attachment 21.

4. Reforestation System

(1) Principle for Reforestation

- ① Tree species: The three species of *Eucalyptus camaldulensis*, *E. tereticornis*, and *E. citriodora* from the past experience and in light of sprouting power.
- ② Cutting period: 5 years to harvest 100 m³ of fuelwood per ha.
- ③ Planting: Reforested customary forests: 2,500 pieces/ha (2.0 m x 2.0 m)
 Around houses: 1,600 pieces/ha (2.5 m x 2.5 m)
 Along roads and between fields: 1,111 pieces/ha (3.0 m x 3.0 m)
- ④ Sprouting: Twice and two-sprout tending

(2) Planted Area by Site

The planted area by site is shown in Table 9-5.

Table 9-5 Planted Area by Site

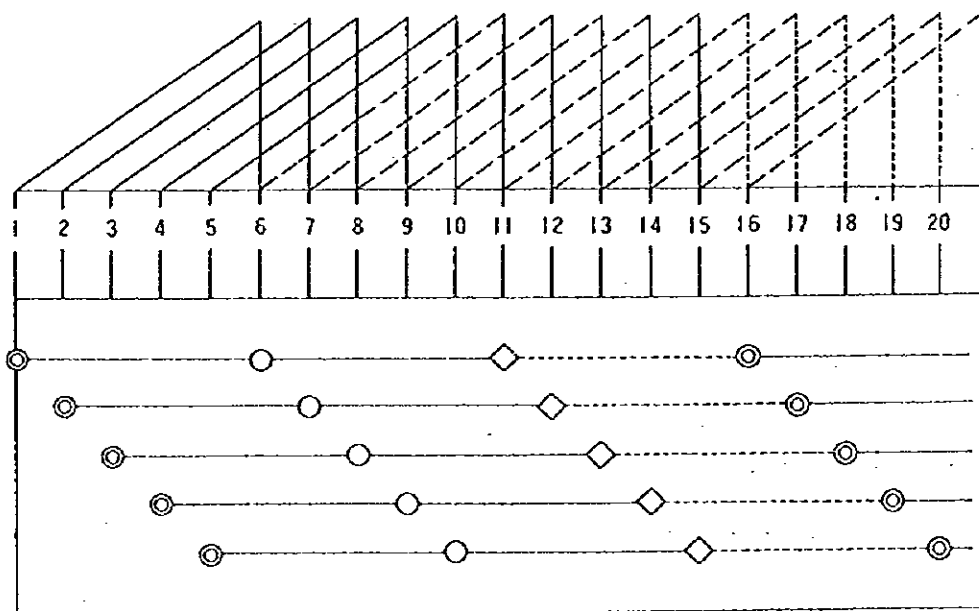
Unit: ha

Model Area	Every Year				Total in Five Years			
	Reforested Customary Forest	Around House	Road/Footpath	Total	Reforested Customary Forest	Around House	Road/Footpath	Total
Area A	15.00	2.70	0.37	18.07	75.00	13.50	1.85	90.35
Area B	7.00	1.30	0.33	8.63	35.00	6.50	1.65	43.15
Total	22.00	4.00	0.70	26.70	110.00	20.00	3.50	133.50

Note: For commentaries on this table, see Table 5 in Attachment 21.

(3) Rotation of Reforestation

The following diagram shows the rotation of reforestation diagrammatically.



Legends: ⊙ planting ○ first sprouting
◇ second sprouting

Fig. 9-4 Diagram of Rotation of Reforestation

5. State of Customary Forests at Return to Normal

(1) Area of Customary Forests

When the state of customary forests would return to normal, the area will be 1,925 ha in Area A and 1,465 ha in Area B. After this, these figures will be fixed. Details of these

changes are shown in Table 6 in Attachment 21.

(2) Supply Volume by Source

The fuelwood supply volume to households by sources shown in Table 9-6 and Figure 9-5.

Table 9-6 Supply Volume by Source

Model Area	Demand (m ³)	Supply (m ³)			Total	Planted Area in 5 years (ha)
		Customary Forests	Dead/Damaged Trees in Reserve	Plantations		
Area A	5,485	3,313	365	1,807	5,485	90.35
Area B	2,560	1,514	183	863	2,560	43.15

Note: For commentaries on this table, see Table 7 in Attachment 21.

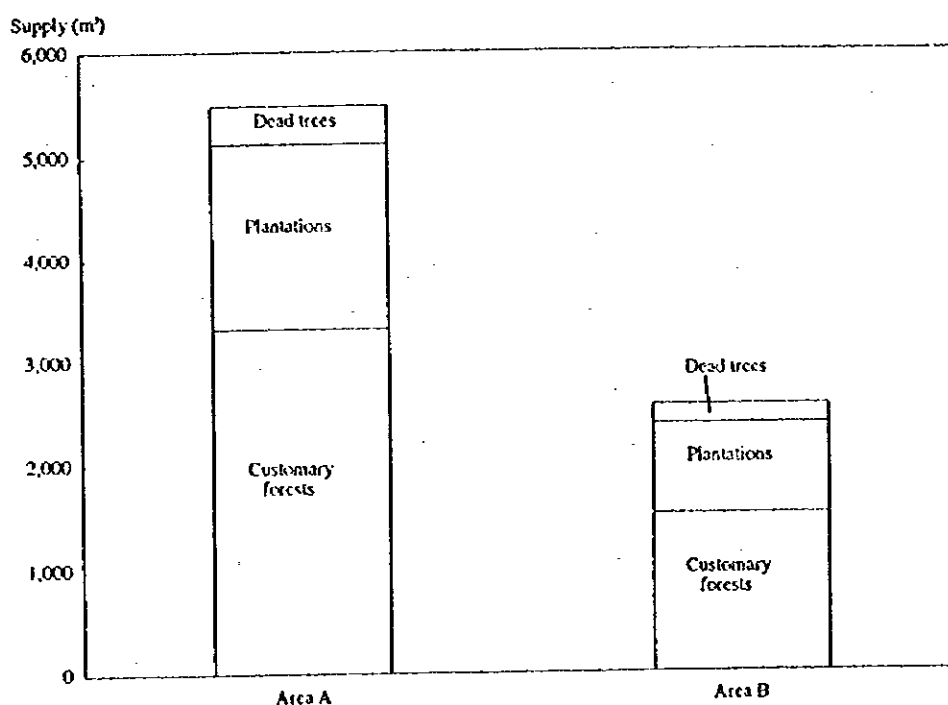


Fig. 9-5 Fuelwood Supply by Areas

9-5 Technical Standards for Forest Operation

1. Reforestation

(1) Land Preparation

In the case of customary forests, land preparation will be made by plowing soil with a plow linked to a tractor and then tilling the land with a harrow linked to a tractor just before planting the trees. The soil will be limed. It is preferable to till twice. Moreover, appurtenant work will be performed, including the construction of firebreaks and protective fences.

When planting trees around houses, along roads and by footpaths between farm fields, a spade instead of a tractor will be used for the land preparation.

(2) Nursery

Nurseries will be constructed in Areas A and B to produce each year 60,000 seedlings for a 20 ha area in Area A and 25,000 seedlings for 10 ha area in Area B. In this case, the yield percent of seedlings will be taken into account. The area of nursery facilities by use is shown in general in Table 9-7.

Table 9-7 Area of Nursery Facilities by Use

Model Area	Unit: ha					
	Nursery Bed (70%)	Windbreak (10%)	Road (10%)	Building (5%)	Others (5%)	Total (100%)
A	0.36	0.05	0.05	0.025	0.025	0.51
B	0.15	0.02	0.02	0.01	0.01	0.21

(3) Planting

Trees should be planted during or just before precipitation in the rainy season.

In customary forests, holes 2m by 2m each will be dug before planting and fertilised in the periphery. For fertilisation, NPK (at the standard ratio of 15:15:15) will be given at a rate of 145 kg per ha. Trees will be planted manually. If necessary, they will be watered after planting.

In the case of reforestation around houses, along roads and by footpaths between fields, special measures, including fencing with thorned branches should be taken to prevent domestic animals from browsing the sprouts.

(4) Supplementary Planting

If necessary, trees will be supplemented one year after the initial planting.

(5) Tending

① Weeding: As a rule, all weeds will be removed. Weeding will be carried out three times in total: i.e., twice in the first year of planting (if planted between January and March) and once in the next year. In the case of customary forests, a harrow with an automatic disk lifter will be attached to a tractor. In the case of houses, roads and fields, weeds will be removed manually.

② Termite Control: Termites will be removed at the same time of land preparation and also once a year from the following year of planting until the year of cutting. As chemicals, heptachlor (pellets) and grommet demethyla (gas) are effective and either should be used depending on the actual condition of the land.

③ Patrol: Plantations will be patrolled at all times in order to detect anything unusual, including fires.

④ Firebreak: In reforested customary forests, firebreaks about 10 meters wide will be constructed on plantations created every year. The use of a grader is effective in maintaining them.

(6) Sprout Tending

Plantations will undergo natural regeneration by sprout in the following year of cutting. Stands cut in the fifth year will undergo the first sprouting in the sixth year. They will be cut again in the tenth year and undergo the second sprouting in the eleventh year. In this case, two good sprouts will be selected from several sprouts and tended, and the others will be cut and removed.

Sprouting stands will be tended in accordance with the care of planted trees.

2. Customary Forest Management System

Customary forests will be managed in the same way as natural forest practices. The standard practices are as follows:

- ① In a rotation of 30 years and a cutting cycle of 10 years, trees will be cut on the multiple recurrent system.

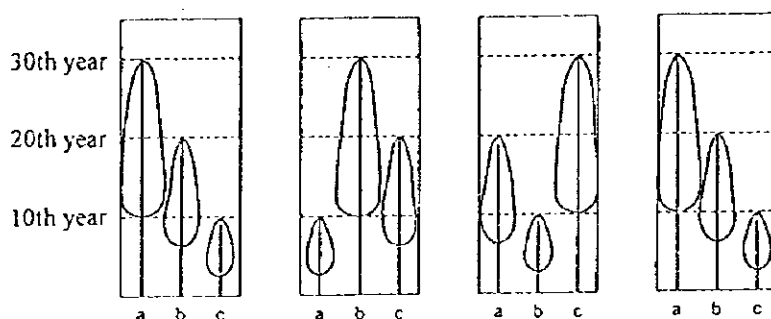


Fig. 9-6 A Model Forest Type

- ② Block rotation system will be employed for cutting. This method is to equally divide a stand into 10 blocks, and the upper-story trees of the stand will be cut in one block every year within the fixed volume.
- ③ A survey of growing stock will be carried out at the beginning and end of each year to see if F/u is kept in balance. In case of overcutting, the cut volume will be reduced the next year. In case of undercutting, it will be increased. (Note: F stands for total growing stock subject to forest operations, and u stands for forest rotation.) However, chain saws will be purchased and renewed every three years.
- ④ In case of damage to mid- and lower-story trees during the cutting, the cut volume will be adjusted the next year.

3. Vehicles and Machines Required for Operations

Purchasing of vehicles and machines is uneconomical if the frequency of work and the efficiency of the machines are taken into consideration. It is reasonable to lease them with qualified operators except chain saws which will be purchased every three years. Necessary vehicles and machines are as follows:

Table 9-8 Machinery

Machinery	Model	Use	No.
Crawler tractor	CAT D4D D6D	Land preparation, forest road construction, nursery development	2
Wheel tractor (farm tractor)	MF SP95X SP285X CBT 2070 VALMET 110-ID	Land preparation, forest road construction, nursery development Weeding, seedling transportation, supplementary planting, watering	4
Grader	HUBERWARCO 140M 130M	Forest road construction, firebreak repair	2
Dump truck	BEZ 1113	Forest road construction, firebreak repair, road repairs	2
Truck		Forest road construction, seedling transportation, worker transportation, forest road repair	2
Road roller	CAT	forest road construction	1
Excavator	D 20 S 3	forest road construction & repair	1
Chain saw		felling and bucking	20
Backhoe	CAT BENZ	ditch digging	1

9-6 Work Process and Expenses by Item

1. Nursery-related Work Process and Expenses

Expenses for constructing nurseries, nursery beds and buildings were estimated as shown in Tables 9-9 and 9-10 by interviewing the local people concerned.

To accumulate expenses, exchange rate US Dollar to Malawi Kwacha fixed 1 US\$ = Mk15.00.

This project is to be done by women in light of the fact that this programme aims at developing fuelwood for households. Accordingly, expenses were estimated on the assumption that tending for planted trees is the work for women. Nursing trees for reforestation, and forests management will be done mainly by a female labour force.

Table 9-9 Nursery-related Work Process and Expenses

Work	Process	Rate	Quantity	Unit Cost US\$	Total US\$
Preparation for sowing	Seed cost 1kg=40,000p	3,200 p/ha	80.0 g	0.054	5.12
	Seedling yield 30%				
	Soil collection & preparation	1,500 p/day	0.6 persons	3.00	1.80
	Soil potting				
	Fertilizer (NPK15:15:15)	US\$ 0.5/kg	0.8 kg	0.50	0.40
	Subtotal				7.32
Sowing	Sowing, watering, general administration		0.8 persons	3.00	2.40
Tending & control	Watering, shading, weeding, chemical spraying		1.25 persons	3.00	3.75
	Chemical cost	US\$ 3.5/kg	0.02 kg	3.50	0.07
	Subtotal				3.82
Planting out	Seedling selection	2,500 p/d	0.4 persons	3.00	1.20
	Loading, planting out	10,000 p/d	0.1 person	3.00	0.30
	Subtotal				1.50
Survey	Growth, survival rate		1.5 persons	3.00	4.50
Total					19.54

Table 9-10 Nursery Facility Costs

Area A (0.51 ha) Area B (0.21 ha)

Area A

Item	Remarks	Quantity	Unit Cost US\$	Total US\$
Nursery bed (land preparation, leveling, pressing)	Tractor 0.05 ha/hr	10.2 hr	40.00	408.00
	Manpower 10 persons/ha	5 pers.	3.00	15.00
	Subtotal			423.00
Shading	Timber, nails, cheesecloth	33 beds	20.00	660.00
	Installation 0.6/bed	19.8 pers.	3.00	59.40
	Pot Set			50.00
	Subtotal			769.40
Total				1,192.40

Area B

Nursery bed	Tractor 0.05 ha/hr	4.2 hr	40.00	168.00
	Manpower 10 persons/ha	8.4 pers.	3.00	25.20
	Subtotal			174.00
Shading	Timber, nails, cheesecloth	14 beds	20.00	280.00
	Installation 0.6/bed	8.4 pers.	3.00	25.20
	Subtotal			305.20
Total				479.50

Buildings (common to Areas A and B)

Building	Specification	Space m ²	Unit Cost US\$	Total US\$
Field office	One-story brick	30	100	3,000.00
Warehouse	One-story brick	20	70	1,400.00
Work station	One-story wooden	50	30	1,500.00
Total				5,900.00

Watering Facilities (common to Areas A & B)

Facility	Remarks	Quantity	Unit Cost US\$	Total US\$
Pumping	0.3m ³ x 20 m with motor	1 unit	5,000	5,000.00
Water distribution	0.2 m ³ x 20 m with motor	1 unit	5,000	5,000.00
Water tank	5t brick-built	1 set	1,200	1,200.00
Pumphouse	5m ² brick-built	1 house	100	100.00
Pipe	Vinyl chloride 50 mm, 30 mm	1 set	2,500	2,500.00
Piping	Digging (50 cm deep, 50 cm wide, 150 cm long) 10 m /day/2 pers. Plumber 30 m/day/2 pers.	150/5	3	90.00
		150/4.289	3	105.00
Total				13,995.00

2. Land Preparation and Planting

Land preparation and planting expenses per hectare are shown in Tables 9-11 and 9-12. These tables will apply to the reforestation of customary forests. The work process and materials for reforestation around houses, along roads and by footpaths between fields will be the same as in the case of customary forests, but machines will not be used. Farmers are expected to serve as workers. To simplify the estimation of expenses, work standards for customary forests were employed.

3. Tending Process and Expenses

- 1) The work process and expenses in the first year of planting are shown in Table 9-13. In all cases except customary forests, firebreak repair costs will be excluded, and therefore, tending expenses will be US\$56.91/ha.

Table 9-11 Land Preparation Process and Expenses

Work	Machinery			Man Power			Materials			Total US\$/ha		
	Item	Efficiency hr/ha	Unit Cost US\$/hr	Expense US\$/ha	Efficiency hr/ha	Unit Cost US\$/day	Expense US\$/ha	Item	Quantity per ha		Unit Cost US\$/ha	Expense US\$/ha
Uprooting	Tractor	1.0	40.00	40.00	10	3.00	3.75					43.75
Plowing	Tractor	0.5	40.00	20.00	2	3.00	0.75					20.75
Tillage	Tractor	1.0	40.00	40.00	3.6	3.00	1.35					41.35
Subtotal												105.85
Termite Control					4	3.00	1.50	Termiticide	2.0 kg	2.50	5.00	6.50
Forest Road/Fire break	Tractor, Dump truck	0.4	40.00	16.00	5	3.00	1.88	Earthen pipe, bridge	1 pc.	50.00	50.00	67.88
Liming	Tractor, Truck	2	8.00	16.00	3	3.00	1.13	Lime	1 t	20.00	20.00	37.13
Protective Fencing	Dump truck	1.0	10.00	10.00	8	3.00	3.00	Wire, stake	10 pcs.	1.00	10.00	23.00
Land Surveying	Compass	2.0	5.00	10.00	32	3.00	12.00					22.00
Total												262.36

Note: Machinery expense is an aggregate of depreciation, grease, fuels, and expendable supplies and costs.

Table 9-12 Planting Process and Expenses

Work	Machinery			Manpower			Material				Total US\$/ha	
	Item	Efficiency hr/ha	Unit Cost US\$/hr	Expense US\$/ha	Efficiency hr/ha	Unit Cost US\$/day	Expense US\$/ha	Item	Quantity per ha	Unit Cost US\$/ha		Expense US\$/ha
Seeding Transportation	Truck	0.9	8.23	7.41	1.0	3.00	0.38					7.79
Seeding Distribution	Farm tractor Cart	0.6 0.7	8.08 2.00	4.85 1.40	2.0 4.0	3.00 3.00	0.75 1.50					5.60 2.90
Digging, Fertilizer Transportation	Truck	1.0	9.00	9.00	5B	3.00	15.00			US\$ 0.5/kg		24.00
Fertilizer					2B	3.00	6.00	NPK(15;15;15)	159	150kg /ha	75.00	81.00
Planting					5	3.00	15.00					15.00
Supplementary Planting (including seedling transportation and distribution)	Truck	0.9	8.23	7.41	1.0	3.00	0.38					7.79
Watering	Farm tractor	2.0	8.00	16.00	2.0	3.00 x 3 persons.	2.25					18.25
Total												168.53

Table 9-13 Tending Expenses in the First Year of Planting

Work	Machinery				Man Power			Total US\$/ha
	Item	Efficiency hr/ha	Unit Cost US\$/hr	Expense US\$/ha	Efficiency hr/ha	Unit Cost US\$/hr	Expense US\$/ha	
Weeding	Farm tractor	1 x 3	15.725	47.18	4 x 2	0.38	3.04	50.22
Termite Control					4	0.38	1.52	1.52
Patrol					0.447	0.38	0.17	0.17
Forest Road, Firebreak Repair	Grader	0.05	40.00	2.00	0.05	3.00	0.15	2.15
	Materials				Total (US\$/ha)			
	Item	Quantity	Unit Cost	Expense				
Termite Control	Termiticide	2.0 kg	2.5/kg	5.00	59.06			

2) Tending Expenses in the Second Year

All work items will be the same as in the first year except for weeding which will be reduced to 50%. Accordingly, the unit cost will be US\$33.95/ha. In the case of reforestation around houses, along roads and by footpaths between fields, the repair of forest roads and firebreaks will be excluded. Accordingly, the unit cost will be US\$31.80/ha.

3) Tending Expenses in the Third, Fourth and Fifth Years

Although weeding will be excluded in these years, other work items will be the same as in the first year. Accordingly, the unit cost will be US\$8.84/ha. In the case of reforestation around houses, along roads and by footpaths between fields, the repair of forest roads and firebreaks will be excluded. Accordingly, the unit cost will be US\$6.69/ha.

4) Accumulation of Tending Expenses by Year

The accumulation of tending expenses by year is shown in the following table.

Table 9-14 Tending Expense by Year

Year	Unit Cost US\$/ha	Area ha	Expense US\$
(first)			
Customary forest	59.06	22.00	1,299.32
Around House	56.91	4.00	227.64
Road/Footpath	56.91	0.70	39.84
Total		26.70	1,566.80
(second)			
Customary forest	33.95	22.00	746.90
Around House	31.80	4.00	127.20
Road/Footpath	31.80	0.70	22.26
Total		26.70	896.36
(third and following)			
Customary forest	8.84	22.00	194.48
Around House	6.69	4.00	26.76
Road/Footpath	6.69	0.70	4.68
Total		27.83	225.92

9-7 Required Funds and Planted Tree Cost

1. Initial Funds for the equipment

The implementation of this plan requires an initial investment and operating funds until the completion of plantations.

Funds for equipment investment in the first year of the project are shown in Table 9-10, summarizing Table 9-15. The initial facilities and equipment, which will become depreciable assets, should be included in reforestation costs. Buildings and equipment will be depreciated in 30 years and 25 years, respectively.

Table 9-15 Required Initial Investment

Unit: US\$

Model Area	Equipment Fund			Total
	Nursery	Building	Watering	
A	1,192.40	5,900.00	13,995.00	21,087.40
B	479.50	5,900.00	13,995.00	20,374.50
Total	1,671.90	11,800.00	27,990.00	41,461.90

2. Initial Funds for the Model Project (reforestation)

The rotation of reforestation will be completed in five years, during which an equal area will be forested every year. Plantations developed in this way will require a certain period for tending, which will end nine years after the start of the model project.

3. Expenses for Sprouts

Plantations will begin to be felled in the fifth year and sprout in the sixth year. They will be felled again in the tenth year and sprout again in the eleventh year. They will be felled again in the fifteenth year, when the cycle of rotation will end, and a new reforestation project will start on the same system.

In the sixth and eleventh years, bud pruning will be added to tending to secure good sprouts and to remove the bad ones. As this work is manually done by five workers, personnel costs will be US\$15.00/ha.

Expenses for sprouts are shown in Table 9-16.

Table 9-16 Expenses for Sprouts

Unit:US\$

Work	6th year	7th year	8th year	9th year	10th year
Bud Pruning	401	40	401	401	401
Tending	1,567	2,463	1,689	2,915	4,141
Total	1,968	2,864	3,090	3,316	3,542
Work	11th year	12th year	13th year	14th year	15th year
Bud Pruning	401	401	401	401	401
Tending	3,141	3,141	3,141	3,141	3,141
Total	3,542	3,542	3,542	3,542	3,542
Work	16th year	17th year	18th year	19th year	
Tending	1,574	678	452	226	
Total	1,574	678	452	226	

4. Total Fund Required until Completion of Circular Man-made Forest

Eucalyptus plantations will sprout twice and rotate in fifteen years. If such plantations are developed in five blocks, they will be sustainable as far as demand is constant. This is one cycle of rotation. In other words, if species of trees whose cutting age is five years and which grow at the same rate are planted to develop plantations at five sites having the same area each, and one of them is felled in turns each year, they will not be depleted.

This system of felling and sprouting will continue until the 19th year of the reforestation project. Even if the rotation of these plantations ends fifteen years after planting, reforestation funds will be needed for 19 years. The required funds in this period are summarised in Table 9-17.

This table just shows a flow of funds. Although it is proper to also show cost in another table, the appraised value of standing trees will be separately shown because this plan is not particularly designed to produce a profit.

Year

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

P1	2	3	4	5	Ai	ii	iii	iv	v	Aj	ii	iii	iv	v				
	P1	2	3	4	5	Ai	ii	iii	iv	v	Aj	ii	iii	iv	v			
		P1	2	3	4	5	Ai	ii	iii	iv	v	Aj	ii	iii	iv	v		
			P1	2	3	4	5	Ai	ii	iii	iv	v	Aj	ii	iii	iv	v	
				P1	2	3	4	5	Ai	ii	iii	iv	v	Aj	ii	iii	iv	v
					P1	2	3	4	5	Ai	ii	iii	iv	v	Aj	ii	iii	iv

Legends	———	Forestation	P	Plantation 1, 2, 3, 4, 5	Planted tree tending i, ii, iii, iv, v	A	Bud pruning i, ii, iii, iv, v	Sprout tending
	====	First sprouting forest						
	Second sprouting forest						

Fig.9-7 Schedule for Reforestation and Tending

Table 9-17 Estimated Expenses by Year

Unit: US\$

Expense	1st year	2nd year	3rd year	4th year	5th year
Equipment	91,462			50,000	
Reforestation	13,160	13,160	13,160	13,160	13,160
Tending	1,567	2,463	2,689	2,915	3,141
Fuel	150	150	150	150	150
Subtotal	106,339	15,773	15,899	66,225	16,451
Expense	6th year	7th year	8th year	9th year	10th year
Equipment		50,000			50,000
Tending	1,574	678	452	226	
Bud Pruning	401	401	401	401	401
Sprout Tending	1,567	2,463	2,689	2,915	3,141
Fuel	150	150	150	150	150
Subtotal	3,692	53,672	3,692	3,692	53,692
Expense	11th year	12th year	13th year	14th year	15th year
Equipment			50,000		
Bud Pruning	401	401	401	401	401
Sprout Tending	3,141	3,141	3,141	3,141	3,141
Fuel	150	150	150	150	150
Subtotal	3,692	3,692	53,692	3,692	3,692
Expense	16th year	17th year	18th year	19th year	
Equipment	50,000				
Sprout Tending	1,574	678	452	226	
Fuel	150	150	150	150	
Subtotal	51,724	828	602	376	
Total	461,237				

5. Appraised Stumpage Value

Investment in reforestation cannot be recovered until five years have passed. In the case of sprouts, investment can be recovered in the tenth and fifteenth years. Estimated as cost, the appraised stumpage value at these points of recovery is US\$3.60/m³ as shown in Table 9-18.

In a strict sense, the depreciation of assets and general administration expenses are also included in stumpage cost. However, they were excluded from the cost in this plan where any benefit or loss was not calculated.

A discounted value factor of 6% was applied as in the general case of reforestation. (Yield was also reduced by the factor).

Table 9-18 Stumpage Cost

Year	Reforestation US\$/ha	Discounted Value Factor 1/1.06 ⁿ	Appraised Value US\$/ha	Yield m ³ /ha	Stumpage Value US\$/m ³
1	549.41	0.9434	518.31		
2	33.57	0.8900	29.88		
3	8.46	0.8396	7.10		
4	8.46	0.7927	6.70		
5	8.46	0.7473	6.32	74.73	7.60
6	73.68	0.7050	51.94		
7	33.57	0.6651	22.33		
8	8.46	0.6274	5.31		
9	8.46	0.5919	5.01		
10	8.46	0.5584	4.72	55.84	1.60
11	73.68	0.5268	38.81		
12	33.57	0.4970	16.68		
13	8.46	0.4688	3.97		
14	8.46	0.4423	3.74		
15	8.46	0.4173	3.53	41.73	1.60
Avg.					3.60

Note: For commentaries on this table, see Table 8 in Attachment 21.

6. Comment

- 1) If farmers do not bear an investment amount of US\$41,461.90 in equipment, annual fuel costs per farm will be estimated at US\$18.0 (MK269.25) in this plan. This is equivalent to MK0.74/day and MK1.08/fagot (0.02m³/fagot). The cost of fuelwood purchased by Blumute Group Village is MK1.00/fagot, near to this plan's estimate. However, this is a stumpage price. To strictly estimate it, cutting and transportation costs and yield percentage must be taken into account. If these costs are added, the real value will be about MK1.30/fagot.
- 2) Seedlings are now sold by the Forest Office at a price of MK0.20 apiece. In this plan, their cost is estimated at US\$19.54 per 1,000 pieces. Converted into the local currency, it will be MK0.29 a piece, a little higher than the current selling price.
- 3) It must be fully examined whether farmers will be able to bear such costs or not. The comparisons of these prices are summarised in the following table.

Table 9-19 Comparison in Price

Unit: MK

Item	Estimated Price	Real Price
One seedling	0.29	0.20
A fagot of fuelwood	1.08 ~1.30	1.00

9-8 Expenses for Natural Forest Practices

Expenses for a pilot project for managing customary forests were estimated as follows for the initial year.

1. Coverage Area

Area A 1,925 ha / 10 = 192.5 ha

Area B 1,465 ha / 10 = 146.5 ha

Total 339.0 ha

This area will be divided into ten equal blocks for rotation.

2. Pilot Project Expenses

The following table shows budget necessary for pilot project.

Table 9-20 Operating Expenses in the Initial Year

Unit: US\$

1. Surveying (1 team 4 persons, 10ha/day, 3/person/day)	
Area A: 4 persons x 19 days x US\$3 =	228.00
Area B: 4 persons x 15 days x US\$3 =	180.00
2. Growing stock survey (1 team 3 persons, 5 ha/day, 3/person/day)	
Area A: 3 persons x 39 days x US\$3 =	351.00
Area B: 3 persons x 30 days x US\$3 =	270.00
3. Tree Selection (the same as growing stock survey)	
Area A:	351.00
Area B:	270.00
4. Felling and bucking (wages, 2 persons, 3 m ³ /day, US\$5/person/day)	
Area A: 2 persons x (3,313 ÷ 5) day x US\$5 =	6,630.00
Area B: 2 persons x (1,514 ÷ 5) day x US\$5 =	3,030.00

5. Purchase of chain saws @US\$2,500/unit	
Area A: 10 units x US\$2,500/unit =	25,000.00
Area B: 5 units x US\$2,500/unit =	12,500.00
6. Fuel and Grease for chain saws (50 m ³ /liter @US\$0.3/liter)	
Area A: (3,313 ÷ 5) liter x US\$0.3/liter =	198.78
Area B: (1,514 ÷ 5) liter x US\$0.3/liter	90.84
Grease (Total of A and B) 20% of fuel cost	57.92
Total:	49,158.00

In the second and following years, the purchase of chain saws will not be needed, but their depreciation expenses will be included.

9-9 Efforts and Expenses for Improving the Furnace

1. Furnace Improvement and Extension

Improving the conventional furnace does not seem to be a very difficult problem. An improved furnace has already been used in the southern part of Malawi. A problem is to spread it. Several attempts have been made to improve furnaces in Africa and South America, too. In these cases, improved furnaces were supported and widely used by farmers only when the following three conditions were satisfied.

- ① They can be installed at a low cost.
- ② They are easily operated.
- ③ Their thermal efficiency is high.

In the process of spread, trials and errors were repeated several times. It is generally said that it takes at least ten years to penetrate among farmers.

In villages around the Reserve, saving fuelwood is an urgent need which cannot be deferred because there is no ways of migrating the increased population and no prospect for using electricity or gas as an alternative fuel.

In a furnace improvement project implemented near Dedza, an improved furnace has already been prevailing among farmers. Fig. 9-8 illustrates both the conventional and improved furnaces.

It seems that administrative agencies will play a leading role in improving the conventional furnace and spreading a better one. In particular, the Ministry of Agriculture and Livestock Development, the Ministry of Women, Children Affairs, Community Development and Social Welfare, and the Department of Forestry of the Ministry of Natural Resources need to collaborate and cooperate with each other for development and extension by setting up two committees, namely the Technical Committee for Furnace Improvement and the Improved Furnace Promotion Committee. In addition to this effort, NGOs are highly expected to develop grass-roots activities as in the case of fuelwood.

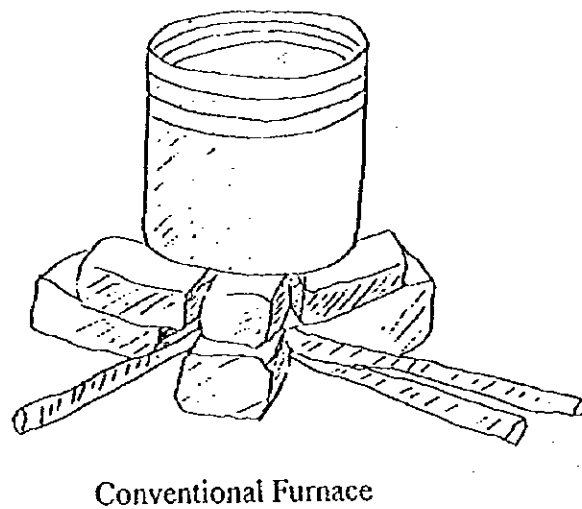
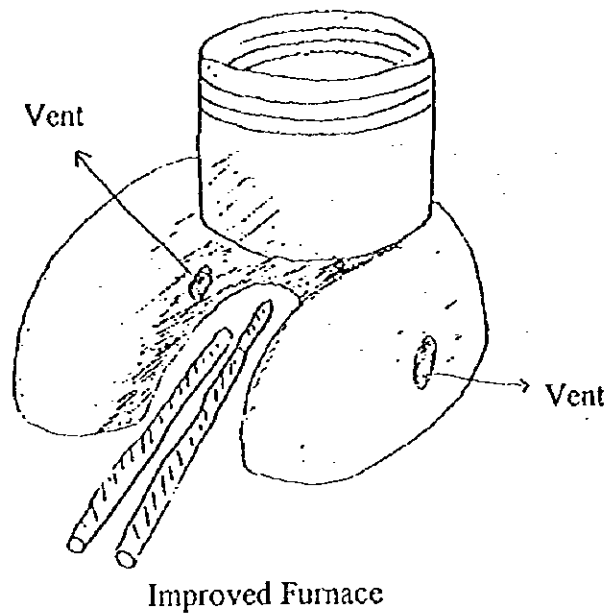


Fig. 9-8 Conventional and Improved Furnaces

2. Furnace Development Expenses

Expenses for furnace improvement project are as follows. The project will take five years to complete.

(1) Research and Development Costs

The following table shows budget necessary for research and development.

(2) Expenses for Furnace Extension Committee

10 members (3 government officials, 4 farmers and 3 experts, for 5 years)

The following table shows budget necessary for Furnace Extension Committee.

Table 9-21 Expenses for Furnace Development

	Unit: US\$
1. Research and development	
1) Material cost	
• 3 sets of bricks and other materials 3 sets x US\$100/set =	300
2) Construction cost	
• Wages @US\$3/person 5 persons x 3 sets x US\$3/person =	45
• Expendable supplies @ US\$10/set 3 sets x US\$10/set =	30
3) Research cost (parts and material)	
1 unit x US\$300/unit =	300
4) Personnel cost @US\$100	
5 times x US\$100/times =	500
5) Examination cost , Fuel @US\$50	
3 sets x 10 times x US\$50/set/time	1,500
Calorie measuring instrument 1 unit	500
6) Expenses for Furnace Development Committee	
10 members (3 government officials, 4 farmers and 3 researchers) 10 times	
• Rental fee for venue @US\$100/time 10 times x US\$100/time =	1,000
• Allowance @US\$10/person 10 times x 10 person x US\$10/person	1,000
Subtotal:	5,175
Furnace extension	
1) Local extension cost (5 tours par year)	
• Traveling allowance @US\$50/trip 10 persons x 5 times x US\$50/trip x 5 years =	12,500
2) Committee expenses	
• Rental fee for venue @US\$100/time 15 times x US\$100/time =	1,500
• Members' allowance @US\$10/person 10 persons/time x 15 times x US\$10/person	1,500
Subtotal:	15,500
Total	20,675

9-10 Expenses for Securing Fuelwood

The table 9-22 shows funds necessary for the programmes above.

Table 9-22 Expenses for Securing Fuelwood

Unit: US\$

Item	Calculation	Expenses for Facilities & Equipment	Operating Expenses	Administrative Expenses	Total
1. Reforestation					
1) Equipment costs	(based on Table 9-17)	41,462			41,462
Nursery establishment	2 nurseries				
Chain saw	@US\$ 2,500 .00/unit	300,000			300,000
	20 units x 6 times x US\$ 2,500=		65,800		65,800
2) Reforestation expenses (for 5 years)	133.50 ha x US\$ 492.89=		15,705		15,705
3) Tending expenses (for nine years)	667.5 ha (total) x US\$ 23.53=		4,010		4,010
4) Bud pruning expenses (for ten years)	267 ha (total) x US\$ 15.02=				
5) Sprout tending expenses					
(for nine years)	1,335 ha (total) x US\$ 23.53=		31,410		31,410
6) Fuel cost	19 years x US\$ 150=		2,850		2,850
Subtotal		341,462	119,775		461,237
2. Pilot Project Expenses	(for ten years based on Table 9-20)				
1) Surveying			4,080		4,080
2) Growing stock survey			6,210		6,210
3) Tree selection			6,210		6,210
4) Felling and bucking			96,600		96,600
5) Chain saw purchase	15 units x US\$ 2,500 x 2 times=	75,000			75,000
6) Fuel for chain saws			3,480		3,480
Subtotal		75,000	116,580		191,580
3. Furnace Development Expenses	(for five years based on Table 9-21)				
1) Research & study			5,175		5,175
2) Expenses for furnace extension staff	Extension activities will be performed for five years.		15,500		15,500
Subtotal			20,675		20,675
4. Department of Forestry Headquarters	(for ten years)			17,000	17,000
5. Nkhotakota Forestry Office	(for ten years)			25,500	25,500
Total		416,462	257,030	42,500	715,992

Note: For the details of administrative expenses for the Department of Forestry Headquarters and the Nkhotakota Forestry Office, see Chapter 12.

X. Policies for Research

To properly perform sustainable resource management in the Reserve, the actual conditions of the Reserve must be grasped, including basic data on resources and ecotourism, the local people in the vicinity of the Reserve and their relationship with the Reserve. For this purpose, it is necessary to establish facilities and systems for continuous and effective research.

It is currently planned to construct a new office in Nkhotakota, which should have facilities for research, extension and education. It is important that various types of research, study and analysis be carried out to clarify the present state of the resources, including animals and plants. These activities will certainly make a high contribution to the development and implementation of various plans and programmes for the Reserve in the future.

10-1 Subjects of Research

1. Tourism Resources

The promotion of tourism and ecotourism in the Reserve requires that basic data be collected at all times, including changes in visitors and their requests. It is also necessary to incorporate in the plan measures to improve the environment as a tourism resource. Specific subjects of research and study are:

- 1) Visitors
- 2) Persons enjoying sport fishing
- 3) Ecotourists
- 4) Detail and actual conditions of ecotourism
- 5) Users and current use of facilities
- 6) Needs of visitors
- 7) Development of new resources

2. Animal Resources

The actual condition of the animals in the Reserve is not clear in many respects and leave much room for research. Data collection and accumulation should be done by both management and research staff. Scientific analysis will contribute to the improvement of the management procedures and to implement the plan for the Reserve.

In view of species conservation, an important function of the Reserve is the introduction and propagation of endangered animals.

1) Survey on actual condition of wild animals

(1) Population Dynamics

Population estimates and monitoring its change are important in animal resource management. Aerial surveys for this purpose should be carried out continuously. Recruitment rate and movements are to be investigated to understand the population increase and decrease in detail. The records of animals death, including pest control, need to be more accurate. The information to be recorded is date, species, sex, age (or age group), cause and place of death, weight of trophies (e.g. ivory), sales of wildlife products, etc. Measurement of body parts will help to determine the average size of species at particular location and how poaching affects the size. All the data should be sorted and stored for various research purpose.

(2) Fish Resources

The first step in understanding fish resources is to accumulate data on fish species identified in the Reserve and changes in the amount of these resources. Based on such data, management policies will be determined for the purpose of conserving fishes in cooperation with the Department of Fisheries. The cooperation of the local people is indispensable for the collection of data.

(3) Effectiveness of anti-poaching

Anti-poaching patrols have been analysed and evaluated over along period of time in Malawi. At present, performance of every team is comparatively evaluated, and the frequency of patrols is shown on the grid map of the Reserve.

In addition it is needed to identify problem areas, to study impacts of illegal activities on animals, and to measure efficiencies of various management approaches.

(4) Crop Damage and Pest Control

Pest control in the study area is indispensable for obtaining cooperation from the community in Reserve management. DNPW should put efforts in prevention of crop damage according to the results of investigation. Degree of damage on crops, influence of pest species in different areas, and the time of frequent crop damage are the items of investigation. As technical and financial assistance should be given to the community for self-defense, study on preventive measures and benefit distribution is also needed.

2. Black Rhinoceros reintroduction

Studies should be carried out concerning the followings:

- ① Whether Nkhotakota Wildlife Reserve is suitable habitat for black rhinoceros
- ② Whether it is possible to secure funds to maintain such a breeding and research centre, to train staff, to supply equipment including ammunition, and to establish a 24-hour management system.
- ③ How to obtain sufficient number of initial animals.
- ④ Whether it is possible to provide enough natural food and manpower to take care of the animals. Whether alternative food is available if there is not enough supply of natural food. Food availability is particularly important in case of intensive breeding with a good number of animals in a confined area.

In addition to the above, establishment of breeding techniques, cooperation with the veterinary section, and coordination with other countries could be bottlenecks. These issues also needs special consideration.

3. Plant Resources

Every type of forest in the Reserve is invaluable. The proper protection and conservation of all forests on the Reserve require continuous research, which are also needed for the sustainable resources use.

1) Effects of Prescribed Burning on Habitats

Burning grass is studied from the standpoint of miombo forest management in Malawi and Zambia. In the Reserve, prescribed burning is regarded as an effective means for sustainable management of habitats and forest resources. However, a more environmentally friendly and more efficient burning system should be established through continuous monitoring. Therefore, general research should be carried out concerning the effects of prescribed burning on the natural environment.

An experimental plot with an area of 200 ha will be chosen for research, and the following subjects will be covered.

- Relationships between prescribed burning and fodder grass
- Relationships between grass burning and vegetation
- The relation between the burning time and herbage intake, comparisons of herbage intake between burned and unburned areas, and optimal rotation of burning.
- Changes in vegetation by forest type and the relation between vegetation and herbage.

2) Rare Plants in the Reserve

Research should be carried out in order to determine the growth of precious and rare plants and flower trees with a touristic value and to protect a variety of forests. To be concrete, plant species, their locations, and the amount of these resources will be listed and mapped, and a plan for protecting and increasing endangered plant species will be developed.

3) Use of Resources

The effects of using forest by-products, such as dead trees and branches, mushrooms and medicinal plants, on the amount of resources will be surveyed to provide basic data for establishing a sustainable resource use system. Sustainable use of resources means that they will be used without overharvesting which may have a serious effect on ecosystems in the Reserve. For this purpose, the results of research must be regularly analysed and evaluated from a general point of view and fed back to local people

Specific items to be surveyed include:

- Effects of collecting dead trees and branches on the present ecosystem (changes in the survival of termites, small animals and birds).
- Mushrooms and medicinal plants:
 - 1) Habitats, species and amount
 - 2) Place of collection, species, and the amount of use
 - 3) Comparison and analysis of 1) and 2).

4. Evaluation of Programmes for Sustainable Resource Use

The progress of every programme using resources, including beekeeping and small animal farming, should be recorded whether it is successful or not. If the activities of all groups using resources are compared with one another, their specific problems will be identified and their activities will be made more effective. Tracking changes in local people's awareness of conservation and Reserve management is important for the evaluation of extension activities. It would be done by questionnaire surveys. The results could be taken into consideration in public relations. Extension staff of the DNPW will be responsible in collecting data.

10-2 Research and Management Link

Management should identify the issues for further investigation to evaluate conventional management operations and to explore new management options. Research unit would discuss with management and extension unit before and after the investigation so that information flows among them.

In the course of the above-mentioned research on tourism and animal and plant resources, the maintenance and use of data should be systematised for the sake of efficiency, and it should be continuously evaluated to what extent the results of research have been reflected in the sustainable resource management. These efforts are commonly needed for

tourism and animal and plant resources.

Necessary data for research will be extracted from patrol reports and other reports by hunter scouts every month and maintained for the researchers' reference. At least one person trained in extracting and filing data should be employed. If all data input is computerised, efficiency will be remarkably improved. In this case, the qualified person should be trained in operating a computer. An example of the necessary computer programmes is one in which the distribution of animals will be shown on a map just by inputting data.

All the report will be kept as research reference along with the data. They should be both in the form of files on a floppy disk and printed papers so that the management and extension staff could read them whenever necessary.

10-3. Expenses for Research

The table 10-1 shows funds necessary for the programmes above:

Table 10-1 Expenses for Research

Unit: US\$

Item	Calculation	Expenses for Facilities & Equipment	Operating Expenses	Administrative Expenses	Total
1. Tourist Attractions	Not specially available.				
2. Animal Resources					
1) Survey on population estimate and distribution	Three times (1st, 5th and 10th years)				
Helicopter rent	@US\$ 600/hour 50 hours x US\$ 600 x 3 times=		54,000		54,000
2) Damage to Crops and Preventive Measures					
Travel allowance	@US\$ 50 4 persons x 5 days x US\$ 50 x 10 years=		10,000		10,000
Fuel costs	@US\$ 0.7/l 2 vehicles 100 km/5 km x 5 days x 2 units x US\$ 0.7/l x 10 years=		1,400		1,400
3) Machinery					
(1) Vehicle	@US 50,000/unit 1 x US\$ 50,000=	50,000			50,000
(2) Computer	@US\$ 10,000 (including a printer) 1 set x US\$ 10,000=	10,000			10,000
(3) Desk & chair	Desk US\$ 400 Chair US\$ 300 2 sets x US\$ (400 + 300)=	1,400			1,400
(4) Filing cabinet	@US\$ 700 1 x US\$ 700=	700			700
(5) Binoculars	@US\$ 500/pair 2 pairs x US\$ 500=	1,000			1,000
Subtotal	63,100	63,100	65,400		128,500

<p>4) Research & Study Expenses (2 researches) Survey of introducing black rhinoceroses Travel Expenses Trip to the Liwonde National park four times a year Fuel costs Material purchase costs Subtotal Total</p>	<p>(for five years) if one researcher goes there to stay for five nights, then: @US\$ 50/night/person 1 x 5 nights x US\$ 50 x 4 times x 5 years= @US\$ 0.7/liter 4 times x (1,000 km/5 km) x US\$ 0.7 x 5 years= @US\$ 50/piece 10 pieces x US\$ 50 x 5 years=</p>	<p>5,000 2,800 2,500 10,300 75,700</p>	<p>63,100</p>	<p>5,000 2,800 2,500 10,300 138,800</p>
<p>3. Plant Resources 1) Survey of burning travel allowance Fuel costs 2) Plant survey Travel allowance Fuel costs 3) Survey of resources use Travel allowance Fuel costs Total</p>	<p>2 members of Forest Research Institute @US\$ 50 2 persons x 5 days x 4 times x US\$ 50 x 10 years= @US\$ 0.7/liter 1 vehicle 100 km/5 km x 5 days x 4 times x US\$0.7 x 10 years= 2 members of Botanic Garden @US\$ 50 2 persons x 5 days x 2 times x US\$ 50 x 10 years= @US\$ 0.7/liter 1 vehicle 100 km/5 km x 5 days x 2 times x US\$ 0.7 x 10 years= 1 member of Forest Research Institute @US\$ 50 1 person x 5 days x 2 times x US\$ 50 x 10 years= @US\$ 0.7/liter 1 vehicle 100 km/5 km x 5 days x 2 times x US\$ 0.7 x 10 years=</p>	<p>20,000 2,800 10,000 1,400 5,000 1,400 40,600</p>	<p>20,000 2,800 10,000 1,400 5,000 1,400 40,600</p>	<p>20,000 2,800 10,000 1,400 5,000 1,400 40,600</p>

4. Others					
1) Accumulation of data for research Allowance to instructor	Computer training @US\$ 50 1 person x 10 days x 1 time x US\$ 50 =	500			500
Teaching materials	@US\$ 20 5 person x US\$ 20 =	100			100
2) Changes in attitudes of local people Allowance to researchers	3 times (1st, 5th and 10 years) @US\$ 50	3,000			3,000
Fuel cost	4 persons x 5 days US\$ 50 x 2 times = @US\$ 0.7/liter 2 vehicles 100 km x 5 km 5 days x 2 vehicles US\$ 0.7 x 3 times=	420			420
3) Evaluation of sustainable resource use programme Allowance to researcher	@US\$ 50 1 x 10 days x 1 time x US\$ 50 x 10 years=	2,000			2,000
Fuel cost	@US\$ 0.7/liter 2 vehicles US\$ 0.7 x 100 km x 5 km 5 days x 2 vehicles x 2 times=	280 6,300			280 6,300
Subtotal					
5. DNPW Headquarters	(for ten years)			375,000	375,000
6. Nkhotakota Wildlife Reserve Office	(for ten years)			700,000	700,000
Grand Total		63,100	122,600	1,075,000	1,260,700

Note: For the details of administrative expenses for the DNPW Headquarters and the Nkhotakota Wildlife Reserve Office, see Chapter 12.

XI. Extension and Education

The participation of the local people is indispensable for the sustainable resource management in the Reserve. To promote their participation, a first step to accurately grasp how much they are interested in the Reserve and what they need. Based on the results of such survey, knowledge as to the Reserve should be disseminated among the local people, and then efforts should be made to lead them to understand the significance of conserving the Reserve, and cooperate for its conservation through extension and education. Visitor education is also needed.

11-1 Extension and Education for the Local People

It is necessary to lead local people to understand the necessity for protecting resources in the Reserve and consider the coexistence between the Reserve and themselves so that they will actively take part in this project.

1. Sharing Benefits

Local communities regard the Reserve as a treasure of natural resources and wish to use them. Any plan for maintaining and managing the Reserve cannot be successfully carried out without the cooperation of the local people. The DNPW needs to draw cooperation from the local people in sustainable resource management through the use of these resources. If both parties work closely together, and perform various activities for mutual interests, they will be able to erase any a sense of inequality that the Reserve has been maintained at the expense of local people. If the local people will participate in programmes for using resources and ecotourism, which will give more opportunities for employment, in the Reserve. In return for this, the DNPW will be able to obtain cooperation from them in maintaining and managing the Reserve, including the protection of forest products against poaching and illegal collection.

2. Needs of the Local People

Every village has its own practical needs in daily life. These specific needs must be grasped, and then appropriate measures should be taken for the maintenance and management of the Reserve. In this respect, the DNPW needs to have a dialog with the local people. In the dialog, they will be able to find out good ways of persuading the local people to understand the necessity of the Reserve and recognise that the Reserve is beneficial to improve their life condition.

3. Exchange of Information

It is important the DNPW should not unilaterally provide information but also reflect the voices of the people in the management of the Reserve. Of course, local communities wish to receive information from the DNPW. At the same time, they have a strong desire to express their own opinions. The DNPW should make more efforts to build a close relationship with the local communities through visits by the staff to villages, an educational tour of the Reserve for villagers, the posting of bulletin boards, the holding of workshops and the provision of opportunities for exchanging information.

4. Environmental Education at Schools

The education of students who will bear the destiny of future generations is also important for environmental conservation. The merits of school education are that many students can be educated at one time, they can exchange opinions with one another, their parents can be indirectly educated through them, and cooperation can be drawn from the teachers. In practice, visits by the DNPW's staff are the easiest way of educating villagers. It is also possible as one practical method of education to cooperate with secondary schools (agriculture courses), the Forest Office, and forestry schools in the neighborhood. Students will be educated through the effective use of land and the proper management of forests in the vicinity of the Reserve.

11-2 Education of Visitors and Guides

The education of visitors to the Reserve for non-consumptive use, including ecotourism, canoeing and sport fishing are also important for conserving the Reserve. It is possible that they will understand well the significance of the Reserve and cooperate for its conservation in the future. As they increase, more opportunities for employment will be given to the local people. From this point of view, it is necessary to improve both the infrastructure and quality of the environment.

1. Education of Guides

Ecotourists should be required to be accompanied by a guide carrying a gun in order to prevent any danger. At the same time, they should be led to understand the significance of the Reserve by the guide explaining the natural environment and history of the Reserve. In visitor centres, too, it is possible to enlighten and educate visitors through general briefing. Therefore, guides need to be fully educated to master knowledge as to the fauna and flora, topography, geology, history and administration of the Reserve.

2. Posting Signs and Notices

As part of educational activities toward visitors, guide maps or bulletin boards will be posted in the Reserve.

3. Display of Education Material and Information on the Reserve in Visitor Centres

General briefing, display of material and photographs, and slide shows will be held concerning the Reserve in the Bua and Chipata Visitor Centres. Educational activities will be promoted toward visitors.

11-3 Other Considerations

Besides the above-mentioned efforts, extension and educational activities toward both the local people and visitors should be considered.

1. Cooperation with NGOs

NGOs, such as the Wildlife Society, have already supported the DNPW in various

forms. For example, they organised educational tours of national parks and reserves, gave financial assistance for improving reserve facilities, and prepared and distributed teaching materials in local languages. NGOs are featured by mobility and flexibility and can carefully act in areas which the DNPW cannot officially cover. Therefore, the DNPW needs to strengthen its relation with NGOs for promoting extension and educational activities in the future.

2. Preparation of Educational Material

The quantity of educational material written in the local languages can be said to be sufficient. The Education, Information and Interpretation Unit of DNPW should actively commit itself to the preparation of such material.

While discussing with the staffs of the management and research section, the staff from the education section must determine what kind of material is needed for each activity by grasping the expectations of the DNPW and the needs of the local people. Although audiovisual aids are very effective, much care should be taken lest they become just entertainment. In terms of extension and education, it is also effective to show notices and announcements from the DNPW in places where people often gather.

11-4 Expenses for Extension and Education

The table 11-1 shows funds necessary for the programmes above.

Table 11-1 Expenses for Extension and Education

Unit: US\$

Item	Calculation	Expenses for Facilities & Equipment	Operating Expenses	Administrative Expenses	Total
1. Survey on people's Needs					
1) Survey allowance	Travel Expenses @US\$ 50 3 persons x 4 days x 1 time x US\$ 50 x 10 years =		6,000		6,000
2) Fuel cost	@US\$ 0.7/liter 1 vehicle 200 km x 5 km x 1 time x US\$ 0.7 x 10 years =		280		280
Subtotal			6,280		6,280
2. Extension and Education					
1) Machines for extension and education					
Vehicle	@US\$ 50,000/unit 1 unit x US\$ 50,000 =	50,000			50,000
Slide projector	@US\$ 3,000/unit 1 unit x US\$ 3,000 =	3,000			3,000
OHP	@US\$ 3,000/unit 1 unit x US\$ 3,000 =	3,000			3,000
Power generator	@US\$ 5,000/unit 1 unit x US\$ 5,000 =	5,000			5,000

2) Information Exchange Villagers' Formal Observation of the Reserve					
Fuel costs	@US\$ 0.7/liter 3 vehicles 200 km/5 km x 3 vehicles x 1 time x US\$ 0.7 x 10 years=	840			840
Posting bulletin boards	@US\$ 50/piece 30 pieces x US\$ 50=	1,500			1,500
Subtotal		2,340			2,340
3) Environmental Education at Schools	Travel Expenses @US\$ 50\$ 3 persons x 5 days x US\$ 50 x 10 years=	7,500			7,500
Expense for visit	@US\$ 0.7/liter 1 vehicle 200 km/5 km x 1 vehicle x 1 time x US\$ 0.7/l x 10 years=	280			280
Fuel cost		10,120		61,000	71,120
Subtotal					
3. Guide Education	10 guides/year, 25 days/year @US\$ 50/person	12,500			12,500
Travel allowance of instructor	1 person x 25 days x US\$ 50 x 10 years=				
Guide allowance	@US\$10/day 10 guides 10 person x 25 days x US\$ 10/day x 10 years=	25,000			25,000
Teaching Materials	@US\$420 for 11 persons 11 persons x US\$ 20 x 10 years=	2,200			2,200
Subtotal		39,700			39,700
4. Putting Up Signs and Notices					
Sign	@US\$420/piece 100 pieces 100 pieces x US\$20=			2,000	2,000
Notice	@US\$ 150 20 pieces 20 pieces x US\$ 150=			3,000	3,000
Subtotal				5,000	5,000

5. Explanation of the Reserve and Preparation and Display of Relevant Material at Visitors' Centers						
Material						
Slides	@US\$ 2/copy 500 copies of each of 20 types 20 types x 500 copies x US\$ 2=	20,000				20,000
Photographs	@US\$ 1/piece 1,000 pieces 1,000 pieces x US 1=	1,000				1,000
Subtotal	@US\$ 0.5/piece 1,000 pieces 1,000 pieces x US\$ 0.5=	500				500
		21,500				21,500
6. Preparation of Educational Material						
Expenses for preparation educational material	@US\$ 2/copy 1,000 copies of each of 20 types 20 types x 1,000 copies x US\$ 2=	40,000				40,000
7. DNPW Headquarters					187,500	187,500
8. Nkhotakota Wildlife Reserve Office					350,000	350,000
Grand Total			66,000	117,600	537,500	721,100

Note: For the details of administrative expenses for the DNPW Headquarters and the Nkhotakota Wildlife Reserve Office, see Chapter 12.

XII. Operating Expenses

Expenses for managing and operating this project incurred by the government of Malawi in one fiscal year were estimated as shown in Tables 12-1 and 12-2 with the cooperation of the DNPW. Expenses for education and extension were estimated at half those for research. It is supposed that expenses for social forestry will be incurred by the Department of Forestry.

Table 12-1 Administration Expenses Concerning Each Categories of the Project for Headquarters

Per Year unit: US\$

Category/ Item	Reserve Management	Resource Management	Resource Use	Securing Fuelwood	Research	Extension and Education
Salaries and Wages	36,000	-	-	-	3,000	1,500
Travelling allowance	40,320	1,000	500	500	4,000	2,000
Foods and Clothes	7,000	-	-	-	1,000	500
Medical Treatment	6,000	-	-	-	2,000	1,500
Light and fuel	5,000	100	100	100	2,500	1,250
Water	8,000	-	-	-	-	-
Article of Consumption	4,500	100	100	100	3,000	1,500
Fuel and maintenance fee for vehicle	4,000	1,000	1,000	1,000	15,000	7,500
Fixtures	-	-	-	-	7,000	3,500
	110,820	2,200	1,700	1,700	37,500	18,750

Table 12-2 Administration Expenses Concerning Each Category of the Project for
Nkhotakota Office

Per Year unit US\$

Category/ Item	Reserve Management	Resource Management	Resource Use	Securing Fuelwood	Research	Extension and Education
Salaries and Wages	15,538	1,200	1,000	800	12,000	6,000
Travelling allowance	11,780	400	300	200	16,000	8,000
Foods and Clothes	3,500	300	200	100	4,000	2,000
Communication	3,000	50	50	50	-	-
Medical Treatment	8,000	200	200	200	3,000	1,500
Light and fuel	1,000	100	100	100	-	-
Water	300	100	100	100	-	-
Article of Consumption	2,000	100	100	100	5,000	2,500
Fuel and maintenance fee for vehicle	40,000	500	500	500	20,000	10,000
Rehabilitation of buildings	700	150	150	150	-	-
Stationary	300	250	250	250	10,000	5,000
Total	86,118	3,350	2,950	2,550	70,000	35,000

XIII. Conclusion

The sustainable multiple-use and resource management plan is focused on the control of resources within the Reserve. In order to reduce the pressure on the Reserve's resources, measures are to be taken in surrounding areas of the Reserve. Also in order to preserve the Reserve's resources, needless to say, the cooperation of regional residents is necessary and requires something fitting in reward, improvement of income level of smallholders.

1. Effects through Execution of the plan

The execution of this plan which includes many measures will produce considerable effects, of which the major results will be as follows:

- 1) It is considered that this plan requires about US\$ 15 million to be carried out and needs to be executed by a design extending over a long period of time. The execution of this plan will produce employment opportunities in the surrounding areas of the Reserves, and contribute to the improvement in the regional residents' standard of living.
- 2) Although measures to be taken in the surrounding areas of the Reserve, particularly the completion of social infrastructures, will require a larger amount of funds, residents in the areas will receive considerable benefits from their completion. However, the prevention of unclear water flowing into wells, which protects the people from disease, and is useful for people's health control requires no large budget. The execution of measures to improve living standards will certainly raise the residents' standard of living, and women's status will be improved by entrusting them with some partial disposal of products.
- 3) The reinforcement of controls on the Reserve, especially an increase in the quantity of scout camps and scouts will strengthen control over poaching. Higher effects can be expected through improvements in tools and materials for patrol and measures to uplift scouts' morale.
- 4) Major measures to preserve resource in the Reserve are to increase the number of animals living in the Reserve for animal resources, to protect evergreen broad-leaved forests, and to preserve miombo forests for forest resources. Increase in the number of animals is attained by thoroughly controlling poaching and maintaining inhabitable environments for the animals. The former step is achieved through the execution of measures for scouts and the latter through the preservation of forests.
- 5) Collection of mushrooms and medicinal plants and beekeeping provide a clue to the residents' cooperation in the preservation of the Reserves. As a method for preserving fishes, this plan admits fishing under certain restrictions, and, in return for this, requires cooperation in the prevention of illegal fishing methods

and poaching. It will be useful for the reinforcement of the residents' cooperation related to the Reserves, if a part of the revenue obtained from the distraction of vertebrate pest such as hippopotamus is used for the establishment of facilities for improving the standard of living in the surrounding areas of the Reserves. The complete execution of these measures, with their effects exhibited, will enable resources in the Reserves to be increased and the residents' cooperation to be obtained. In addition, the regional residents will come to recognise the Reserve as useful. Cooperative condition will be established between DNPW and the surrounding areas of the reserves to improve relations between the two factors, and will exert favorable influence on the control and operation of the Reserve.

- 6) The active use of the Reserve in the form of ecotourism will lead people to recognise the significance of the Reserve and provide educational opportunities for nature conservation. In addition, the income level of people will rise, and revenues from fees for using the Reserve will also increase.
- 7) Conserving miombo forests occupying the greater part of the Reserve will conserve plant resources in the forests as well as good habitats for animals. In parallel with that, rivers will also be conserved as spawning grounds for lake salmon, an important resource of Lake Malawi.
- 8) For the use of resources, the use of dead trees in the Reserve has important significance. In order to promote social forestry, it is required to recover the existing forest resources of customary forests. In this case, dead trees can be used to make up for any deficiency in fuelwood for households. In addition to this, the collection of mushrooms and medicinal plants and the use of honey obtained from beekeeping are important resources utilised by the residents. Fishery, that is admitted aiming at the protection of fishes, can also be deemed as a form of resource utilisation.
- 9) With regard to the execution of securing fuelwood, although this plan is a model, its development will show the regional residents a method that is necessary for keeping the balance between supply and demand of fuelwood for households in the region. At the same time, this execution will have the residents understand the magnitude of results produced from concerted work, significance of reforestation, usefulness of furnaces, and the importance of women's activities in communities.
- 10) Surveys have enabled us to monitor the existing condition and changes of resources in the Reserves, to confirm the residents' intentions toward the reserves, and to accurately grasp the number of persons who have slipped into the reserves. This has provided DNPW staffs with elementary information on the control and operation of the Reserves.
- 11) Protecting rare living organisms is an important role of national parks and reserves. Accordingly, it is significant as a measure for the future to study and consider various problems in introducing black rhinoceroses into the Nkhotakota

Wildlife Reserve and propagating them. However, intensive study is recommended to examine the feasibility in the Reserve.

- 12) Extension and education will bring about effects that have the regional residents and persons who have slipped into the Reserves recognise the importance of the Reserve and cooperate in preserving the areas, by letting them know the details of the Reserve such as fauna, flora, geology.
- 13) This master plan for the sustainable multiple-use and resource management has been prepared on the basis of scoping in the initial environmental survey. In this case, it was thought that full attention should also be paid to social environments with consideration toward natures in the Reserve and their surrounding areas, deemed as a matter of course. The execution of this plan will improve the nature and social environments in the Reserve and their surrounding areas.

For exhibition of these effects, it is earnestly desirable active approaches by DNPW and other related administrative organisations.

2. Budget

The total budget for implementing the Sustainable Multiple-use and Resource Management Plan is as follows.

Table 13-1 Summary of Operating Expenses

Unit: US\$1000

Category	Item	Calculation?	Expense for Facilities & Equipment	Operating Expenses	Administrative Expenses	Total
Reserve Management and Operation	Access	54 km, bridge 50 m long, etc.	2,025			2,025
	Scout housing	60 houses, 10 wells, etc.	1,060			1,060
	Administrative office and other facilities	Office building, housing, etc.	353			353
	Scout equipment	Camp equipment, etc.	316			316
	Administrative office Equipment	Vehicles, communications equipment	111			111
	DNPW Headquarters Nkhotakota Wildlife Reserve Office				1,108	1,108
	Subtotal		3,865		861	5,834
Resource Management in the Reserve	Animal resources	90 km	360			360
	(electric fences)					
	Forest resources	Extinguishers, firebreak, etc.	48	12	22	60
	DNPW Headquarters Nkhotakota Wildlife Reserve Office				34	22
	Subtotal		408	12	56	476

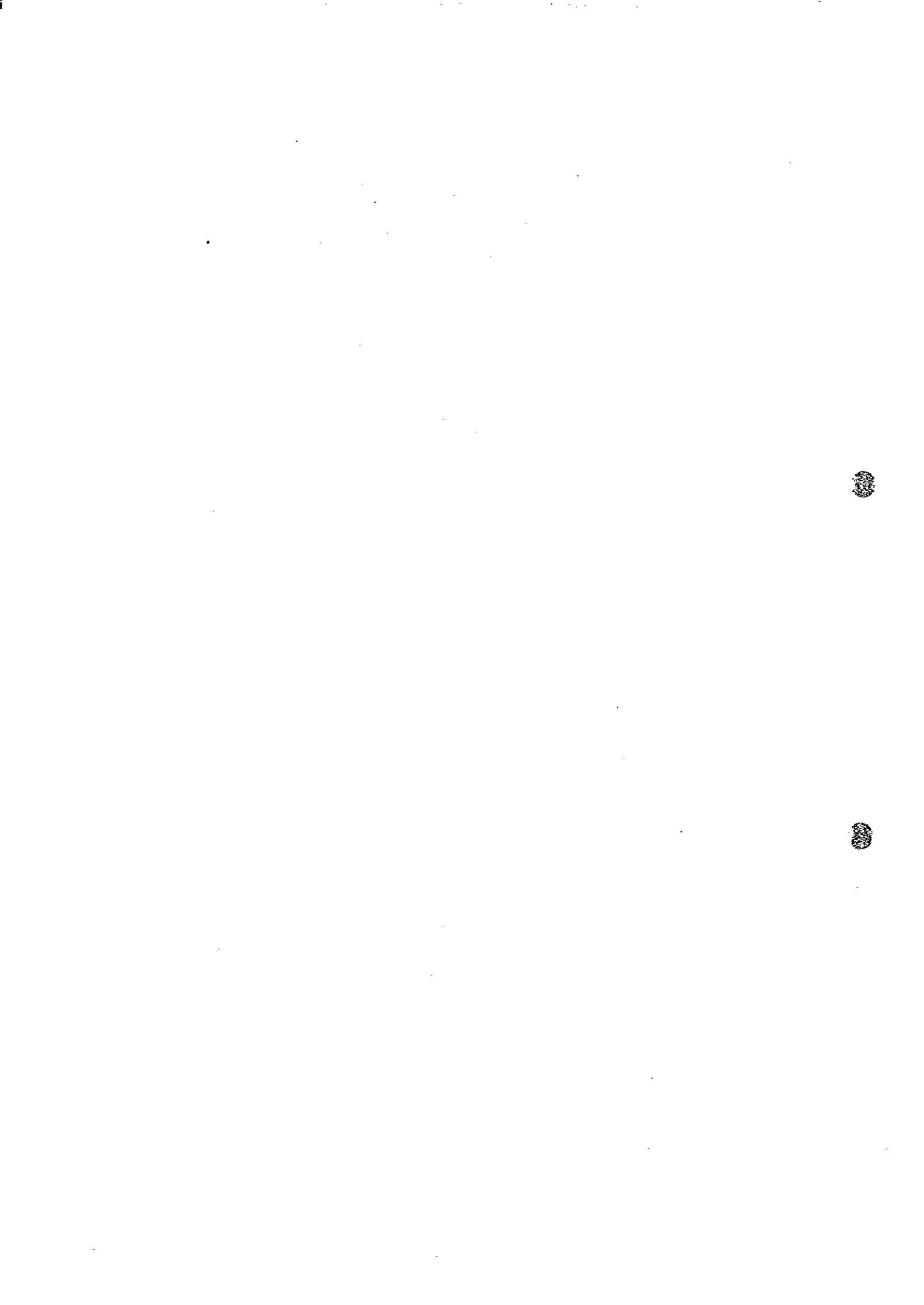
Resource Utilization	Bua Visitors' Center	Visitors' Centre, etc.	1,625						1,625	
	Chipata Visitors' Center	Visitors' Centre, etc.	1,086						1,086	
	Equipment in the vicinity	Improve roadways and constructing sidewalk	1,882						1,882	
	DNPW Headquarters						17		17	
	Nkhotakota Wildlife Reserve Office						30		30	
	Operating costs of touristic Programmes			1,558					1,558	
	Subtotal		4,593	1,558			47		6,198	
	Securing Fuelwood	Reforestation	133.5 ha	341	120					461
		Natural forest practice	3,390 ha	75	117					192
		Furnace improvement & prevalence			21					21
Department of Forestry							17		17	
Nkhotakota Forestry Office						26		26		
Subtotal		416	258			43		717		
Research & Study	Animal Resources		63	76					139	
	Plant Resources		-	41					41	
	Others			6					6	
	DNPW Headquarters						375		375	
	Nkhotakota Wildlife Reserve Office						700		700	
Subtotal		63	123			1,075		1,261		
Extension & Education	Survey on people's needs			6					6	
	Extension & education		61	10					71	
	Guide education			40					40	
	Signs, etc.		5						5	
	Various types of material			62					62	
	DNPW Headquarters						188		188	
	Nkhotakota Wildlife Reserve Office						350		350	
Subtotal		66	118			538		722		
Total		9,411	2,069			3,728		15,208		

Acknowledgments

The surveys for preparing this plan progressed under the guidance and cooperation of agencies such as the Republic of Malawi's Ministry of Natural Resources, DNPW, Forestry Department, Fisheries Department, Ministry of Agriculture, and Livestock Development, relevant District Commissioners and Traditional (Subtraditional) Authority chiefs, including relevant staff members, and the Japanese Ambassador to Zambia and a relevant secretary, the Japan International Cooperation Agency's Head Office, Malawi Office and Zambia Office. We hereby express our profound gratitude.

In addition, we also express our thanks to Bunda College of Malawi University and the Wildlife Society of Malawi, from which we received cooperation in the subconstructed survey.

Attachment



Attachment 1 List of Interviewees

Ministry of Natural Resources

Hon. Essau Phiri	Deputy Minister
Dr. James H.A. Maida	Principal Secretary
Mr. Sam K. Botomani	Deputy Secretary
Mrs. A. Chapuma	Economist

Department of National Parks and Wildlife (DNPW), Lilongwe

Mr. M.W. Matemba	Director, National Parks and Wildlife
Mr. J.N.B. Mphande	Deputy Director, National Parks and Wildlife
Mr. H.E. Nzima	Principal Parks and Wildlife Officer
Mr. H.S. Jamusana	Acting Senior Parks and Wildlife Officer
Mr. F.X. Mkanda	Acting Senior Parks and Wildlife Officer
Mr. P.C. Mbota	Parks and Wildlife Officer
Mr. B.B. Mbulumbunde	Clerical Officer
Mr. Matthias v. Bechtolsheim	Advisor
Ms. T.S. Msiska	Economist
Mr. Mark G. Tengeletu	Assistant Parks and Wildlife Officer

Ministry of Agriculture and Livestock Development, Lilongwe

Mr. C.C. Nyirongo	
Mr. Buddhika Samarasinghe	Economist
Mr. Masanobu Kiyoka	Planning Division / JICA Expert

Ministry of Works

Mr. H. Chiudzu	Quantity Surveyor
Mr. D. Kara	Controller of Roads

Ministry of Research and Environment Affairs

Mr. J.A. Malunga	
Mrs. Mwanyogo	Economist

Ministry of Economic Planning and Development

Ms. R. Fatch	Economist
Mr. Steven K. Banda	Economist

Ministry of Finance

Mr. G.B.H. Maganga	Administrative Officer
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Department of Forestry, Lilongwe

Mr. Solomon Chipompha	Deputy Director
Mr. Sam Kainja	Forestry Officer
Mr. John D. Ngalande	Forestry Officer, Planning
Mr. Gilbert Mtsendero	Assistant Divisional Head
Mr. Joel Luhanga	Senior Forestry Officer, Planning Unit
Mr. L.C. Zulu	Senior Forestry Extension Officer
Mr. B.K. Chongwe	Senior Assistant Surveyor

Department of Fishery

Mr. A. Bulirani

Research Officer

Mr. Motohiro Ohashi

JICA Expert, Domasi

Nkhotakota District Parks and Wildlife Office (DNPW)

Mr. A.P. Dzimbiri

Assistant Parks and Wildlife Officer

Mr. Boniface Mwanza

Senior Parks and Wildlife Assistant

Chipala Scout Camp

Mr. Robert Kwengwele

Senior Parks and Wildlife Scout

Mbobobo Scout Camp

Mr. Brison Sakala

Parks and Wildlife Assistant

Mr. Nicholas Msowoya

Chief Parks and Wildlife Scout

Kasaka Scout Camp

Mr. Laston Chisale

Senior Parks and Wildlife Scout

Bua Scout Camp

Mr. Ponsiano Kwendanguwo

Parks and Wildlife Assistant

Tongole Scout Camp

Mr. J.K. Batha

Senior Parks and Wildlife Scout

Mzuzu District Parks and Wildlife Office (DNPW)

Mr. Chipofya

Assistant Parks and Wildlife Officer

Mr. J. Bonongwe

Parks and Wildlife Scout

Mr. J.P. Siwakwe

Parks and Wildlife Assistant

Liwonde National Park (DNPW)

Mr. Connex Mbewe

Senior Assistant Parks and Wildlife Officer

Mr. G. Thamala

Assistant Parks and Wildlife Officer

Mr. Edson Sichali

Parks and Wildlife Assistant

Lilongwe Nature Sanctuary (DNPW)

Mr. Yoshiaki Mizutani

Parks and Wildlife Officer (Education), JOCV

Kasungu National Park (DNPW)

Mr. L.B. Satali

Parks and Wildlife Officer (Research)

Mr. T.O. Makanjila

Senior Assistant Parks and Wildlife Officer

Mr. C.P. Mwale

Senior Parks and Wildlife Assistant

Mr. Katsutoshi Matsunaga

Parks and Wildlife Officer (Research), JOCV

Mr. Devie Lazaro

Assistant Parks and Wildlife Officer (Research)

Mr. E.S. Liwewe

Parks and Wildlife Assistant

Lake Malawi National Park (DNPW)

Mr. B.C. Zakochera

Nyika National Park (DNPW)

Mr. Tomy Mhango Senior Parks and Wildlife Officer
Mr. A.M. Chirwa Assistant Parks and Wildlife Officer (Research)

Vwaza Marsh Wildlife Reserve (DNPW)

Mr. H.G. Msiska Assistant Parks and Wildlife Officer

Nkhotakota District Forest Office (Department of Forestry)

Mr. Foster Solijala District Forest Officer (former)
Mr. G.S. Mkoola District Forest Officer

Ntchisi District Forest Office (Department of Forestry)

Mr. P.S. Mphande District Forest Officer

National Herbarium and Botanical Gardens

Mr. A.J. Salubeni Senior Assistant Technician
Mr. Indra Hassam Patel Senior Assistant Technician

Nkhotakota RDP Office (Sallima ADD, NRDP, Ministry of Agriculture)

Mr. B.G.S. Zimba Project Officer
Mr. G.K. Kambuzi Assistant Project Officer
Mr. Joseph D. Chikumba Evaluation Supervisor

Ntchisi RDP Office (Kasungu ADD, NRDP, Ministry of Agriculture)

Mr. S. Mtato Project Officer

Nkhotakota Irrigation Office (Department of Irrigation, Min. of Agriculture)

Mr. B. Banda Assistant Irrigation Officer

Kasitu Selfhelp Irrigation Scheme (NRDP, Sallima ADD, Nkhotakota RDP)

Mr. Ellason W. Chiwaya Scheme Manager

Nkhotakota District Office

Mr. O.A.Z. Chirambo Nkhotakota District Commissioner

Kasungu District Office

Mr. R.B.C. Moyo Kasungu District Commissioner

Ntchisi District Office

Mr. Rodrick L. Ndala Ntchisi District Commissioner
Mr. Timothy E.C. Mwale Assistant District Commissioner

Malenga Chanzi Traditional Authority

Mr. Moses T. Malenga Chanzi Chief

Kanyenda Traditional Authority

Mr. Wilton S. Banda Kanyenda Chief

Kapelula Traditional Authority

Mr. Kapelula Chief

Mphonde Subtraditional Authority	
Mr. Mphonde	Chief
Nthondo Sub-traditional Authority	
Mr. Nthondo	Chief
Chilooko Subtraditional Authority	
Mr. Jesimon Chilooko	Chief
Kafudzira Subtraditional Authority	
Mrs. Milliam Nyabanda	Chief
Namakwati Group Village (Malenga Chanzi T.A.)	
Mr. Buliani Ipagi	Group village head man
Chanika Village (Malenga Chanzi T.A.)	
Mr. Sumaili Itimu	Village head man
Mphikaphika Village (Kanyenda T.A.)	
Mr. Stephen Boniface	Village head man
Malawi Army Headquarters	
Mr. J.G. Chimbayo	Brigadier / Chief of staff
Mr. L.M.R. Bukani	Lieutenant Colonel
Malawi Army Air Wing	
Mr. S.G. Ngwira	Lieutenant Colonel
Mr. E.G. Kandiero	Lieutenant Colonel
Mr. F.B. Nsambo	Major
Mr. D.B. Mukhuna	Major
(Operation Team)	
Mr. C.S. Utumbe	Captain / team leader
Mr. T. Kandoje	Captain / pilot
Mr. F. Mpando	Captain / pilot
Civil Aviation Office	
Ms. I. Namanja	Civil Aviation Officer
SADC Wildlife Sector Technical Coordination Unit	
Dr. Michael Dyer	Wildlife Technical Advisor
South African High Commission - Malawi	
His Excellency Leon Viljoen	High Commissioner
Bunda College, Animal Science Department	
Dr. G. Kanyama Phiri	Dean
Mr. T. Kadzanja	Registrar
Mr. T.N. Ngwira	Head of Animal Science Department
Dr. M.A.R. Phiri	Lecturer

Mr. Toshio Miharū	JICA Expert
The Wildlife Society of Malawi	
Dr. John G.M. Wilson	Chairman
Dr. Denis Tweddle	Research Officer
J&B Circle Friends	
Mr. W.P. Tunney	
Japanese Embassy in Zambia	
His Excellency Tadashi Masui	Ambassador
Mr. Takayuki Miyashita	Councilor
Mr. Yasuhiro Murakami	Secretary
Mr. Mitsunori Yunki	ditto
Mr. Tatsuo Koga	ditto
JICA Zambia Office	
Mr. Yoshinori Ebata	Resident Representative
Mr. Kozo Tsukada	Deputy Resident Representative
Mr. Shinji Obuchi	Assistant Resident Representative
Kafue National Park Management Project in Zambia	
Mr. Isao Akai	Team Leader, JICA Expert
Mr. Fukuo Miyauchi	JICA Expert
Mr. Kazuhiro Nitta	ditto
Kafue National Park North in Zambia	
Mr. Wilbroad Chansa	Acting Wildlife Warden
Mr. Paul Zyambo	Wildlife Biologist
Mumbwa Game Management Unit in Zambia	
Mr. Finalli Kandela	Unit Leader
Mr. Morgan Nzovu	Deputy Unit Leader
Others in Zambia	
Mrs. Hilda M. Shamkanga	Deputy Head Teacher, Kabulwebuiwe Primary School
Mr. K. O. Manicle	Headman, Kabulwebuiwe Sub-authority
JICA Malawi Office	
Mr. Yusuke Kitamura	Resident Representative
Mr. Seiichi Kimura	Deputy Resident Representative
Mr. Ryosuke Kojima	Deputy Resident Representative
Mr. Jiro Inamura	Assistant Resident Representative
Mr. Tetsuo Seki	ditto
Mr. Akio Kagawa	ditto

MINUTES OF MEETING ON THE DRAFT FINAL REPORT FOR THE MASTER PLAN STUDY ON SUSTAINABLE MULTIPLE-USE RESOURCE MANAGEMENT OF THE NKHOTAKOTA WILDLIFE RESERVE, MALAWI

The Study Team (hereinafter referred to as "the Team") headed by Mr. Hiroji Okabe and the Advisory team headed by Mr. Takamasa Hayase organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") visited Malawi from 28 October to 7 November 1996 and from 28 October to 6 November respectively, for the purpose of explanation and discussion of the Draft Final Report for the Master Plan Study on Sustainable Multiple-Use Resource Management of the Nkhotakota Wildlife Reserve (hereinafter referred to as "the Study").

The Team submitted 30 copies of Draft Final Report of the Study to the Government of Malawi.

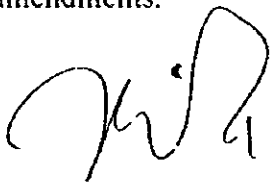
The Team and Advisory Team held a series of discussions on the Draft Final Report with Malawian officials and members of the Steering Committee Meeting for the Study (hereinafter referred to as "Malawian Officials"). The Meeting was chaired by Mr. Francis X. Mkanda.

The list of participants is shown in the Attachment I.


The main issues discussed in relation to the Draft Final Report are shown in the Attachment II.

Resulting from these discussions, the Draft Final Report was agreed upon after some amendments.

Lilongwe, 4 November 1996

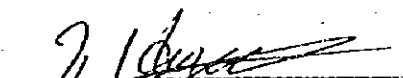


Mr. Matthew W. Matemba
The Director
The Department of National Parks
and Wildlife
Malawi



Mr. Hiroji Okabe
Leader
The Study Team
Japan International Cooperation Agency
Japan

Witnessed by



Mr. Takamasa Hayase
Leader
Advisory Team
Japan International Cooperation Agency
Japan

Attachment I

List of Participants

Malawian Officials

1. Mr. F.X. Mkanda
Senior Parks and Wildlife Officer, Department of National Parks and Wildlife (DNPW)
2. Mr. H.S. Jamusana
Acting Senior Parks and Wildlife Officer, DNPW
3. Mr. A.G. Dzimbiri
Assistant Parks and Wildlife Officer, DNPW
4. Mr. P.C. Mbota
Parks and Wildlife Officer, DNPW
5. Mr. M.v. Bechtolsheim
Advisor, DNPW(GTZ)
6. Mr. S.K. Banda
Economist
Ministry of Economic Planning and Development
7. Mr. G.B.H. Maganga
Administrative Officer
Ministry of Finance
8. Mr. A. Bulirani
Research Officer, Department of Fisheries
9. Mr. R.B.C. Moyo
District Commissioner, Kasungu
10. Mr. O.A.G. Chirambo
District Commissioner, Nkhotakota
11. Mr. L.G. Mwalughali
District Commissioner, Mzimba

Study Team

1. Mr. H. Okabe
Leader, Study Team
2. Mr. K. Tajima
Member, Study Team
3. Mr. K. Nagao
Member, Study Team
4. Ms. Y. Kato
Member, Study Team

Advisory Team

1. Mr. T. Hayase
Leader, Advisory Team
2. Mr. Y. Nakayama
Member, Advisory Team

JICA Malawi Office

1. Mr. A. Kagawa
Assistant Resident Representative

Attachment II

1. The meeting agreed to indicate "co-management" as a guiding principle which leads four management measures (Management and control, Resource management, Utilisation of resources, and Education and extension) in the chart of the structure of the sustainable multiple-use resource management plan.
2. The Malawian officials suggested to use the phrase "sustainable multiple-use and resource management" instead of "sustainable multiple-use resource management" because it is misleading in the meaning. The Team agreed to use the phrase in the text but the title of the project will stay the same as determined in the initial stage of S/W because of the length of process involved for the change.
3. The Malawian officials requested to include safari hunting as one of the revenue generating measures in animal resource utilisation. The Team agreed to include it as a possible option for animal resource management on the condition that consensus of the local community will be obtained before implementation .
4. The Malawian officials strongly recommended to have an estimated recurrent cost of the proposed project for the purpose of decision-making. The Team agreed to indicate it if the Malawian officials could provide some expected expenses that are difficult to be projected by the Team.
5. The Malawian officials suggested that if a certain project cost covers more than two categories of the management plan, the cost should be separated or such an overlap should be mentioned rather than indicating the cost with "-" or "0". The Team agreed to the suggestion.
6. The Malawian officials requested to state the idea of revenue retention and revenue sharing along with the lines of the Nyika/Vwaza project. The Team agreed to include it.
7. The Malawian officials mentioned that some parts of the demarcation in the map of the study area needed correction. The Team agreed to revise the map with correct information from the Malawian officials.
8. The Team mentioned that black rhinoceros reintroduction programme will be included in the section of research, not in the section of animal resource management, in the view that resource management should primarily deals with the existing resources. The Malawian officials requested to keep the principal idea in the resource management section since it can be a strong tool for the development of the Reserve, if it is successfully implemented. The Team agreed to state the idea in resource management with an emphasis on research to determine the feasibility of rhinoceros reintroduction into the Reserve.
9. In the initial environmental survey, the Malawian officials pointed out that ecotourism could lead to loss of scenic beauty, and there is a possibility of minimal soil erosion due to ecotourism. The Team agreed to change the rating of impacts.

10. The Malawian officials pointed out the calculation of prospective visitors should use the figures from the Reserve instead of those from other national parks. The Team agreed to change all the relevant figures and calculations.
11. The Malawian officials pointed out that the countermeasures proposed for improvement of living standard of the local community were not sufficiently described. The Team agreed to rewrite the section.
12. The Malawian officials mentioned that the distance between Chipala camp and the proposed A camp is too close, compared to that between Chipala and Kasaka camp and suggested to move Chipala camp to the north as the boundary area along the Dwangwa River suffers encroachment problems. After taking various factors into account, it was agreed to move Chipala camp toward the north.
13. The Malawian officials requested to have a proposed organisation chart of Nkhotakota Wildlife Reserve office. The Team agreed to produce a new chart.
14. The Malawian officials suggested to include anti-poaching activities for hippopotamus as well as reinforcement of crop protection force. The Team agreed to the suggestion.
15. The Malawian officials corrected the statement about penalties for animals poaching from "fine or imprisonment" to "fine and imprisonment". The Team noted the correction.
16. The Malawian officials pointed out that the benefits of hippopotamus include meat, skin, and teeth which have a value of MK 10,000 approximately. The Team replied that the figures were collected from the actual records in Nkhotakota Wildlife Office, but the Malawian officials offered to provide correct figures to the Team.
17. The Malawian officials suggested to raise the price of wildlife meat to that of beef, using two tier pricing system for rural and urban areas respectively. The Team replied to consider it in view of general meat price and demand in the local community.
18. The Malawian officials asked why an electric fence was proposed only for a certain part of the Reserve boundary. The Team replied that the area was selected in consideration of existing records of crop raiding and human injuries, and of the location of the forest reserves adjacent to the Reserve. The Malawian officials insisted that it is important to consider the whole surrounding area and the Team suggested to give a priority setting for fence construction in different areas.
19. The Malawian officials agreed with an idea of banning smoking in the Reserve but they suggested designation of smoking areas, e.g. smoking could be allowed in visitors facilities only. The Team noted the suggestion.
20. The Malawian officials asked the time frame of the projects. The Team replied that some activities were for 10 years and others for 5 years.

21. The Malawian officials pointed out that the 3 km fire break for Chipata Mountain evergreen forest is not long enough. The Team agreed to change the length to 10 km. The Meeting also confirmed that the fire break indicated in the plan was designated only for the evergreen forest.
22. The Malawian officials asked if the Team insists on a grass-thatched roof for tourist facilities even though it may cost more in maintenance than an iron sheet roof. The Team replied that with an emphasis on ecotourism, the grass-thatched roof was preferred.
23. There was a question from the Malawian officials whether 5% of depreciation rate applies to Malawi. The Team was suggested to check with relevant agencies.
24. The Meeting agreed that commentary tables and formulas in social forestry section should be moved into the Data Book.
25. The Malawian officials requested to include the study of recruitment rate and movement in the research on population dynamics of wild animals. The Team agreed to the request.
26. The Malawian officials mentioned that utilisation of forest resources by local people will require a controlling mechanism for sustainable use. The Team agreed to suggest such a system.
27. Misspelling and misleading sentences will be corrected as agreed by the Meeting. Some paragraphs or sections concerning black rhinoceros reintroduction and social forestry will be rearranged according to the changes mentioned during the discussion.
28. All the calculations and figures will be checked carefully to avoid discrepancies.
29. Department of National Parks and Wildlife will convey to JICA its comment on the Draft Final Report, not later than 30 November, 1996.





