JAPAN INTERNATIONAL COOPERATION AGENCY

MINISTRY OF MINES, NATURAL RESOURCES
AND ENVIRONMENT, MALAWI

PILOT STUDY
ON
COMMUNITY VITALIZATION AND AFFORESTATION
IN MIDDLE SHIRE
IN
MALAWI

FINAL REPORT

MAIN

MARCH 2005

SANYU CONSULTANTS INC.

PREFACE

In response to a request from the Government of Malawi, the Government of Japan decided to conduct a study titled "Pilot Study on Community Vitalization and Afforestation in Middle Shire in the Republic of Malawi" and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Toshihide Shibata of Sanyu Consultants Inc. and composed of members from the said consultancy company between April 2002 and January 2005.

The team held discussions with the officials concerned of the Government of Malawi and conducted field surveys in the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Malawi for their close cooperation extended to the study.

March 2005

Etsuo KITAHARA
Vice-President
Japan International Cooperation Agency

March 2005

Mr. Etsuo KITAHARA
Vice-president,
Japan International Cooperation Agency (JICA)
Tokyo, Japan

Dear Mr. KITAHARA,

Letter of Transmittal

We are pleased to submit herewith the Final Report on the Pilot Study for the Community Vitalization and Afforestation in Middle Shire in the Republic of Malawi. This Report presents the application of a Model for developing sustainable forestry and income-generating activities with the advices and suggestions of the authorities concerned of the Government of Japan and your Ministries concerned. Also included were comments issued by the Ministry of Mines, Natural Resources and Environment of the Republic of Malawi during the technical discussions held at Lilongwe and Blantyre in January 2005 on the draft final report.

The overall objective of this Study is to contribute to the rehabilitation of deteriorated watershed in the Study Area based primarily upon village-based forestry, agro-forestry and income generating activities. The study has been conducted in partnership with and by guidance from the Department of Forestry of Ministry of Mines, Natural Resources and Environment, and incorporated the views of the collaborating Land Husbandry Division of Ministry of Agriculture and Community Services Division of Ministry of Gender, Youth and Community Services, local authorities, international funding agencies, NGOs, etc. The process of this Study centered on the following actions aimed in the Study:

1) To verify a proposed model for rehabilitating watershed in the Study Area,

2) To transfer techniques and to assist capacity building of the stakeholders, and

3) To present improved framework of managing village natural resources.

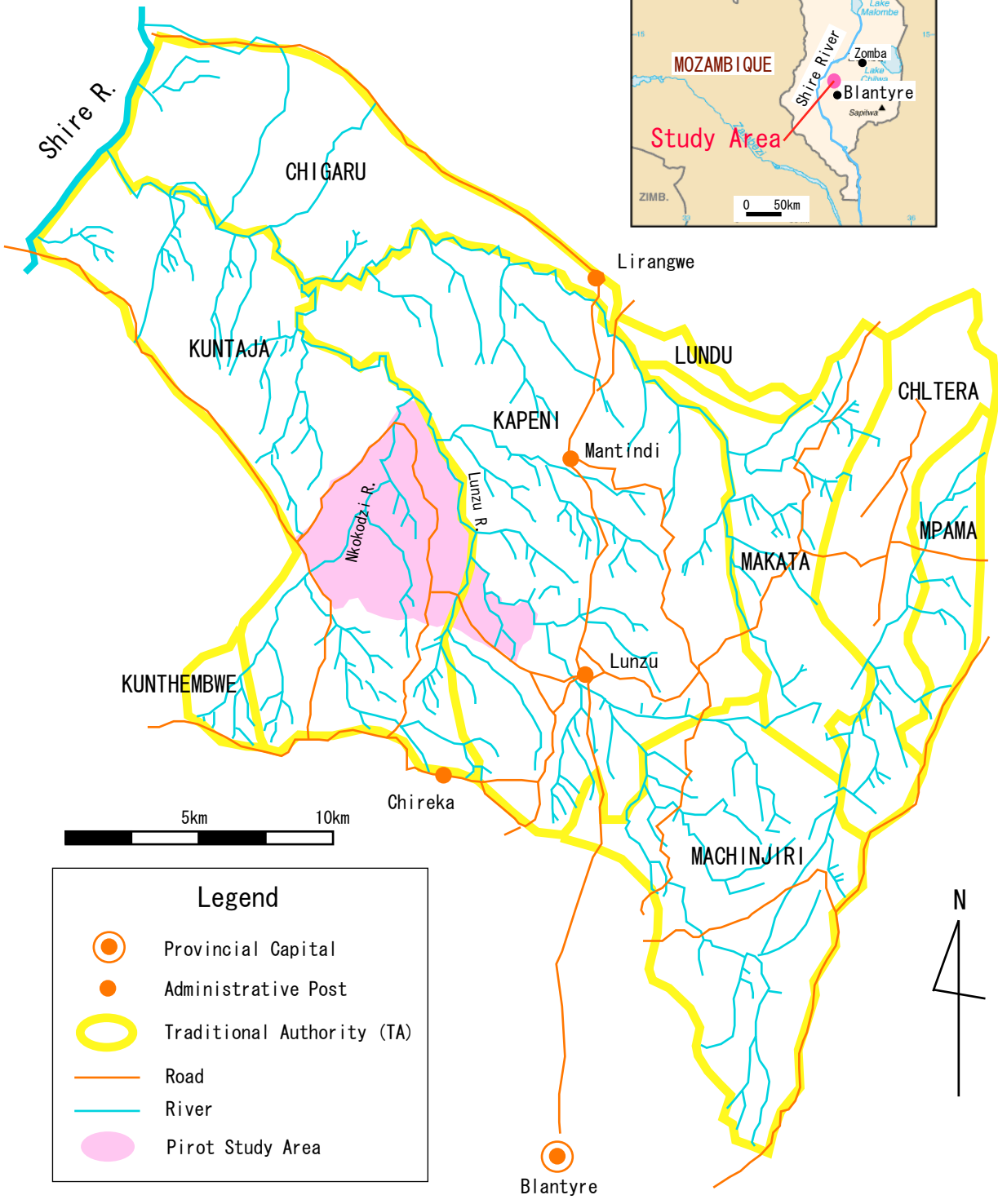
To attain the above objectives, this study has been carried out for three years from April 2002 to January 2005; in 24 villages chosen as the Study Area. The study in the first year dealt mainly with identification of issues and tasks through baseline and inventory surveys for situation analysis, simultaneous establishment and use of village nurseries, of income-generating activities (IGAs). In the second year, planting trees, agro-forestry practices and development of IGAs were promoted through heavy input of extension services. In the third year, the study analyzed and summarized the verified results, proposing follow-up actions based on verified performances.

Taking this opportunity, we wish to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs, Ministry of Agriculture, Forestry and Fisheries of the Government of Japan. We also wish to express our cordially appreciation to the counterpart agencies including relevant Ministries of the Republic of Malawi and Department of Forestry for their close collaboration and assistances extended to us during our study.

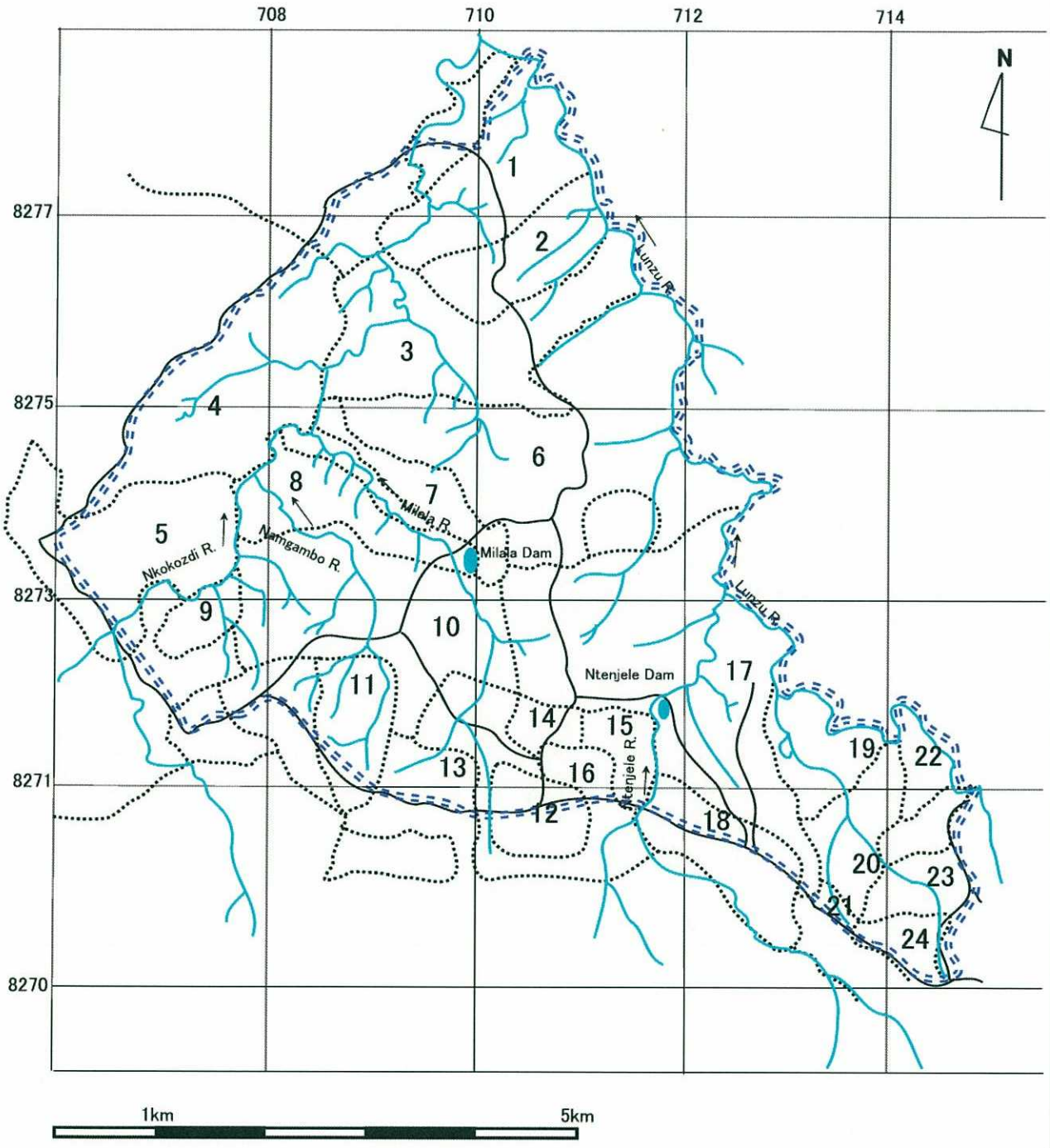
Very truly yours,

Toshihide SHIBATA
Team Leader of the Study Team

Location Map of the Study Area



Location Map of the Study Area



Legend

- Road
- River
- Village Boundaries
- Project Area Boundary

No.	Village Name	No.	Village Name	No.	Village Name
1	Makonokaya	9	Chakana	17	Kamwendo
2	Siyandima	10	Lemu	18	Peter Bilila
3	Kaumbata	11	Magombo Ngondo	19	Ndemanje
4	Mdala	12	Kam'mata	20	Simon Mpombe
5	Nanjiwa	13	Kumanda	21	Kateya
6	Chikoja	14	Tamve Kenji	22	Maluwa
7	Manjelo	15	Chilangali	23	Kumponda
8	Teula	16	Daniel Mbeza	24	Kumisati Chigumula

Nursery activity

(August 2004, Kam'mata)

Training of out-planting activity

(November 2002, Chikoja)

Agroforestry

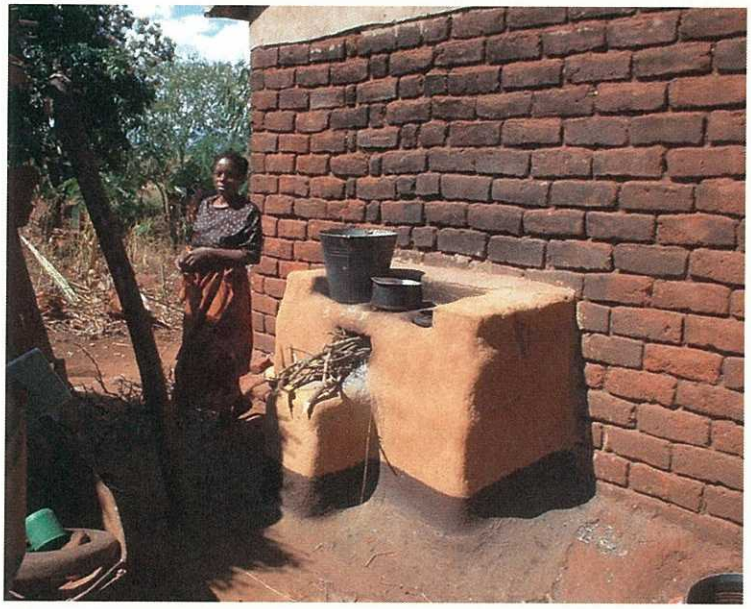
(December 2003, Ndemanje)

Gliricidia sepium, *typical species of agroforestry were planted in maize fields*

Woodlot

(December 2003, Nanjiwa)

Eucalyptus



Improved Stove

(June 2004, Ndemanje)

Income Generation activities:

Treadle pump

(December 2003, Kumponda)

Income Generation activities:

Bee keeping

(November 2003, Mdala)

Income Generation activities:

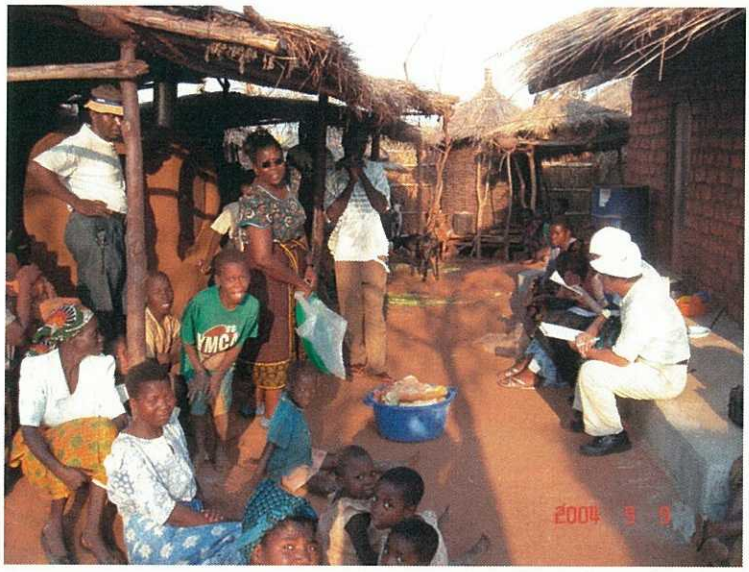
Goat rearing

(December 2003, Maluwa)

Income Generation activities:

Guinea fowl rearing

(December 2003, Daniel Mbedza)



Income Generation activities:

Home Bakery

(September 2004, Manjero)

Stove (left) and breads (middle)

Income Generation activities:

Fishery

(December 2003, Milala Dam)

Raft making

Income Generation activities:

Sweet potato processing

(December 2003, Maluwa)

Processing demonstration

Summary

Chapter 1 The Outline of the Study

1.1 Background of the Study

Forest area in Malawi in early 1990s accounted for 38.6% of its territory, extending over 118 thousand square kilometer, of which 17% belonged to Customary Land traditionally managed by local communities. These forests and woodlots in Customary Land have supplied firewood accounting for 90% of the domestic fuel consumption. However, population pressure has narrowed the area, dwindled and degraded forest resources through rampant felling or reclamation of land into crop field until forest cover declined to 25.3%. As local population have seldom planted trees, heavy exploitation for consumption deteriorated Customary, where topsoil has been eroded away into streams at an enormous rate. As a result of such escalated soil erosion mainly occurring in Middle Shire, huge amount of silt has been deposited in the dams along Shire River, thus narrowed capacity of power generation and urban water supply.

To find a solution to this exigent problem, Ministry of Mines, Natural Resources and Environment (hereinafter referred to as MMNRE) requested Government of Japan to conduct a Master Plan Study (M/P) on Watershed Rehabilitation in Middle Shire in June 1998. In response to the request, Japan International Cooperation Agency dispatched a reconnaissance survey team in March 1999 for preliminary consultation and agreed with Government of Malawi to launch the Master Plan Study (hereinafter referred to as MP) from 1999 to 2000. In the M/P, it was proposed to implement a pilot Model study within a model area in the form of coupled components, combining forestry and agro-forestry (hereinafter referred to as AF) components with income generating activities (hereinafter referred to as IGA) for three years.

In accordance with the proposal in the report of M/P, Government of Malawi further requested Government of Japan to undertake the proposed Study. After the dispatch of preliminary survey mission, Government of Malawi and Japan International Cooperation Agency agreed on the Scope of Work and Minutes of Meeting on the Pilot Study on Community Vitalization and Afforestation in Middle Shire in Malawi (hereinafter referred to as the Study) on October 11, 2001. The agreed Study has a period of three years for verifying what have been proposed in M/P report, from 2002 to 2004.

1.2 Objectives of the Study

As mentioned above, the Study has a definite objective of verifying what have been proposed in M/P study report, where five major components have been proposed, viz, 1) utilization of agro-forestry, 2) forestry promotion, 3) promotion of income generating activities, 4) strengthening of village organizations and 5) enlightenment, capacity building and effective application of extension services. These components should be envisaged in the Village Natural Resources Management Plan (hereinafter referred to as VNRMP) to be planned at village level in concrete types of participatory works. Here, community vitalization serves as a tool to attract attention of villagers, followed by afforestation as the major goal, thus the name of the Study expresses the order to be realized, because Government of Malawi has ample experiences on the well-known behavior of local population always pursuing tomorrow's food rather than forest benefit of ten years ahead. In this respect, the objectives should include the estimation of effect brought about by the coupled component of forestry (duty) and IGAs (incentives), where the relevance of

implementing the proposed model through the scheduled process with capacity building of both extension staffs and villagers is verified.

The watershed rehabilitation in the Study Area shall thus be addressed and verified by those who live therein and the counterparts though it takes far-reaching period to attain. The proposed pilot Study herein could serve as a threshold of rehabilitating action with sustained efforts of the villagers and counterparts concerned to challenge their long-term task of environment conservation. Though the Study proposed herewith should have covered social infrastructure that villagers acutely have desired as a component to be implemented in the model area, it has been cancelled because it can hardly be constructed during the short Study period.

Targets of the Study are placed on use of AF, promotion of social forestry and of IGAs through organization and extension activities for the community concerned. Although quantified results are difficult to obtain, verification has been targeted on how the villagers concerned can manage and rationally utilize local resources and how they make efforts of learning techniques for conservation/rehabilitation of environment. AF should come first among the components on the time sequence of implementing Pilot Study followed by IGA, and community forestry should come last because the result can be manifested very late as compared to other components.

Study has a period of three years, but the actual starting of the activities tends to delay because fairly long preparatory period is required to smoothly initiate the envisaged activities especially in the developing countries where procurement of material is not so easy because of limited availability. The activities proposed in the Pilot Study have aimed at capacity building of the villagers in the course of various activities including site training, study tours, demonstrations and workshops. The study itself aims at examining whether the proposed Model in M/P report is really workable in the Study Area or not. Through the whole process of the implementation of the Pilot Study, relevance of the Model should be verified, and the lessons learnt from the Study should be reflected in the brushing-up of the whole M/P, to be later implemented by the Government of Malawi.

Another important objective of the Study resides in technical transfer from the Study Team to the counter parts and from them to grass-root villagers. Traditional society inherently has many obstacles and constraints towards modernization and development but these should be rectified through the introduced activities. The basic stance of this Study lies in that villager's affinity to modernization shown in the past projects (those sponsored by USAID and the World Bank) is also realized in the proposed Model implemented in this Study. Whether they can radically change their concept or the can really understand environmental affairs around them have to be surveyed through this technical transfer.

Another objective of the Study is to provide a practical manual for both extension staff and villagers, summarizing useful data and findings obtained through the Pilot Study, so that they can utilize it for their works. There is a possibility that villagers at large can tackle environmental conservation for future welfare by making use of a full-illustrated manual. Such basic manual is currently very difficult for them to obtain, though many villagers want to make use of for improving their skills of vocation and life style.

Besides, creation of comprehensive partnership among related Ministries at regional and district level was sought for a smooth and efficient implementation of community vitalization and forestry activities, since inter-ministerial coordination must play a leading role to assist local population in such a multi-disciplinary trial. Commonly, extension staff of different expertise render their services individually without mutual liaison, however, local population require a series of simultaneous services ranging different fields. The proposed Pilot activities enable them to receive a set of concentrated, multidisciplinary services for three years.

Chapter 2 The Study Area

2.1 The Study Area

2.1.1 Location, Topography and Physiography

The Study Area is located at the north of Chileka International Airport, the location coordinates of which extends 15° 35'- 15° 43' S in latitude, 34° 58'- 35° 03' E in longitude, with the total surface area covering 40.08 km^2. It forms central part in the watershed of Lunzu River, the altitude of which ranges from 395 - 780 m above the sea level. Topography thereof has a typical feature of peripheral Chileka pineplane in the southern villages including K. Chigumula, Kateya, Kumponda, S. Mpombe, Kamwendo, D. Nbeza, M. Ngondo, T. Kenji, Kammata and Chilangali, with flat, not much dissected remnant plain where two dams, Ntenjela and Milala are located. Northern part is located on a terrain with a remnant hill of Chilangoma, where Chikoja, Teula, Manjelo, P. Bilila, Lemu, Kumand , Ndemanje and Maluwa Villages are located. Hilly and undulating area beyond Chilangoma Hill covers Nanjiwa, Mdala, Kaumbata, Makonokaya, Siyamudima and Chakana villages.

Two major streams run along the eastern edge and western border of the Study Area. Lunzu River (catment area: 327.2 km^2, length: 49.3 km, mean streambed gradient 1/75) flows eastern border of Makanokaya, Siyamudima, Kaumbata, Kamwendo, Ndemanje, Maluwa and S.Mpombe villages, supplying perennial surface flow to these villages. Nkkokozdi River, largest tributary of Lunzu River (catchment area: 72.7 km^2, length: 17.6 km, mean stream-bed gradient 1/125) flows along western border of Makonokaya, Kaumbata, Manjelo, Teula and Chakana villages and along eastern border of Mdala and Nanjiwa villages, also supplying perennial surface flow to these ones. Other villages are not faced to major streams, but some small tributaries like Ntenjela, Nasonje, Namilango and Milala rivers that tend to deplete surface flow during late dry season, hence villagers in these villages have difficulty of procuring daily water during dry season.

2.1.2 Geology and Pedology

Mountains and hills surrounding Chileka peneplain had been formed in Cretaceous age, while the peneplain itself was leveled in mid-Tertiary age. The basement rocks under these mountains and remnant hills consist of country gneiss-granulite (metamorphic / metasomatic rocks observed in the stream bed of Shire River) covered by perthosites (alkaline), perthite-gneiss and granite striped with basic orthogneisses (acidic), accompanying with charnockitic granulite. The latter is found also in Mount Ndilande laying south of the Study Area, while calc-silicate granulites are most abundantly distributed in the south - eastern part. These acidic rocks have derived coarse sandy soils (Entisols, psamment) developed in the center to north of the Study Area, infertile due to lack of humus, whereas Lateritic soils (Oxisols, fragiustox) widely covers Chileka peneplain. Stripes of alkaline rocks such as perthosite and tonalite (acidic~alkaline) and also limestone intervene acidic base rocks that have been weathered into relatively fertile soils found in the southern half of the Study Area.

Soil physical property, i.e., content of capillary pores has close bearing to the survival rates of out-planted seedlings. Entisols with coarser textures mainly distributed in the northern part have less capillary pores, hence showing lower water retentive capacity than Oxisols and Vertisols distributed in southern part. The former has very low level of phreatic surface, whereas the former has comparatively higher groundwater surface because Chileka peneplain acts as an underground reservoir during dry season. Apart from this swampy structure of Chileka, Milala Dam has similar hydrological function to the peneplain, where fertile soils are distributed along stream banks of Milala River.

2.1.3 Meteorology and Climate

There has been a consistent declining trend in annual rainfall in the Study Area for these two decades, evidently leading to accelerated desertification to semi-arid zone. Level of annual precipitation has decreased from 700 - 800mm in early 1990s to 500 - 600mm in 2000s. The basic reason stems from global greenhouse effect, but topographic condition also contributes to the lower precipitation prevailing therein. The Study Area is located in a concave pocket surrounded by hills and mountains where rain-clouds stay hanging and precipitating. Therefore, annual rainfall in higher altitude receives higher annual rainfall by 70~80% than lowland. Lunzu River has a part of watershed in this mountainous area sustaining basic perennial flow. Precisely, annual rainfall pattern in southern Malawi follows a bimodal with major season falling on November to April and minor one from July to September. Albeit, actual precipitation has not been recorded in the Study Area during minor season though large hills and mountainous area often receive foggy showers called "chiperoni". As to monthly precipitation, January seems to receive most stable rain.

General character of rainfall is observed as site specificity on account of orogenic nature, because rain falls only beneath strips of proceeding cloud. It often occurs that villages on a line receive enough rain but adjacent ones do not receive a drop, thus causing a wide diversity by village. Another outstanding climatic character is found in higher evaporation rate particularly in pre-rainy season. This gives detrimental effect to crops and seedlings susceptible to drought. Other meteorological factors include: annual lowest temperature recorded 13.4℃ (in July), annual highest temperature; 31.1(in January), lowest relative humidity; 51% (in September), highest relative humidity; 79% (in January) shortest sunshine hours; 6.6 hours (in January), longest sunshine hours; 9.2 hours (in September), highest monthly evaporation; 295mm (in September), lowest monthly evaporation; 141mm (in March), maximum wind velocity; 6.4m/sec (October) and minimum wind velocity; 3.8m/sec (January).

2.1.4 Flora and Fauna

Last decade was epoch-making period of accelerated vanishing of canopy cover. In the Baseline Survey conducted in 2002, surveyors also identified that biodiversity in the Study Area underwent a typical decline represented by vanishing of mopane forest dominated by *Colophospermum mopane*. Although quantitative canopy cover cannot be obtained from the result of the baseline survey, frequency of occurrence by tree specie in the villages of Study Area can be outlined. Mango tree, Eucalyptus (mostly *E.tetecornis* but also some *E.camaldulensis* and *E. grandis* are found) and Cassia are by far common throughout the Area. These are not indigenous but planted exotic species. Among these, mango is the most important tree for the villagers because it gives nourishing fruit during famine season. Eucalyptus suits land conditions in the Area, and villagers have experienced its out-planting through the projects sponsored by MASAF etc. Cassia, along with *Gmelina arborea* and neem tree (*Melia azaderach*), has tough proliferation and surviving power than other exotic species, acclimatizing themselves to drying climate with deeply reaching root systems.

All the exotic species ranked higher in the inventory list of transect records are tolerant to drought spell and show faster growth than others. Generally speaking, exotic species are by far more commonly observed in the Area than indigenous ones mainly because of vanishing natural Miombo forest during deforestation process and substitution of indigenous canopy with exotic ones planted later. Deforestation has been accelerated since 1980s through charcoal production for vending in urban consuming areas. Villagers fell trees that are suitable for charcoal production (for example *Brachystegia speciformis* and *Julbernardia spp.*) , while those that yield poor charcoal quality have left standing (such as *Adansonia digitata*, *steculia quinqueloba* and *Terminalia sericea*). Shrub trees that are hardly browsed by goats, such as agro-forestry

leguminous species including *Gliricidia sepium*, *Tephrosia vogelii* and *Senna (Cassia) spp.*, tend to survive, giving additional advantage to these fast growing species.

As regards indigenous species, *Terminalia sericea*, *Lonchocarpus capassa* and *Brachystegia spp.* are most frequently found, but their occurrence is mostly confined to hill-side shrubs and cemetery yards where villagers traditionally do not enter to fetch firewood because they believe animism. Only *Lonchocarpus capassa* is widely found in cropped field owing to vigorous proliferation and deep rooting. Indigenous species tend to be concentrated in northern part of the Area (in the villages of Mdala, Nanjiwa, Makonokaya, Siyamudima, and Kaumbata) presumably on account of sparse population density and relatively higher firewood availability. In densely populated southern part where many households have to buy firewood, they mostly survive in grave-yards after rampant collection of firewood and production of charcoal.

In common, growth of indigenous tree species is much slower than that of exotic ones, and this would lead to faster disappearance of indigenous canopy than that of planted or exotic one. particularly, hard wood species like *Terminalia sericea* (villagers use this timber for making mortar), *Pterocarpus angolensis* or *Kaya senegalensis & anthotheca* grow very slowly but their timber can be sold at dearer prices. *Terminalia sericea* and *Lonchocarpus capassa* bear abundant seed in younger age and this fosters higher survival rate than other indigenous species. Some indigenous tree species are useful for medicinal use because majority of villagers cannot afford to go to medical doctors and clinics even though they seriously suffer from diseases. Bark or leaves of *Afzelia quanzensis*, seed and bark of *Melia azadirach* are useful as free of charge herbal drugs for poor families.

As regards fauna, natural resources related most closely to villagers comprise inland fish, rodents like wild mice and hares, monkeys and insects like bees and ants because many tribes serve these as food. Population of these fauna has traced a declining trend in proportion to the decrease in suitable area of habitats as a result of expanding reclamation and housing. Villagers catch fish by angling in major streams and dams, where the demersal type species consists of catfish (*Clarias gariepinus*), cichlids (*Oreochromis shiranus, O. mossanbicus*) and cichlids mostly exotic tilapia (*Tilapia rendalli, Barbus trimaculatus, Barbus paludinosus).* Annual yield was estimated at a rate of 318 kg/ha/year, or about 1 ton/ year in this dam (with the catchment area of 210 ha only).

2.1.5 Social Features

The Study area is chosen according to the selection criteria of the Model area in the M/P, characterized as an averaged sample of population density, vegetative cover and topography among the watershed area of Lunzu – Nkokodzi Rivers. As of 2002, the Area had a population density of 250/km^2, about 2,930 households, arable land of 1,474ha (47% of the total Area, or 0.5ha per household), wood lot area of 0.14ha per household (including such unusable land as wasted or grave yards, out of which only a third can be used as a resource base). Average distance from the villages to market sites measures at 4.6km, implying considerable remoteness. The Area is characterized by meager water availability because mean number of tube-well counts only 0.83 per village and 450 villagers use a tube well. Road network within the Area is favorable with the access to the national highway, 4km from the center of the Area.

Administratively, 17 villages located in the central to the northern part of the Study Area belong to TA Kuntaja and 7 others located in the southern part to TA Kapeni. The Area constitutes a matriarchal society forming multi-tribal community where succession to a status and property has been done through matrilineal kindred, and matrimony is entered even among different tribes. Salient features of social dimension include relatively higher proportion of female population. This is partly attributable to immigrant labor power of male from villages to urban center and also to longer life expectancy of female family members. Recently, one parent or both of parents die leaving one or two children per household, leading to fewer family members

in a household (2.8 persons/ household) and rapid increase of orphans. Arable land per capita accounts for 0.2 ha from which 160 kg of maize grain is expected. Woodlot availability per household is estimated at 1,400 m^2, or 560 m^2 per capita, from which only 330 stands remain per person.

2.2 Environmental State of the Study Area

The Study area has experienced an explosive expansion of population during 1980s and 1990s, although now turning into a declining trend since late 1990s. It had abundant deposit of firewood at that time that sustained the expanded population through their own consumption and sale of charcoal. As an aftermath of accelerated wood consumption, the crown coverage of the Study Area dropped from over 20% to only 4% in the end of 20th century (Surrounding TAs, like TA Makata and TA Machinjili lost more forest to less than 2%). Villagers now have to pay 10~20 MK for buying routine firewood. Recently, prices of charcoal have been escalated from MK250 to MK450 per 50kg-bag. In the Study Area, where tree stands have become much more sparser than before, burning kilns of charcoal production for marketing to urban area have lately been witnessed in two villages, namely Nanjiwa and Chikoja. Only 113ha of forests remain in graveyards where villagers have traditionally refrained from fetching firewood.

After villagers fell wood to burn charcoal within their villages, they didn't replant any trees, partly because seedlings were not available or they cost too dear for them to buy, partly because they needed to expand maize field to offset eroding yield level. As no data is available as to former land use in the Study Area, there is no way other than deducing past development through the memory of elder villagers. During 1980s and 1990s arable land area in the Study Area increased by about 60% (from 25% to 40% of village area) according to the estimation of Blantyre RDP based on hearing of village cadres during workshops in 2002. It meant that area under wood-lots and natural forests shrank from about 30% to 15%.

The extension staff involved in the Pilot Study identified a number of limiting factors to restore the lost natural resources and deteriorated environmental structure, as listed below:

(1) Vicious circle of poverty - lack of inputs and techniques - no means of development,
(2) Shortage of land to plant trees, both village woodlots and private ones.
(3) Shortage of manpower to participate in participatory works to plant trees,
(4) Lack of background education, basic knowledge, experience and organization,
(5) Insufficiency of assistance by extension services, official aid arrangements,
(6) Difficulty in finding threshold of rehabilitation, leaders or initiative takers and
(7) Undermined villager's health, power and spirit affected by lingered food shortage.

According to this breakdown of land use as of 2002, arable land occupied 1,474ha (accounting for 47%), forest/ woodlot and natural shrubs 515ha (16%), out of which woodlots available for fetching firewood accounts for 170ha (5%), homestead 406ha (13%), wasted land 308ha (10%), other land 262ha (8%) including graveyard 113ha and irrigated garden 49ha (1%). Wasted land is currently under fallow, earth borrowing area of brick production and idle land owned by absentee landholders.20 households rely on 1 hectare of viable woodlot against the optimum rate of 6 - 7 household per hectare.

Poor canopy coverage has fostered soil loss and erosion along farm paths and unpaved roads, (often occurring on coarse textured soils) sometimes reaching as deep as 2-3m below the ground surface. Since livestock density has been kept low on account of frequent robbery by foreign invaders happened during the past decades, environmental damages by overstocking could have been avoided. Nevertheless, loss of desirable soil structure and plant nutrients has been lost

since denudation of surface vegetative cover has started, eventually affecting agricultural and livestock productivity.

2.3 Baseline Survey and Results of Workshops by PIU

Baseline survey was conducted at the initial stage of the Pilot Study through a subcontract to an NGO. It was carried out in workshops held in each of target villages where villagers were invited and facilitators led them to a discussion on daily life in the village, where extraction and identifications of constraints, issues and problems, their inter-relationships, vicious circles, social structure, characters of gender issues, villager's and their groups' activities were made. The obtained results were analyzed village-wise, and the base of village data was created so that they could be compared with later results obtained each year from Pilot activities. In parallel with the Baseline Survey, PIU staff carried out introductory workshops where villagers in a target village were called to involve in a consultation with PIU on what components were applied to, how they were implemented and what concept and understanding they kept in mind as to village environment and resource conservation.

In social aspects, villagers belong to a matriarchal society where marked division of works has traditionally been kept with biased role inclined to women. In this society, women are more robust than men and willingly take part in various activities. They have longer life expectancy than that of male household members. Also, women constitute major elderly household member. Throughout the survey, villager's lack of quantitative concept impeded precise grasp of what were aimed at, because no measuring tape, no balance, no watch or no calendar is available in the villages. Consequently, quantitative or time sequential comparison could not be made between two periods, i.e., before the implementation of Pilot Study and thereafter.

As social dimension among the major results of the survey, borehole, health and school committees consist of major community activities to which villagers attach importance, followed by security, assistance for orphans and forestry. Committees have been established by activity, where villagers' activities for the sector are planned and implemented. The members have provided by-laws, collected maintenance levies, periodically reported routine results and others, but some of the committees have nominally remained, not necessarily functioned as initially expected. In some cases, they have failed to solve or cope with the issues and problems posed to the committees. Here, leadership of the village chiefs and cadres has influence on their activities and functions of the committees (usually 3-4 committees have been established per village), and the difference of governance among villages has led to differentiation in the state of organizational activities.

The results have shown rare visit of extension staff to the Study Area. This is attributable to lack of means of transport to their service area. However, if assigned staff lives near the village, he/she can visit frequently. If some merits, for example chance to acquire loans for the extension staff himself/herself, he/she will visit the villages. Usually, an assigned staff should cover a lot of villages by bicycle, hence his/her visiting frequency is affected by distance from residence. Among various extension services, agricultural services have the highest evaluation by the villagers, followed by health. Forestry extension was negatively assessed perhaps on account of rare visit to the villages and most villagers did not make acquaintance with staff in charge of home husbandry due presumably to low attendance to the villages by the staff living in urban areas.

Villagers have indicated problems as tabulated in Table 2-1 except for diseases. They have caused their community such constraints as decline in labor force, erosion of active willingness to make improvement, eventually entailing in aggravation of living environment. Though villagers have encountered these problems during the implementation of the Pilot Study, PIU has made efforts to mitigate these as far as possible.

Table 2-1 Principal Problems Encountered by the Villages (except diseases)

Problem	famine	theft damages*	prostitution	wood destruction
Number of villages	20	18	8	15
% of 24 villages	83%	67%	33%	62%
Negative effect arisen from problem	decline of labor productivity	hampered willing-ness of creation	deficiency of immunization	exacerbation of living environment

note: criminals are mostly inhabitants living outside of the damaged villages

The problems faced in rehabilitating environment and villager's proposal to cope therewith in the Baseline Surveys were summarized as:

1) Vicious circle of poverty has trapped the villagers in an endless ring, poverty~ lack of inputs and techniques~ no means of development~ impoverishment. Therefore, an injection of inputs can give them to get rid of the circle. However, they do not know how to sustain the proper and efficient use of inputs so that only one chance of receiving them can yield benefit to maintain production cycle. It follows that technical transfer accompanying with the input supply is indispensable.

2) Shortage of land to plant trees for both village woodlots and private lots poses a difficulty in developing forestry activities. It is necessary for the villagers to create their private woodlots near their houses, otherwise frequent poaching damages by invaders would end up their efforts of planting trees in vain. To realize this, it is no other way than, planting trees within their reach of vigilance, i.e., living quarters and homestead.

3) Shortage of manpower to participate in participatory works to plant trees would pose another noxious issue as observed in small villages where orphanage households account for fairly large portion. Elderly people are not suitable to involve in heavy works for raising seedlings and out-planting them on wasted land and other hard ground. To cope with this issue, as many women as possible are to be mobilized in the works.

4) Lack of background knowledge, experience and organization also act as hazard in developing new activities in traditionally closed communities. In most villages, no one has sense of improving life, environment and society. Without relevant sensitisation or enlightenment villagers feel difficulty in comprehending what extension staff or facilitators explain to them on the environmental issues and countermeasures.

5) Insufficiency of assistance by extension services, official aid arrangements for helping villagers to take actions for something new may inhibit development of villager's will to tackle a new trial in their villages. Rural society without outer communication due to remoteness often fails to receive projects and other chances of income generation.

6) Difficulty in finding threshold of rehabilitation, lack of leaders or initiative takers to lead and mobilize villagers into restoring works may also retard implementation of environment conservation.

7) Undermined villager's health, power and spirit by lingered malnutrition attenuate resolution of their actions to rehabilitate or conserve living environment, even if they intended so. In particular, ephemeral life of rural inhabitants fosters inertia, reluctance or rejection to struggle with far-reaching activities like forestry, land conservation and watershed rehabilitation. Food security and nutritional amelioration are essential preconditions for villagers to evoke their intention to be engaged in conservation works for their own sake.

As to firewood availability, the whole Study Area has already been suffering from firewood scarcity to the extent that 40% has failed to supply within the village though 45% can meet village demand. Villagers have to travel about 2km taking 3 hours to fetch firewood a few times

a week. About 60% uses primitive, three stone type fireplace for cooking. The observed changes in firewood supply has brought about since a few years back because villagers admitted that firewood trees were enough to supply firewood in 1990s. Villagers have to sell firewood amidst acute shortage to sustain their families and those in three fourths of the villages actually sell firewood (some even charcoal), and they fear dwindling depletion of firewood resources within their reach.

2.4 Summary of Inventory Survey

Inventory survey was conducted in 2002 on a subcontract basis to use as a reference of formulating Pilot components and planning management of established component activities. The survey covers major projects so far implemented in Malawi with similar objectives on environmental observation to what is aimed by the Study, including 9 cases of environmental observation such as forestry, 1 case of resource saving and 9 cases of income generating activities. In this survey, a subcontractor has prepared outlines and briefs of these on-going activities through the site survey and summarized them in a report. The Study Team made use of the report in selecting the sites of study tours for villagers, in collecting data and information concerned to provide IGAs, in procuring material and basic inputs for use in the Pilot activities.

Chapter 3 The Model and Contents of the Pilot Study

3.1 Implementation Agencies and Relevant Government Organizations

The government agencies in charge of the Pilot Study are:

1) Department of Forestry, under Ministry of Mines, Natural Resources and Environment (MMNRE),
2) Department of Land Resources Conservation, under Ministry of Agriculture (MOA), and
3) Department of Community Services, under Ministry of Gender, Youth and Community Services (MGYCS)

These central official agencies have established the Supervisory Board (SB) of the Pilot Study where meetings have been held to supervise the Steering Committee (SC), to coordinate among the related agencies and institutions, and to negotiate the foreign related agencies. The SC consists of the following three agencies under the above ministries at regional and district level in order to supervise, advise, support and monitor the activities of PIU:

1) Regional Forestry Office South (RFO (S))and Blantyre District Forestry Office (DFO), under MMNRE),
2) Land Husbandry Division and Blantyre Rural Development Project (RDP) of Agricultural Development Division (ADD) South, under MOA), and
3) Regional Community Services Office (RCSO) South and Blantyre District Community Services Office (DCSO), under MGYCS

PIU (Project Implementing Unit), the executing organ of the Pilot Study, consists of extension staff from the above three regional and district offices. PIU, SC and SB also include advisable expertise staff belonging to an environmental NGO. It comprises a chief (principal forestry officer), four forestry extension staffs, five agricultural extension staffs, two gender extension staffs and three (four in 2002) NGO staffs. These fifteen (sixteen in 2002) regular members have been grouped into three teams (Group P, Q and R), and each group visits eight fixed villages grouped as their service areas. A team is composed of one or two forestry extension staff, one or two agricultural extension staff, one (circulating) gender staff and one NGO staff. Each team has demonstrated, trained and instructed villagers on various forestry, agro-forestry (AF) and Income Generating Activities (IGAs) planned therein. It visited activity spots in eight jurisdictional villages three to six times a week, mostly in the morning, where villagers are engaged in participatory activities such as nursery works and IGAs. A team can visit three to four villages a day, that is to say, it visits a village at least twice a week. Once in a week or in two weeks, PIU has held regular meetings where results of activities achieved in the preceding week has been reported from each team and plan or measures for later weeks have been discussed.

3.2 Target Villages and Villagers' Organizations

Out of 24 target villages, 4 villages (Mdala, Lemu, Kammata and Kumponda) are functioning as group villages, and other 19 belong to these four, but one (Chakana) is under Kuntaja, or village of TA. In all the target 24 villages, there have nominally been Village Development Committees (VDCs), but they had actually been dormant without any particular activity. PIU advised to establish nursery committee and component wise IGA committees in these villages. Based on this advice, all the villages have established these committees though written by-laws have not yet mostly provided for these newly established ones due mainly to prevalent illiteracy. These committees convene regular or casual meetings to discuss action plans, to review results, to propose and decide future schedules, burden/benefit sharing, to evaluate results of activities, to

communicate with stakeholders and to supervise performances of the activities. So far as participatory approach is concerned, attendance of the participants to field works determines the outcome of implementation, where such characters of village chiefs and committee members as their prudence, activeness, administrative and coordinating capacity influence participation and participant's willingness/motivation to work, solidarity and performance.

Village Natural Resources Management Committee (VNRMC) must be established in every village, according to acts related to Natural Resources Conservation, though few of existing rural communities so far have established this legal organization. Such inertness in rural society might have stemmed partly from traditional governance system with multi-ethnic composition in rural population, partly from lack of chance to get acquainted with gazetted ordinances. Since it's evident that proper management of village natural resources leads to both public and private benefits in the long run, it is possible to attract villagers, by appealing benefits of managing available resources, so that they can join management activities, sharing benefits and duties of public management. It is essential to make a rigid framework to guarantee the participants in resource management with equitable sharing of current and future use of managed resources, where equal share of norm and fruit of work plays key role to satisfy all the participants with the participatory activities. As to what activities the villagers should be engaged in and what level of targets they should set under the participatory actions, the village organizations responsible for participatory activities must decide them within the available alternatives or inputs, making full use of guidance and instructions given from assistants. Through the envisaged process of the Pilot Model, PIU determined technical and substantial assistance based on their decisions for efficient implementation of the planned approach.

Each committee has a chairman, a vice-chairman, secretary and vice-secretary, treasurer and vice-treasurer and other members. Villagers have been mobilized into participatory activities led through leadership of village chiefs / cadres and attendants are eligible to become potential beneficiary of fruit of the participated activities.

3.3 Structure and Functions of the Verified Village Natural Resources Management Model

3.3.1 Concept of the Village Natural Resources Management Model

The Study Area has various constraints in carrying out adequate management of natural resources. In particular, recent erratic climate conditions got many villagers into self-insufficiency of daily foods and, in turn, chronic famine severely deteriorated villagers' physical strengths. As it will take around seven years, equivalent to 20% of their life expectancy, to acquire benefits from the planted trees that constitute major part of village resources, it is not easy for them to endure until they get profits from their participatory efforts if forestry alone is proposed to them. Managing works for natural resources in their villages require not merely one year but also many years of consistent rehabilitating in proportion to the degree of degradation that should continuously be sustained by mobilizing majority of village population. Because participants in resource management cannot expend their energy and time only awaiting benefits expected from rehabilitated resources in the future, it is imperative to procure any means of livelihood sustenance making use of currently available village natural resources, in addition to the conservation and management works for them, so that the latter works can long been sustained. Simultaneously, measures for securing crop production are indispensable for getting rid of chronic hunger. To this end, AF must be adopted along with provision of tree seedlings in nurseries to utilize it as an incentive similar to IGAs.

As stated above, IGAs are supposed to bring following effects.

1) They secure alternative cash income of the presently widespread income source,

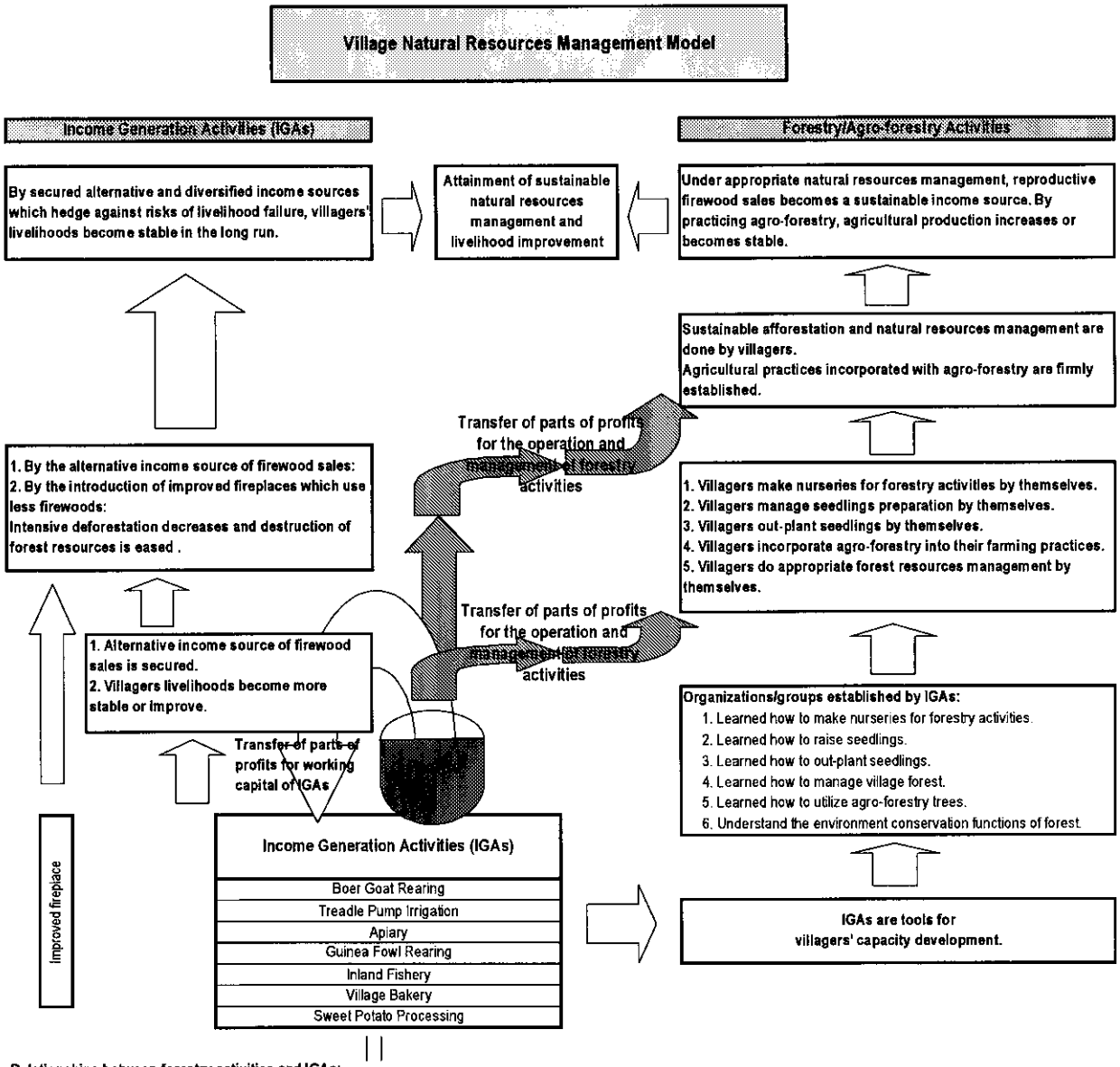
firewood sales.

2) The villagers' groups are being organized and strengthened in the course of various IGAs.

3) They secure desirable operation and maintenance of forestry activities if profits of IGAs are obtained for improving their ration.

Figure 3-1below shows the model of VNRMP with implemented components in this pilot study.

Figure 3-1 Concepte of the Village Natural Resources Management Model



Relationships between forestry activities and IGAs:

IGAs	Year Started	Relationships between forestry activities and IGAs
Boer Goat Rearing	2002	Goats eat many tree leaves in a dry season and these feeding trees are introduced.
Treadle Pump Irrigation	2002	To have enough irrigation water, function of rainwater retention of forest is dispensable.
Apiary	2002	Trees are necessary to put beehives and as sources of nectar.
Guinea Fowl Rearing	2002	Forest provides various kinds of feeds such as insects and tree leaves. (Originally, they live in the forest.)
Inland Fishery	2003	Without forests in the upstream of ponds, sediment flows into the ponds and habitat of fishes deteriorates.
Village Bakery	2003	Because firewoods are necessary to bake breads, villagers recognize the importance of firewoods supply.
Sweet Potato Processing	2003	Because firewoods are necessary to steam sweet potatoes, villagers recognize the importance of firewoods supply.
Improved fireplace	2002	Less firewoods are used and ashes can be applied in the nurseries.

Understandings of the Present State	Forest resources are deteriorating because of expanding farmlands and gathering firewoods from forests. => Rainwater retention function of soils is deteriorating. => Water conservation function of forest is deteriorating. Annual food production is not enough for villagers' livelihoods. => Villagers need to earn money to buy foods. => Villagers collect firewoods from the forests and sell them. Primarily, cash income is indispensable for villagers' daily lives. => Villagers collect firewoods from the forests and sell them. => As a result, forest resources diminish except for graveyards and self-sufficiency of firewoods collapse.

3.3.2 The Framework of the Pilot Study

(1) Forestry and Agro-forestry Activities

As the target villages consist of many scattered households, it requires enormous administrative efforts and budgetary resources to encompass and mobilize all of them. To cope therewith, it has been decided to establish a village nursery (size; 10m x 10m) in each target village as a base of development, to accommodate around 20 households as participants to raise as much seedlings as to offset their annual consumption of firewood in to maintain sustainable supply. The capacity of seedling production in this size of nursery holds at most 5,000 per year, or 200 seedlings envisaged to out-plant per participant, though the number seems too many for a participant suffering from hunger during planting season. To make the planting activity as sustainable as for 6 years to plant enough seedlings that can compensate for forest destruction rate by firewood exploitation, the PIU considered necessary to couple the forestry works with IGAs that can maintain incentives and energy required for additional works incurred by free of wage based Pilot works. Though villagers initially expected in the workshops to benefit from wage labor or food for work, PIU managed to convince them to join proposed participatory works without wage or food, instead, with inputs for IGA.

Then, the sites for creating village and private woodlots were sought and PIU identified them through transects after holding workshops. It identified that most land within target villages had already been allocated to individual households, where public land available for village forests remained only as much as 7ha per village, or 170ha in total. As an estimation as of 2002 for future fire-wood requirement, it was calculated that afforestation of 211ha was needed to meet the requirement of current population in addition to currently available remaining woodlots equivalent to 138ha, implying that it should be met with homestead planting, use of pulled-out residue of regenerated AF plots along with the supply from presently available woodlots. For this purpose, PIU decided to recommend the villagers to plant on individual farmland, homestead and roadside along with village forests. It takes 9 years to complete the proposed planting with the above mentioned pace.

Table 3-1 Estimated Area Requirement to Sustain Firewood Demand

Demand firewood Total (m^3)	Supply by wood (m^3)	Supply by residues (m^3)	Supply by agro-forestry (m^3)	Required firewood area (ha)	Existing woodlot (ha)	Actual required woodlot (ha)
4,669	1,379	1,737	1,552	349	138	211

Therefore, in order to fulfill the requirement of self-sufficiency it is necessary to increase initial estimation by PIU on both planting number and participants by 50%. This calculation assumes the whole supply for the entire households by the work of only 20 households per village, and if all of them (140 households per village) can be mobilized in turn, the labor can reasonably be shared equally among them.

PIU members suggested mild target from the standpoint of villagers' physical capacity, because tree planting should be done during peak of farming season. A villager can dig 30 to 40 pits per month, even during hunger period for three months during rainy season, where 40 - 50 villagers per village should be participated. It comes to around 13 years, even taking survival rate into account, to cover the area required for self-sufficiency.

(2) Income Generating Activities (IGAs)

Participatory activity can be sustained only by the voluntary will of participants. Whereas, majority of the participants in forestry practices suffers from hunger during peak forestry season.

This is why health of the participants is duly regarded, where compensatory means of acquiring alternative incentive for forestry practices including raising seedlings and planting and tending them are needed Also, it is needed to disperse labor peaks in a way that afforestation is carried out during peak cropping (or rainy) season while IGAs have their peak period in dry season. Owing to PIU's incessant efforts to make villagers realize basic concept of environmental care, including exigency of reforestation, they have become aware of the fact that farming, forestry and IGAs will altogether bring benefits to them.

In the Pilot Study, the villagers themselves have selected the most suitable IGA based on the proposal and they have seriously been engaged therein, though it takes time to achieve substantial gain. As the IGA distributed in 2002 could not cover all the participants to forestry activity, in 2003 another or the same IGA was given to each village so that all the forestry participants can receive at least one IGA. The most important factor to be regarded in choosing them constitutes seasonality and availability of resources. Taking account thereof, four major components have been chosen to meet the requirement to avoid overlapping of peak season of an IGA with that falling on farming and forestry activities and to efficiently utilize village resources.

3.3.3 The Verified Village Natural Resources Management Model

Based on the above-mentioned framework, PIU established the following Model.

(1) Details of Village Natural Resources Management Model

A. Principles of the Model

- Make participants viable so that they can create forest and rehabilitate environment
- Use available resources within the village to develop sustainable /viable IGAs
- Secure the benefit of both IGAs for the participants of nursery/out-planting
- Combine forestry activities and IGAs based on the resource availability
- Utilize location advantage for promoting IGAs

B. Relationships between Forestry Activities and IGAs

In order to make the combination of forestry and IGAs fully sustainable, it is essential to select relevant component of IGAs taking account of the following interrelationships:

- Goats eat many tree leaves in a dry season and these feeding trees are introduced. Droppings are useful as manure for tree seedlings.
- To have enough irrigation water, function of rainwater retention of forest is dispensable. Irrigation works can be done simultaneously to both of tree nursery and irrigation filed
- Trees are necessary to put beehives and as sources of nectar.
- Forest provides various kinds of feeds such as insects and tree leaves. (Originally, they live in the forest.)
- Without forests in the upstream of ponds, sediment flows into the ponds and habitat of fishes deteriorates.
- Because firewood is necessary to bake breads and process sweet potato, villagers recognize the importance of firewood supply
- Use of improved fireplace leads to less consumption of firewood where ashes can be applied in the nurseries.

C. Process of selecting IGAs

- Collection of basic data on availability of village natural resources, needs of villagers and conditions of locality,
- Preview of the collected data at committee meeting/ workshops with PIU,
- Preparation of short list comprising a few components of suitable IGAs and provision of advice for selection and
- Final selection of IGAs in consultation with PIU staffs

(2) Establishment of sub-committees for managing activities

PIU recommended to establish management sub-committees in addition to the existing ones in order to manage inputs for IGAs, so that the planned IGA activities could be distributed to the participants of forestry activities through the established ones.

(3) Items to be verified in terms of IGAs

As regards function of the Pilot Model, the following items were chosen to verify its functions.

1. Utility and effect of the Model on environmental conservation
   (1) Extent of villager's comprehension of environmental conservation
   (2) Extent of fulfillment against the targets for the rehabilitation of village resources
   (3) Possibility of extending forestry coupled with IGAs
   (4) Effects of extension activities on villager's enlightenment and capacity building
   (5) Sustainability of participatory approach on forestry and AF
2. Efforts of the participating villagers oriented to the implementation of the proposed Model and actual benefits obtained therefrom.

3.4 Supply of Inputs for the Pilot Study Activities

Inputs for implementing the Model consist of extension services and material supply as initial and additional procurement. Both extension services and material supply have equally been applied to all the target villages. At first, PIU planned to allocate IGAs to the target villages according to the extent of efforts and management of each target village towards forestry and AF activities, but their performances were too comparable to identify any differentiation. Inputs for IGAs were also evenly distributed among villages, for if PIU dared to do discriminatory input supply to the villages, the differential treatment would have threatened the created harmony among the target villages. The quantity of inputs for the same component of the second IGA to be distributed per village was determined at PIU meetings at even rate without introducing any difference among villages. Although some differentiation had been observed on the efforts for forestry and AF activities, PIU could not distinguish whether it had been attributable to the difference of villagers' efforts or to the difference of instructing methods. This was the reason why the inputs for the second IGA were equally delivered to the villages that were engaged in the same IGA components. However, as to the additional supply of inputs for forestry and AF in 2004/05, differential distribution was made according to the efforts and attitudes towards forestry and AF practices, because the reasons of differentiation among them were evidently verified, giving more material and implements to those who expanded the scale of forestry performance as compared to those who did not pay particular efforts thereon.

Table 3-2 Annual Input Supply to 24 Target Villages

Inputs	supply in 2002/03	supply in 2003/04	supply in 2004/05	number of users
Forestry/AF	240 sets	240 sets	120 sets	1,089
IGAs	24 sets	24 sets	-	1,358
Extension services	16 staffs	15 staffs	15 staffs	1,358

The same quantities of inputs for forestry and AF, 10 sets per village were supplied to all the target villages regardless of their population, but they were shared for use because more than 20 participants per village participated in nursery and out-planting works.

The supplied inputs have properly been used and managed by the committees responsible for the activities, creating storerooms by village where inputs were locked up for storage after use. They have been well kept though minor cases of theft have taken place. Even though some cases of misuse of the supplied inputs had happened, they have been rectified to bring overall satisfaction by the efforts of PIU staffs and inter-location monitoring by related villagers.

3.5 Contents, Methodology and Processes of the Pilot Study Activities

3.5.1 Contents and Methodology of the Pilot Study Activities

In this study, major task of the Study Team has been placed on how the proposed model functions to develop rational use and conservation of village resources in line with the principles of VNRMP (Village Natural Resource Management Plan). The sustainability can be judged from the attitude of the villagers towards participatory activities and basic understanding on the exigency of taking actions for better conservation of their living environment. Final goal has been set at villager's voluntary and willing actions dedicated to environmental conservation evolved from deep concern on the deterioration of current resources in their villages. Villagers have already observed, recognized progressive depletion of perennial flow in the streams or of water yield in borehole-wells they rely on. They feel difficulty in fetching not only water but also daily needed firewood and even grass for thatching and mat weaving. However, the largest issue still lies in food security and all their efforts are obliged to get concentrated on food procurement and day-to-day earning.

Table 3.3 Indictors of Achievement to Judge Efficiency of the Proposed Model

Activities/ indicators	Participation	Participation	Products	Benefits	Constraints	Sustainability
Nursery	work days	participants	seedlings	planting rate	remoteness	activeness
Out – Planting	work days	participants	seedlings	survival rate	land scarcity	tending
IGAs	work days	participants	gain from inputs	shared gain	theft/diseases	management
PIU services	work days	attendance	awareness	Empowerment	traditions	office budget
Supporting Agencies	meetings	attendance	experience	useful data	mobility	will of support

In addition to this issue, villagers have not yet obtained the knowledge of tree-planting, because they haven't any experiences to plant trees and to be learned how to make the nursery. Another issue has arisen from shorter life expectancy by HIV. Concern for implementing environmental conservation should be oriented to a worry that aged and infantry strata should play major role of implementers. Under such circumstances, the Study Team tried to verify the items in Table 3.4 within the given three-year term. Actual achievement has so far been recorded for two consecutive years, but as to the third year, the activities have covered only a half of the planned schedule.

During the process of applying the model to the target villages, PIU collected data from time to time listed in the above table and feed back to the villages in the form of advice, rectifying help, input supply and technical instructions / demonstrations. In the numerical analysis in Chapter 4, these indicators are employed to find out what interactions govern the outcome of applying the model.

3.5.2 Processes of the Pilot Study Activities

Since a village has 127 households and 452 villagers on average, it's very difficult to involve all households into a participatory activity within the given budget. So, the proposed model covers

implementing the Pilot Study. Actually, attendants to the workshops in a village seldom exceed 30 because many villagers who don't belong to chief's clan have not been engaged in past group activities and they actually live remote from the village center. The involvement of village chief is essential from security of inputs, mobilization of potential participants, and sustainability points of view. Image of the verifying Model was explained in the workshops held in each of the target villages where chiefs and most VDC members attended.

At the same time, PIU helped villagers organize committees for the receptor of the Model, Pilot Activities. All the target villages accepted to join the proposed activities because IGAs were promised to follow forestry activities. Otherwise, most villagers seemed reluctant to be involved in mere forestry activities without wage payment, because hitherto most of assistance project had been carried out on wage payment basis. Villagers have rarely had experiences of purchasing seedlings and of planting them around their homestead, and this means that they were not fully aware of necessity to plant trees. However, raising seedlings and planting works fall on just hunger season and many villagers feel difficulty in the mere involvement in forestry works that incur loss of physical energy and necessity of learning technology.

Therefore, PIU staff promised villagers to couple forestry works with IGAs together with the technology transfer, so that participants in forestry activities were guaranteed to gain benefits from IGAs. PIU sought for sustainable IGAs in the target villages and reached a conclusion that they should be based on currently available resources in the villages. PIU concluded that giving to a village only one component of IGAs each was not enough to keep the participants in full participation, because scale of input supply was very much limited. It also concerned for sustainability of recurrent management if IGAs that were completely dependent on the material supplied from outside that the villagers had learned in the study tour to a poly-techniques center. PIU finally decided to introduce only four resource-based IGAs in the first year and proposed to the target villages. PIU reviewed all the requests from target villages and finally recommended a few components per village based on resource availability assessment and past experiences. After ample adjustment debates, requested first priority component was finally agreed on with all the target villages as the best-suited IGA component to the village from the standpoint of resource availability. Thus, the actual activities based on the Model started in each village. PIU chose only four components to apply to the target villages judging from the base of available resources therein and gave priority according to the degree of abundance or availability of resource items, and suggested it to the village committee so that they discussed and finally agreed. Almost all the villages followed the suggestion by PIU.

It also suggested the same components as the second IGAs in 2003 to the target villages letting them to choose by themselves. In addition to the conventional four components, PIU decided to introduce home bakery into a village, inland fishery to three villages surrounding Milala Dam and sweet potato processing accompanied with distribution of vine cuttings to all the villages with a view to making efficient use of resources and demand for inhabitants. Because Boer goat rearing had been successful with favorable reproduction of offspring, most villages requested to employ it as the second IGA. Thus, 75% of the target villages employed it since there was ample room for grass resource to accept herds, there was no concern for marketing unlike vegetables, and initial expense of rearing was negligible. In the management of herds of goats, the employed villages could select two different ways, one was pooled system and another was individually divided one. The former follows pooled rearing in a hut by group members, makes pooled benefit (each member can receive primary offspring as his/her property, then giving an offspring back to the pooled herd when it's born from the stock he/she received) to be distributed equally to the participants, but the latter allows individual members to rear a stock distributed to him/her, thus pursuing individual benefit. PIU admitted that the former was more desirable to keep the participants in forestry activities, because those who failed in IGA tend to

drop out. Since goat can develop 3 generations within 2 years, very little failure arises only if theft damage does not take place and enough grass is available in the villages.

3.6 Contents and Methods of Technical Transfer

There have been many occasions of technical transfer from The Study Team to PIU staff, and PIU to villagers though various measures. Technical transfer is made through material, input supply and also through real management of launched activities without particular need of substantial supply. In particular, demonstration provides effective means in transferring techniques to the targeted villagers, though ample time with repeated displays is required until all the stakeholders enough acquire what is transferred to them. PIU staffs have made use of the compiled illustrative manual for their instructions to disseminate standardized contents of skills/ techniques, thereby enabling villagers to repeatedly master them regardless of instructors' habits, contributing to the improved performances of forestry and IGAs.

Transfer can be made in many opportunities including workshops, committee meetings, study tours, demonstrations and work sites where use, management and maintenance of supplied inputs and material, farming and rotation systems, seedling rearing, seed collection, nursery establishment and management, AF practices, installment of improved fireplace, arrangement of water sources, soil conservation, general surveys, managerial techniques of accounting, marketing, livestock hygiene, reproduction and rearing, leadership training, organization management, food processing and storage etc. can be transferred. Very limited technical transfer has been made from the Study Team, adapting original Japanese skills to local conditions such as use of indented or blade sickles and sharpening with whetstone, measurement of soil physico-chemical properties, provision of fermenting manure, and preparation of illustrative manual. As for rearing techniques of honeybees, fowls and goats, transfer was subcontracted to local experts belonging to NGOs.

In addition to the above, three PIU members at the beginning of 2003 and five others in 2004 were dispatched for one month respectively to Kenya Forestry Research Institute (KEFRI) in Kenya for third country training in order to obtain the advanced knowledge and technologies.

Chapter 4 The Result, Analysis and Evaluation of the Pilot Study

4.1 The Survey on Forestry/ Agro-forestry and the Result

In 2002/03 the villagers raised seedlings and planted 223 thousand of them on village woodlots and roadside, riverbanks, homestead and existing crop field. 49% of the seedlings were *A. albida* followed by an agroforestry specie, *G. sepium* accounting for 28% and fast growing exotic tree, *E. grandis* for 13% , and 9 other minor species. Out of which, 128 thousand have been survived as of 2004, including *A. albida* (56%), *G. sepium* (65%), *E. grandis* (43%). *Senna spectabilis* and *Malia azadirach* recorded the highest survival rate, around 90% in spite of heavy drought. A half of the out-planted species comprised those suitable for AF (*G. sepium, L. capassa, A. albida, Tephrosia vogelii, L. leucocephala* and *S .sesban*), but some of these were planted on the border of farm plots, along farm paths and homestead.

In 2003/04, villagers filled seedling pots as much as 70% of the previous year's performance, partly because seed availability was less than the previous year level and villagers had been fatigued by lingered famine. Severe drought with only 550mm of annual rainfall gave fatal damage to the growth of nursery seedlings that allowed only 62% (113 thousand) of the germinated pot-tubes. However, timely out-planting concentrated on early - mid January (most precipitation occurred during this period in 2004) luckily rescued planted seedlings from drought damage, allowing viability of 80.1%. However, survival rate was lower in the northern part of the Study Area where Oxisols dominated on which root-pruned ones were scorched away. Higher survival was obtained for *G. sepium* (37 thousand), *E. camaldulensis* (13 thousand), *A. albida* (11 thousand), *Senna siamea* and *E, grandis* (10 thousand each).

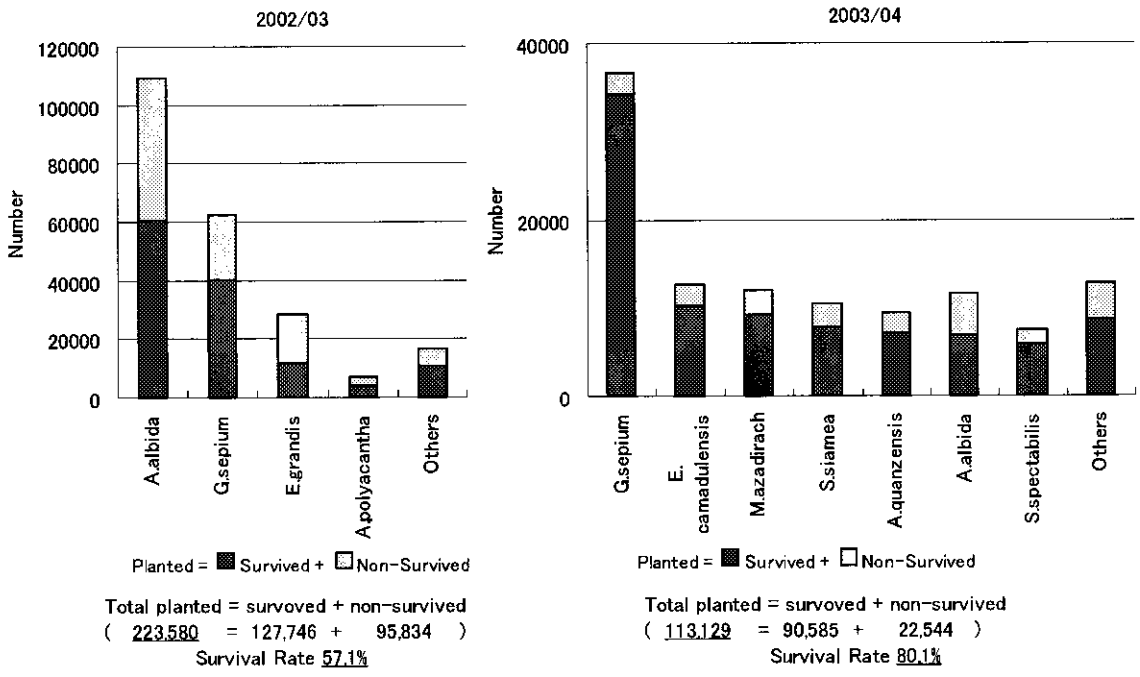


Figure 4-1 Survival Number of Major Tree Species

Table 4-1 Relation between Survival Rate of Wood-lot Out-planting and Monthly Rainfall

2002~2004	Dec.02	Jan.03	Feb. 03	Mar. 03	Apr. 03	Dec. 03	Jan. 04	Feb. 04	Mar. 04	Apr. 04	Correlation coefficient	
mm	111	184	149	215	1	46	300	47	107	73	2002 ~ 03	0.803
survival	30%	53%	38%	80%	28%	28%	84%	52%	41%	31%	2003 ~ 04	0.880

Table 4-1 gives monthly distribution of survival of out-planted seedlings planted in these months. Survival rates of seedlings are highly correlated with monthly rainfall. As to viability by species, *G. sepium* has again shown highest survival rate in 2003/04, possibly because this specie can quickly develop root system and the tap root readily reach capillary zone above aquifer surface faster than that of other species. Also, some indigenous species have high drought resistance including *Senna spectabilis* and *Malia azadirach.* for two consecutive years. Likewise, *Afzelia quanzensis*, and *Senna siamea* showed higher tolerance to drought, because these species can temporary shed leaves during dry season and develop new leaves from leaf-buds at lower stem. Most of them are deciduous. Other indigenous ones give lower surviving rates including *A. quanzensis, Z. mauritiana, B. thonningii, A. albida* and *T. sericea*. These are ever-green species but they can also shed leaves and only stem is surviving during dry season.

Termite damages are closely related with drought during which termites give heavy damage to young seedlings, but they become less active in wet climate. Damages mostly coincide with wither stunting of planted seedlings of *E, grandis, E. camaldulensis* and some other species, but *A. indica, S. siamea* and *A, quansensis* are almost immune to attack. Seedlings planted over granite-derived Oxisols have seriously been attacked especially in 2003/04, where long drought spells prevailed in post-planting period. It was monitored that taller seedlings have lower survival rates than younger ones, most probably because they are tended to have root injure by root pruning and higher transpiration from wider leaf area. It implies that younger seedlings should be planted before they develop roots beyond the bottom of tube-pots. According to forestry extension staffs, mean viability rate for ordinary year ranges 30 - 40%.

The fact that the Study Area undergoes drying process towards semi-arid zone is well reflected in its floral transition, where young saplings of *Adansonia digitata* and *Steculia quinqueroba* that can withstand aridity have been augmenting, reciprocally hygrophytic species such as *Toona ciliata* and *Bridelia micrantha* have sharply been declining.

As regards spacing of tree planting, narrow planting land led to denser spacing at a density of 2.25 m^2 or 1.4m x 1.5m, equivalent to 4,444 seedlings per hectare, followed by thinning a few years after out-planting. Whereas, agro-forestry ones have often been transplanted on every other ridge at 1m (interval on the same ridge) x 1.5 - 2m or 5,000 - 7,000 seedlings / ha. After planting nursery-raised seedlings over village woodlots (located on hillside, rocky slope, stream banks, roadside etc.), participants in nursery works plant surplus ones individually over privately allocated land (farm plots, homestead, dimba gardens, farm paths, along drainage channels etc.) where they planted in 2002/03 about 70 seedlings of forest species and 43 AF species. Further, they practiced inter-planting on over-exploited and deteriorated open forests. on their homestead, they plant hedgerow species, fruit saplings and shade species. Some farmers planted also leguminous species in their fallow land left uncultivated for years due to exhausted fertility (especially direct sowing of *Tephrosia vogelii* and up-rooted seedlings of *F. albida).* Table 4-3 and 4-4 show distribution and area of these out-planting.

Table 4-2 Planting Sites of Nursery Seedlings by Village

YEAR	2002/03					2003/04				
Planted Site	Village wood-lot	Private Lots	Crop Field	Home-stead	Inter-planting	Village wood-lot	Private Lots	Crop Field	Home-stead	Inter-planting
Major Specie	*E. camald*	*A. indica*	*G. sepium*	Fruit Trees	Indige-nous	*E. grandis*	*S. siamea*	*G. sepium*	Fruit Trees	Indige-nous
Total	129,363	19,916	62,110	4,690	7,500	52,131	6,237	36,697	7,094	10,970
percentage	58%	9%	28%	2%	3%	46%	6%	32%	6%	10%

Note: (1) Committees allocated the seedlings to the participants and villagers to plant their homestead and private wood-lots as well as crop field.

(2) Indigenous tree species includes T.sericea, A. quanzensis K. anthotheca, A. polyacantha etc.

Table 4-3 Number of Planting Sites by Village

YEAR	2002/03 (unit:; number)			2003/04 (unit:; number)		
Planted Site	Crop Field	Number of VWL*	Number of PL***	Crop Field	Number of VWL*	Number of PL***
Average	25	2	29	9	2.5	60

Note: * VWL; village wood-lots, ** including homestead, ***;PL; private wood lots including homestead

Growth of out-planted seedlings greatly differs from site to site. *G. sepium* has recorded fastest growth, reaching higher than 6m (DBH measured at 4.3cm) at the sites with high ground water level during 20 moths after planting. *S.siamea* follows it growing as high as 2.35m with its DBH at 2.2cm in 17 months after planting, further followed by *E. camaldulensis* reaching 2.3m with DBH at 1.3cm during the same period. Even shrub specie, *Z. mauritiana* has grown as tall as 2.3m with DBH measured at 2.8cm after 16 months, *A. polyacantha* has grown to 2.2m with DBH at 1.1cm after 17 months and *F. albida* to 2.1m with DBH at 1.7cm. These rates of growth have been obtained in the sites with favorable growing conditions, while mean growth rates remain in around a half of the above-cited values.

4.2 The Survey on Income Generating Activities and the Results

In 2002/03, PIU decided to introduce an IGA for all the target villages in order to align the willingness of all village participants to nursery works. The activity to be introduced to a village was discussed and the following criteria were adopted to choose IGA for all villages.

1) a short list is to be provided based on desire and priority of villagers in the target villages, resource availability and site suitability of each village, based on the results of Baseline Survey,
2) to make the IGA sustainable, those that can make use of forest / wood resources, as well as those yielding useful by-products for forestry use should be given priority in order to couple them with forestry activities,
3) as to the size of input to a village, budget availability should be taken into account but membership of each IGA group should accommodate all the participants to nursery and out-planting works,
4) as a basis of IGA allocation, antecedent experiences of being engaged in the desired components by interested villagers are considered for the allocation,
5) at villager's capacity dimension, current activity group(s) of tight solidarity can be evaluated in the selection and allocation of IGAs,
6) as regards technical fitness, an NGO gives relevant comments and assistance prior to starting IGA in the target villages. PIU staff members include experts of IGA who belongs to the NGO.

Based on the above criteria for judgment, villagers and PIU finally decided to introduce the following IGAs to the target villages. PIU set a target for IGA that should benefit all the participants of forestry activities to the extent that half of their annual livelihood requirements

can be earned therefrom. In this context, it debated that it was difficult to accommodate all the participants in nursery and out-planting activities by one IGA only, in order to realize this target, so it recommended to distribute the second IGA, desirably different ones within the village, to each. Reflecting the results of IGAs distributed in the previous year, most villages desired goat rearing but no village desired bee keeping. The selection of the second IGAs in 2003/04 was carried out in the same principles where two villages desired expansion of the same IGA, goat rearing. Also, based on the requests by some villages, new IGAs, to be added to hitherto introduced IGAs, were discussed in PIU, i.e., home bakery and inland fishery, and were finally concluded to introduce into the villages with best suited location, namely the remotest village to the market as concern home bakery, and three villages facing to Milala Dam. In introducing these, PIU aimed at a chain reaction of enhancing existing traditional income generating vocation, sale of firewood in and around home bakery, to maintain bakery activity, thus promoting tree planting for producing firewood for sale. It was expected that three villages located around the Dam engaged in fishery to plant many trees for the purpose of conserving watershed of the Dam lest soil should flow into it thus spoiling fishing ground at its bottom. As the result, the following have been distributed into the participants in forestry in the target villages.

Table 4-4 Number of villages by component of IGAs

kind of IGAs	treadle pump	bee keeping	goat rearing	Guinea fowl	home bakery	Fishery	Sweet potato processing
2002 / 03	10	7	4	3	0	0	0
2003 / 04	5	0	16	1	1	1	10
Total	15	7	20	4	1	1	10

Favorable reproduction has continued in goat rearing with few problems of theft damages and diseases curable by veterinary treatments. As far as cash income is concerned, however, development still remains in embryonic stage since the rearing groups cannot sell stocks they keep until all the participants receive offspring. Number of heads increased by 30% half a year after the delivery, then by 70% after one year. As of September 2004, the herd has expanded by 83%, and it will be doubled two years after delivery. Thus, over 80 % of the target villages have so far reared improved goats, with a capacity of propagating resources 5 times as much as the herd currently reared.

In the case of irrigation with treadle pumps, it has also smoothly been practiced yielding cash income, though serious troubles have arisen from depleting water sources and limited area of irrigable plots. So far as income from IGAs is concerned, treadle pumps much contributed to real income generation, although the starting of field practice delayed by failure of procurement due to scarcity of purchasable pumps in the markets and participants missed the production in 2002 season. Therefore, the practice was initiated from dry season 2003, but poor performance in product sale resulted from 0.7ha of irrigated dimba (700m^2 per engaged village, 10 villages). In early 2004, cash income equivalent to about MK51 thousand was generated from 0.8ha (530m^2 per engaged village, 15 villages). As of September 2004, cash income from pumping reached around MK63 thousand (MK4.2 thousand per village involved) where 28 participants per village were practiced with a gain of only MK150 per person.

Similar delay of input delivery also retarded the initiation of apiary practice where colonization of beehives remained only 10 out of 28 beehives supplied to 7 villages. Colonization increased to 22 in early 2004 and as of September 2004 to 28. However, the participants could not collect honey from all the colonized hives on account of their immature skill, leading to limited cash income equivalent to MK11 thousand (of which MK7 thousand was sold and the rest was domestically consumed). With regard to rearing of Guinea fowls, cash income reached only MK2 thousand gained from sale of collected eggs. Provided that the value of livestock reared by

the participants is included, the value of IGAs held by a participant amounts to MK 800 for goat, MK 1,000 for treadle pumps, MK 400 for apiary, not reaching half of annual per caput living expense, equivalent to MK 3.6 thousand.

4.3 The Results of Combined Activities of Forestry with IGAs

4.3.1 Significance of coupling forestry with IGAs

In developing Pilot activities envisaged in the Model, close coupling of forestry / agro-forestry activities with IGAs constitutes essential part because the same villager should take part in both activities. The envisaged combination has been realized in all target villages albeit some conflicts has taken place between village chiefs or committee members and nursery participants on account of habit of monopolizing or usurpation by the former side. These conflicts were reported to the group villages controlling the villages concerned and finally to T.A. who made equitable decision to solve or reconcile them. Thus, a lady chief of Kateya village was replaced due to dispossession of irrigated plots cultivated by participants. PIU staff also redistributed Boer goats supplied through input supply of Pilot activities in order to rectify biased possession of inputs in favor of chief's clan in three target villages. Local community undergoes a process of democratization through implementation of projects, renovations and other actions brought outside the villages.

PIU staff has emphasized rigid application of fair combination of these activities anticipating that forestry performance would adversely be affected by reluctant participation in nursery and out-planting works if the participants are mobilized into hard norms without remunerative return with IGA distribution. Majority of the target villagers have realized the mechanism of this coupling through repeated lectures by the staff. The efforts of PIU staff for equitable distribution of IGA inputs among maximum households likely to involve in the Pilot activities have borne a fruitful result of satisfactory and sustainable participation in forestry activities for three years.

Because both forestry and IGA norm have suddenly been imposed on the same participants who are in most cases in poor nutrition especially during rainy season with heavy field labor, the burden would threaten their health if no measures were taken. This is the reason why IGA components have been selected in a way that their labor peaks do not fall on rainy season, but are evenly distributed throughout a year. Actually, about half of the participants have got engaged in forestry and two different IGAs in 2003/ 04 and they manage to get along without suffering from overwork. For example, participants in half of the target villages are working for forestry, Boer goat rearing and dimba irrigation with treadle pumps. Vacant periods of these activities fall on April - June, September - November and January - March, thus no labor peak comes overlapping in particular season.

From use of available resources point of view, the planned combination does not arise inner competition of resource use. For instance, water is used both for nursery and treadle pumps, but water use for the former concentrates on October - December while that for latter mainly occurs from April to September. Grass is also used both for manure preparation for nurseries and for feeding goats The period for the former develops during March - July but the latter takes place from August to October, thus no serious competition on use of resource would arise here.

As shown in Figure. 4-5, a high correlation is perceived between nursery works and performance of IGAs, where numbers of nursery-raised, out-planted and survived seedlings tend to augment as managerial state of IGAs is improved. Likewise, a positive correlation is found between quantities of available resources (such as grass and water) within a village and the values created by IGAs. Though it is not illustrated in the figure, participants in forestry works and IGAs have completely been overlaid for two years, indicating that close linkage between

forestry and IGAs has been secured. From these analytical results, it is identified that the aimed combination of forestry with IGAs has been held with closer inter-linkage as initially expected.

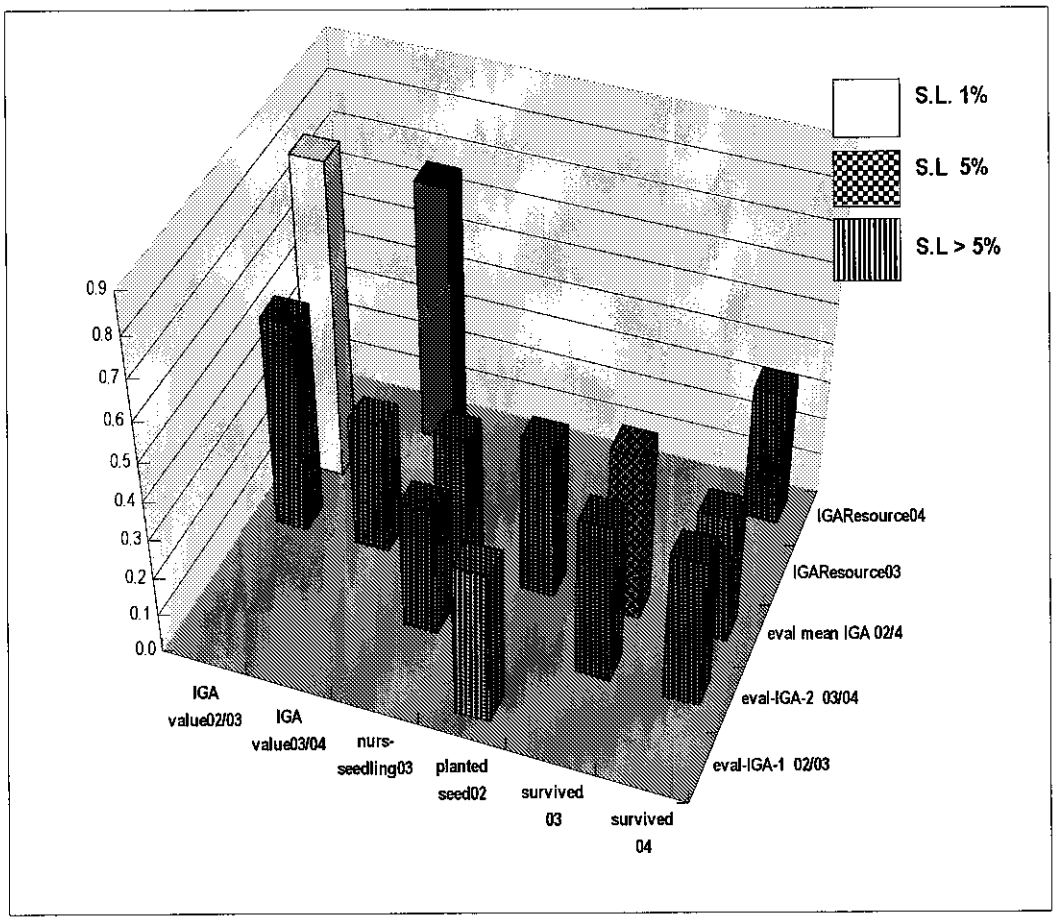


Figure.4-2 Analysis of Interaction between IGAs and Forestry

4.3.2 The Results of Villager's Self Evaluation

In July – August 2004, a survey on Villager's Self Evaluation was made where 5 villagers per target village were asked to do their own evaluation by individual, and the results were summarized below: Many respondents appealed drought affected conditions and entailed food shortage (during October - February) and firewood scarcity. Villager's income sources were concentrated on piece-meal works followed by sale of crop and grocery commodities. Sale of wood and livestock occupied lower position as compared to the state surveyed in Baseline Survey. on account of dwindling resources.

The participants worked 14-18 days /month during this period and rate of satisfaction with their involvement in IGA introduced in 2002/03 reached 90% with a duration longer than the first IGA. As to equity and quantity of benefit share among the participants, response showed mostly satisfaction. As regards the second IGA, participation of ladies has been comparable to that for the first IGA, but men's participation has become declining. Satisfaction rate of IGA involvement has increased to over 90%. Benefit sharing performance has become better than the case of the first year IGA. These trends indicate that both the benefit carrier and the receiver have got accustomed to the management of IGAs that are gradually oriented to a stabilizing

phase. Frequency of meeting has increased, implying that committees become more active with many things to discuss. What has been decided in the committees in 2004 has more been reflected in IGA management than in 2003.

In the villager's self evaluation survey, multitude of replied that they can continue forestry activities without continuing particular substantial aids, with a background of extension service and input supply for three years. They also replied that they expect future fruit gained from forestry works with an image of past reliance thereto. As concern IGAs, similar result was obtained on the sustainability to the forestry activities. They gave similar evaluation pattern for IGAs to that given to the forestry activities, implying that they recognized that forestry and IGAs are coupled and mutually dependent.

Villager's concept has undergone a drastic change into higher recognition of needs for planting trees than the level prevailed in a few years back, accounting for benefits that trees will bring, most probably impressed by the repeated lectures by extension staff. Expectation in IGAs was as strong as that in forestry activities, where they deemed IGA as a resource based tool for improving future livelihood.

4.4 Monitoring / Evaluation of Pilot activities and its Feedback

4.4.1 Monitoring and Evaluation of the Activities

The system of Project Cycle Management has been applied to the monitoring and evaluation of Pilot activities. Land scarcity remains as a bottleneck giving a hazard to afforestation activities. Previously only 9 village forests remained but more than two sites per village, or 61sites in total have been planted as village forest during Pilot activities. 27 sites per village have so far been planted as private woodlots with nursery raised seedlings though average area of the lot is as small as 200 m^2 or so. This is a considerable achievement compared with the previous density; 4 private lots per village. Small size as they may be, the planted sites are dispersed over the villages, thus served as barrier of soil erosion while they promise future individual procurement of firewood in so far as the planted trees stand on private land.

As to AF practices, procurement of seed has been ensured through creation of seed banks. It was not until the third year that actual practice was diffused among the participants, who created 34 AF practiced plots per village versus none before the Pilot Study. Smooth development of AF has been brought about by improved material and seed supply to individual participants as such constraints as seed shortage, insufficient practical knowledge/ skill have been removed off. Such innovation was not confined to AF, but in IGAs including apiary and irrigation with treadle pumps horizontal expansion of techniques progressed in 2003/04, enabling participants who got accustomed to practices to earn cash income. Total annual value created by two major components of IGAs is estimated at MK1,312 / participant / year (not real cash income).

A typical character in both forestry and IGA activities is found in prominent participation of housewives rather than men. This is partly imputed to traditional division in matriarchal society but partly to physical capacity or posture with challenging nature. Women account for more than 60% of the total participants in the Pilot activities where ladies attended nursery works at the rate of over 70% under village head women. Remarkable diffusion of improved fireplaces has been fostered by only voluntary labor with material at hand and easy skill for its installation.

Over 25 fireplaces per village were installed during two and a half years and most of them were offered to daily use, yet there had been none before the Study in the Area. It has been identified that improved fireplaces can save 16% of firewood by test trials, and this rate of diffusion implies acute shortage of firewood in this Area.

Significant improvement as cited above has thus been made in terms of village vitalization and afforestation during the process of the Pilot Study, the salient figures of which are listed in Table 4-5 and 4-6.

Table 4-5 Village Vitalization before/during the Pilot Activities

	Goat head per villagers		Intensive vegetable raising by treadle pumps		Number of IGAs run by villagers		Number of IGA participants in the village		Rate of IGA participants to economically viable population	
period	2002	2004	2002	2004	2002	2004	2002	2004	2002	2004
figures/ village	0.04	0.11	295	1,055	0.5	2.5	3	28	1%	27%

Table 4-6 Reforestation before/during the Pilot Activities

	Area of recent outp-lanting (ha/year)		Numbers of villagers who planted trees per year		Numbers of seed-lings survived in planted lots(includ-ing AF species)		Firewood consumption by villagers per annum (m^3)	
period	2002	2004	2002	2004	2002	2004	2002	2004
figures/ village	0.3	1.2	6.3	41.8	480	14,174	27.4	24.5

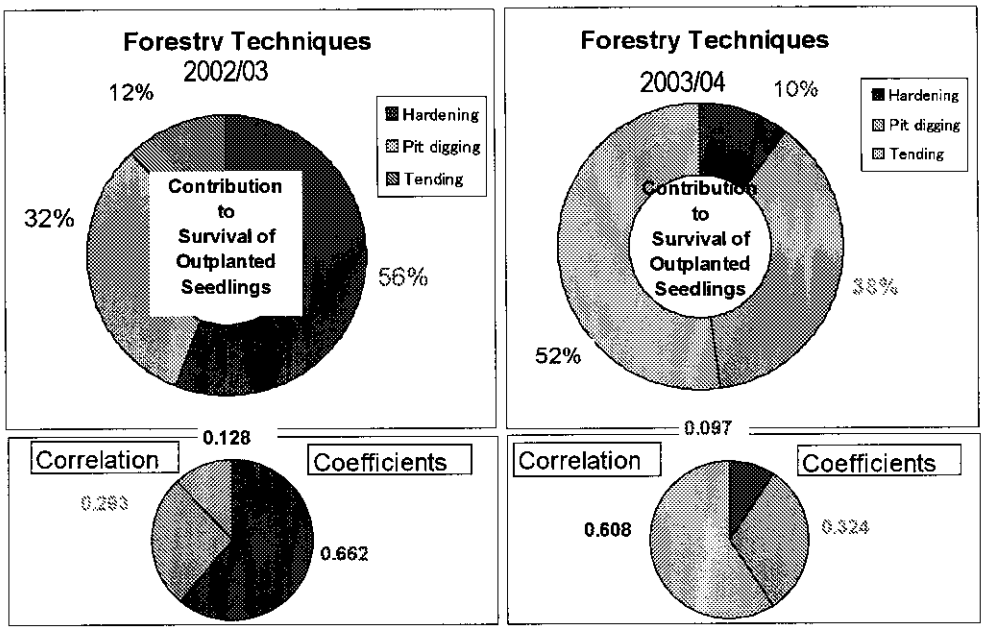
4.4.2 Feedback of the Obtained Results into next Plans and Schedules

PIU has played a role of feeding the results of the Pilot activities back into establishment and revision of plan /schedule, employment of new tactics or countermeasures and other actions. PIU staffs arranged performance of the Pilot activities through PDM learned in the process of technical transfer lest already established goals should be ignored, and periodically delivered results and information collected and compiled in the villages concerned to the participants so that participation can be sustained pursuing the goals. They also distributed recording notebooks to each target village so as to allow villagers to record monthly performances and attendance to the participatory works. Making full use of this recorded information, they tried to continue capacity building for the participants in Pilot activities so that they themselves can establish plans ahead, implementing schedules and self evaluating what they have practiced.

4.5 Analysis of the Results for Elucidation of Intra-factor Relations

The results of the Study have been qualitatively and quantitatively analyzed through the method of observing inter-village differentiation and quantified method by five-rank-evaluation,

Based on the performances of tree planting in the target villages in 2004, following differentiation was observed between highest-ranked 8 villages with regard to number of raised seedlings in their nurseries and lowest-ranked eights. The former planted much more seedlings than the latter, and achieved higher survival rate than that of the latter. The former mobilized more participants in nursery works and out-planting activities. The participants in the former villages worked longer hours and more frequent than those in the latter. The former village group had more committee members than the latter. The cadres in the former village group behaved in more equitable way than those in the latter group, for example, in the even distribution of such benefits as seedlings, and goat kids as well of even sharing of burden such as water fetching for nurseries. Likewise, the cadres in the former group showed stronger leadership than those in the latter in such occasion as arrangement of training, punctual mobilization of villagers to demonstration by PIU staffs. Both cadres leadership and villager solidarity made them faithfully follow what PIU staffs advised, thus selecting better date of tree planting for achieving higher survival of what they planted. They could follow what were instructed by PIU staffs partly because more ample experience the villagers in the former group had in the past. The former group has narrower woodlots in their villages to fetch firewood that might have induced ardent attitude to promote tree planting



Note: Independence of the independent variables was proved through chi-square tests among these variables.

Figure 4-3 Weight on the Effects of Participants Technical Level on the Survival of Out-planted Seedlings

Figure.4-3 indicates the coefficients of multiple regression equations (upper part) among the variable (survival) and three major influencing indicators (hardening, size of planting pits and post-planting tending observed in 24 target villages for two years, and their partial correlation coefficients (lower part). Although contribution of these indicators to survival of planted seedlings varies with observed years, their importance has been identified from these figures. In this connection, out-planting dates in 2002/03 were scattered in a wide range of rainy season, but those in 2003/04 were concentrated on early ~mid January. Survival status of the former depended highly on monthly rainfall for one month after planting, but that of latter was largely influenced rather by nursery water availability than monthly rainfall, because participants out-planted most seedlings during January with ample rain in spite of a serious drought prevailed in the rest period.

The analyzed relationships among interrelated indicators through qualitative analysis were in conformity with those obtained through quantified analysis (including that by tree species). The salient features extracted from these analyze are reflected in the proposals cited in Chapter 6.

4.6 Causative Tracing of Intra-Area Differentiation

During the Study differentiation in forestry and IGA performances has taken place. The causes that have brought were traced and some social factors were identified as affected or attributable ones including participation of women, village area and past experiences of reforestation etc. These findings were served for the analysis mentioned above..

4.7 Villager's Consciousness of Environmental Conservation

One of the positively evaluated results gained through the Pilot Study is explicit change in villager's consciousness of environmental importance, as grasped in villager's self evaluation, that can help the resource rehabilitating activities more sustainable.

4.8 Conditions for Sustainability of Social Forestry Activities and Related Factors

Firstly, tight combination of forestry activities with agro-forestry and IGAs is considered viable to make participatory approach enough sustainable. Secondly, application of pertinent extension services with timely and adequate input supply for promoting forestry and IGA is imperative. Also, setting reasonable long-term targets for village resources management is recommendable.

4.9 The Results of Implemented Technical Transfer

Substantial efforts were made through concentrated extension services by PIU staffs that made a systematic technical transfer to grass-root villagers possible.

4.10 Justification of the Pilot Study

Cost comparison was made with possible energy-substitution projects and substitution of PIU services with contracted resource rehabilitation. The result justified the Pilot Study through the creation of village initiatives where villagers themselves intend to promote rehabilitating activities, as compared with alternatives in which villagers only receive facility without any effort.

Chapter 5 Revised Village Natural Resources Management Plan (VNRMP) in and around the Study Area

5.1 Constraints and impetus of Forestry and Agro-Forestry Development

There are a number of constraints that inhibit development of social forestry and agro-forestry activities in rural media, classified into endogenous and exogenous ones, by the origin of causes.

Constraints of such endogenous nature as villager's laziness and inertia can more easily be handled than exogenous one because only villager's willingness or effort is required to rectify them. As exogenously originated ones inclusive of contagious diseases and climatic vagaries are beyond villager's control, measures to cope therewith need threshold chances by the help of assisting entities. Hunger constitutes the most influential inhibitor. Among the activities developed in the Pilot Study, forestry works require high physical energy (2,500 kilocalorie per person / day) equivalent to 24kg of cereal or MK 1,700 per annum, which has been met in hitherto implemented assistance project. In the Pilot Study, this requirement has been covered by IGAs. Through this trial, any compensatory measures have proved to serve as an incentive towards the participants in forestry and environmental conservatory activities. AF has also similar effect of giving incentive, but it takes fairly long period until effect is manifested.

In many cases, there exist many vulnerable strata in a village like ethnic minorities and lately joined households who often fail to join any projects when they are launched. Such out-casted people also have to consume firewood everyday, or get inevitably involved in environmental destruction and theft cases. This is the reason why environmental activity should involve all strata of the villagers, including vulnerable strata of villagers to avoid discrimination of participation. In order to maintain the participation of the villagers in these activities in a sustainable way, it would be indispensable to support the groups that can realize equitable share of benefit and labor burden as mentioned above. Since small villages often suffer from lack of water sources to singly maintain village nurseries, joint management of village nursery by several villages should be considered to make the participation and management more sustainable. Majority of villagers cannot afford to go to hospital nor buy medicines and no doctor is available in their villages. They used to such natural drugs of plant roots, barks, leaves and fruits of indigenous trees and insects, but nowadays such resources deplete to a critical extent, along with acute shortage of firewood. Indigenous medicinal species have been raised in nurseries established by the Pilot Study and seedlings of which have been distributed to the participants, who planted them in their private lots and homestead.

5.2 The Appropriate Implementation System for Realizing VNRMP

5.2.1 Concept of the Structure of VNRMP

Villages should take initiative of formulating and implementing VNRMP that includes major activities of conserving and rehabilitating natural resources through afforestation etc. With a view to performing these activities in a participatory approach amalgamation of afforestation and IGAs is required. These coupled activities can yield positive interactions to make afforestation sustainable. To smoothly realize the plan, supporting Government organizational framework, ranging from central ministries to local government agencies, plays key role in closer link with autonomous administrative entities. The supporting framework should assist them by making current status and desires of the target villages clear so that relevant technical transfer and effective input supply can be applied to meet the needs, thus disseminating the planned activities into the entire targeted areas.

5.2.2 Extension Tactics

In promoting works planned in VNRMP in a voluntary participation a campaign is needed to facilitate villager's participation. Since systematized and well-organized villager's association has the key to success, therefore it is difficult to promote the planning and implementation of VNRMP unless supporting framework urges cadres of target villages to strengthen existing village organizations. It is also difficult to involve the whole village population in newly launched activities of VNRMP from the beginning, especially in vast villages, though thorough involvement of villagers in the plans is a final goal. Along with above cited support it is necessary for extension staff and NGOs to have a catalytic function so that villagers are oriented to make voluntary efforts towards VNRMP. Most villages already have committees but additional leverage is required to vitalize them as a carrier of VNRMP, while it is necessary for supporting framework to establish a group for extension campaign. It would be a strategic alternative to begin with an approach to demand-supply linkage, necessarily involving those who have been engaged in such illegal conduct as charcoal burning. Pilot activities have suffered from a number of theft damages leading to loss of village assets, thereby villager's willingness to participate in Pilot activities have been eroded. This suggests acute necessity of employing self-help security means as a component of VNRMP to be organized by male villagers as already observed in the villages around the Study Area. Through the alert and vigilance of this group, not only village resources but also assets of IGAs can be protected. If this is proposed in VNRMP, those who have bitter experiences of theft damages can be mobilized as participants in VNRMP.

In such a way, fortification of management system of village resources can be made sustainable by pertinent orientation though extension services.

5.3 Review on the Training of Extension Staff Techniques and Improvement in Village Organizations:

What are acutely required at present include feeding of contemporary techniques and findings to the extension staff in charge of VNRMPs and environmental conservation works, compilation and exchange of related data among stakeholders, provision of regular courses for in-service training for extension staff to brush-up their instruction capacities, and above all, creation of habit of measuring and analyzing results not in a descriptive manner, but in a quantitative way. PIU has rendered assistance to improve function of village organizations not only technical aspect but also social one. To brush up their contribution, it is desirable to give extension staff leadership training. It is also desirable for related government agencies to make use of data and information based on real experiences in the Pilot activities.

5.4 Revised Village Natural Resources Management Plan (VNRMP)

5.4.1 Factors Considered in VNRMP

In July 1999 Department of Forestry publicized "GUIDELINES FOR FORMATION AND STRNGTHENING OF VILLAGE NATURAL RESOURCES MANAGEMENT COMMITTEES" for empowering officers to facilitate establishment of VNRMP as many villages as possible. This dictates a legal procedure to be advised to the villagers, but it didn't give any concrete ideas for them to pursue. So, it is really necessary for the villagers to advise what to do in their committees established as VNRMC.

The first and foremost factor to be regarded in the formulation of any VNRMP constitutes the current status of natural resources and inventory of available resources in the village concerned. This is because the plan must be based on the observed, actual availability of resources, current land use and status of labor force that can be mobilized. More concretely, the first step starts

with resource inventory or the baseline survey. From these background data, villagers can come to a mutual agreement on what to do and what not to do for properly conserving, rehabilitating currently available resources and creating new resources, thus making their resource base recover from damaged and degraded state to restored one.

5.4.2 Community Participation in the VNRMP

As to what should be planned in VNRMP, it should let villagers to consider what have been happened in their villages on their environment, and let them design how to cope with. Then, at the stage of decision on the concrete components of VNRMP, it makes them to review on possible constraints and problems likely to encounter. At the same time, it makes them consider their daily demand for village resources and set forth their targets for rehabilitating or conserving their resources. Moreover, it requests them to establish participatory working plans in which manning schedules are clarified on who are in charge of what tasks and when they should be done necessary inputs and possible sources of procuring them. Likewise, the established plan should include an equitable process of allocating duties and rights to the participants. As participants are recruited on a voluntary basis, the plan specifies the committee members to provide a recruitment call and accompanied orientation. Systematically, TAs have to take charge of developing the campaign of VNRMP, so he/she is requested to get involved in the campaign to set a target of convincing villages under his/her jurisdiction.

5.4.3 Agro-forestry Diffusion

In VNRMP, AF should be given priority as a useful tool of implementing the Plan, coupling it with afforestation or small scale tree planting. Referring to promising results of Pilot Study, seed banks should be applied to the target villages, in the meanwhile extension staffs demonstrate the AF practices to the villagers. Responding to villagers' needs and expectation of practicing AF revealed in the Pilot Study, promising species of better performance during the Pilot Study including *G sepium*, *T.vogelii* and *F. albida* added to existing *C.cajan* are applied to cropping plots and fallow land.

5.4.4 Basic Approach to the AF Development Plan

In VNRMP, concrete plan of AF application to the field of participants should be formulated according to field conditions, where extension staffs take action to transfer AF techniques to the target villagers. Here, joint use of village seed bank for this purpose should be included. Also, AF material should be multiplied in village nurseries to distribute it among the participants. In parallel with the introduction of AF, practices of land husbandry should be diffused on the practiced farmland.

5.4.5 Forestry Extension Plan

In VNRMP, villager have to current status of existing forests and woodlots in their villages and availability of resources including firewood, thereby establishing relevant reforestation program in which needs of the villagers are duly reflected, taking due account of conditions of locality, current trend of biomass resources and demand forecasts. The extension services should provide technical transfer with reference to past experiences and ability the villagers acquired. They thereby recommend the villager's selection of technical options including fast-growing and indigenous species that match conditions of locality. Then, the extension staffs urge the villagers to select sites of reforestation and small-scale planting, then, the scale of rearing seedlings and location of village nursery are determined. Then, they urge villagers to establish VNRMC to review the formulated Plan and to decide the implementing program.

In providing the program, the extension staffs direct them to make use of locally adapted species verified in the Pilot Study and suitable combination of fast-growing and indigenous ones as proved therein so that many sites of small-scale woodlots to cope with insufficient area for

out-planting can be created. The extension staff can recommend them to employ the species tolerant to drought and termite damages (*Melia azadirach*, *Azadirachta indica*, *Senna siamea*, *Senna spectabilis*, *Afzelia quanzensis*) in combination with fast-growing ones including Eucalyptus , so as to realize a diversified planting not biased to the latter.

Dual significance, i.e., supply of subsistence resources and securing water sources are involved in the interrelationship between forestry and community. The latter aims at water and soil conservation by restoring vegetative cover that tends to decline year by year, utilizing wasted or idle land, thereby out-planting in as many sites as possible until unbiased crown can be restored. To attain it, it is advised to deploy wider land use as experienced in the Pilot Study, by planting on stream banks and lakeside, homestead, along farm paths, rocky mounds and inter-planting in residual indigenous woods and graveyards.

In urging villagers to prepare the Plan, it is pertinent to orient them to consider demand for firewood by women, so that practical out-planting program can be provided based on future projection of demand for wood. In this connection, extension staffs try to let them realize that if they continue to raise and plant seedlings as practiced in the Pilot Study it will take 6~7 years of sustainable efforts to meet the demand.

5.4.6 Income Generation Activities

In planning IGAs to be based on efficient use of local resources, practical program should be established regarding consistency of the measures to meet commercial demand for, or market outlet of IGA products with forestry / AF activities. It is recommendable that VNRMP includes irrigated crop production with treadle pumps and improved goat rearing as verified in the Pilot Study taking due account of quantities of available input resources and labor within the villages.

5.4.7 Community Organizations

It is imperative to improve and strengthen villagers' organizations that are indispensable to sustain their participation in village vitalization activities on a basis of participatory approach. It has been proposed that technical and leadership training, study / inter-location tours and revised school education at environmental dimension.

Chapter 6 Conclusion and Proposal

Exigent need of taking due measures has been called for to be taken against the problems posed in Middle Shire in Malawi on deterioration in natural resources and negative effects on local population. The clue resides in the right consciousness of inhabitants on the official efforts of positively addressing these, thereby tackling desirable rehabilitation / management of natural resources including afforestation. The Pilot Study has proved relevance of the proposed Model of coupling forestry with AF and IGAs that can be implemented in a sustainable manner. If GOM can make use of this result for applying to the expansion towards the surrounding villages around the Study Area, it is considered possible to cope with the environmental degradation problems. Here, basic concept of coupling forestry and AF activities with IGAs until the first harvest of planted trees is realized should be pursued to guarantee the participants incentives for sustainable challenges for far-reaching rehabilitation of degraded environment.

In this context, the following has been proposed as to future follow-up action for the Pilot activities within the Study Area and horizontal expansion of the Model to adjacent Areas.

How to develop the Pilot Study Activities (the Model) to surrounding areas

It is considered better to begin with selected villages with relatively abundant available village resources, rather than diffusing into all the adjacent ones, because selective expansion can minimize failure. As regards components of IGAs, it is recommendable to restrict only two IGAs including improved goat rearing and irrigation with treadle pumps, as far as resources are available. The coupling of forestry activities with IGAs should be followed in a simultaneous implementation so that participants to forestry activities can sustain hope and impetus. Also, forestry should be geared with AF. For the purpose of extending the proposed Model, it is proposed to organize an extension team composed by RFO(S), RDP and RCS in charge of extension services related to the extension of the Model. Criteria of village selection may include: 1) the village has suitable site for village nursery, 2) it has enough space for afforestation, 3) it has ample experience of planting trees and 4) it has been equipped with equitable governance and leadership to tackle new trials. the selected villages can serve as a nucleus to expand results into adjacent villages.

The extension team enders assistance to the selected villages for harnessing their village organizations to urge them to establish VNRMCs that provide VNRMPs. In compliance with the formulated VNRMP, the extension team can arrange IGAs for these selected villages (if possible, supply of official loans), supply of forestry inputs and material. As the supporting by donors, that of technical collaboration projects are conceivable.

How to monitor and encourage on-going Pilot activities in 24 target villages

Current PIU may be disintegrated and the target villages will be treated as ordinary beneficiary of extension services. PIU may be remodeled into PMU so that denser monitoring can be resumed than ordinary villages. The staff composition is reduced from 15 members to 8 on account of austerity budgetary situation of relevant regional agencies. The mandate of PMU staff includes monitoring the participatory activities at a frequency of twice a month until the end of 2007, giving proper advice to the participants, transferring additional techniques / skills to the participants for the maintenance of their activitiesAs regards the supply of inputs, durable inputs have already been supplied to the target villages in 2004. From 2005, it is desirable to replenish 6,000 tube-pots and 1 kg of forestry seed to each target village per annum. .It regularly holds meetings once in quarterly at RTC Lunzu for executing the plan of monitoring/ extension and exchanging information as well for reporting to the relevant agencies, and the report the resuls of monitoring to Department of Forestry. It is desirable that GOM takes these follow-up activities, however, the attendants to SB meeting held in September expressed difficulty in

following this proposal. Alternative countermeasure includes the involvement of JOCV dispatched to Blantyre District who follows extension activities.

Contents

ABBREVIATIONS

AA	Agricultural Assistant (Extension)
ADD	Agricultural Development Division, MOA
AF	Agro-forestry
BCFP	Blantyre City Fuelwood Project by NORAD
CDA	Community Development Assistant, MOGYCS
DBH	Diameter at Breast Height
DCSO	District Community Ser ice Office
DDPS	District Development Planning Office
DFO	District Forestry Office
EPA	Extension Planning Area, RDP
ESCOM	Electricity Supply Commission of Malawi
EU	European Union
FA	Field Assistant, EPA, Forest Assistant
FD	Forestry Department
FINCA	Foundation for International Community Assistance
FRIM	Forestry Research Institute of Malawi
GOJ	Government of Japan
GOM	Government of Malawi
GTZ	German Technical Cooperation
ICRAF	International Council of Research on Agro-Forestry
IGAs	Income Generating Activities
JICA	Japan International Cooperation Agency
KEFRI	Kenyan Forestry Research Institute
MASAF	Malawi Social Action Fund
MAFE	Malawi Agroforestry Extension Project
MK	Malawi Kwacha
M/M	Minutes of Memorandum
MMNRE	Ministry of Mines, Natural Resources and Environment
MOA	Ministry of Agriculture
MOGYCS	Ministry of Gender, Youth and Community Services
M/P	Master Plan Study
MRFC	Malawi Rural Finance Company
NGOs	Non Governmental Organizations
NORAD	Norwegian Assistance for Development
OJT	on-the-job training
PCM	Project Cycle Management
PDM	Project Design Matrix
PIU	Project Implementation Unit
PMU	Project Management Unit (Monitoring)
PRA	Participatory Rural Appraisal
PTA	Parents and Teachers Association
RDP	Rural Development Project, in ADD
RFO(S)	Regional Forestry Office (South)

RRA	Rapid Rural Appraisal
RSCO	Regional Community Service Office
SA	Study Area
SADC	Southern African Development Community
SB	Supervisory Board
SC	Steering Committee
TA	Traditional Authority
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
VC	Village Committee
VDC	Village Development Committee
VNRM	Village Natural Resource Management
VNRMC	Village Natural Resource Management Committee
VNRMP	Village Natural Resource Management Plan
WB	World Bank
WESM	Wild Life and Environment Society of Malawi (NGO)
WPO	Women's Program Officer

CURRENCY EQUIVALENTS (as at December 10, 2004)

1 US$ = 110.00 Malawi Kwach (TTB)
1 US$ = 101.50 Japanese Yen (TTB)
1 MK = 0.0091 US$
1 MK = 0.9227 Japanese Yen
1 JY = 1.0837 MK

MALAWIAN FISCAL YEAR

July 1 to June 30

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Chapter 1 The Outline of the Pilot Study

1.1 Background of the Study

Forests in Malawi in 1990s accounted for 38.6% of its territory, extending over 118 thousand square kilometer, of which 17% belonged to Customary Land traditionally managed by local communities. These forests and woodlots in Customary Land have supplied firewood occupying 90% of the domestic fuel consumption. However, population pressure had narrowed the forest area, Forest resources have been dwindled and degraded through rampant felling or woodland reclamation into crop field until forest cover declined to 25.3% in early 2000s. As local population have seldom planted trees, one-sided heavy exploitation for consumption deteriorated Customary Land where topsoil was eroded away into streams at an enormous rate. As these changes escalated soil erosion mainly occurring in Middle Shire, huge sediment has been deposited in the dams along Shire River, thus narrowed capacity of power generation and urban water supply.

To find a solution to this exigent problem, Ministry of Mine, Natural Resources and Environment (hereinafter referred to as MMNRE) requested Government of Japan to conduct a Master Plan Study on Watershed Rehabilitation in Middle Shire in June 1998. In response to the request, Japan International Cooperation Agency dispatched a reconnaissance survey team in March 1999 for preliminary consultation and agreed with Government of Malawi to launch the Master Plan Study (hereinafter referred to as M/P) from 1999 to 2000. In the M/P, it was proposed to implement a pilot verification study within a model area in the form of coupled components, combining forestry and agro-forestry components with income generation activities (hereinafter referred to as IGA) for three years.

In accordance with the proposal in the report of M/P, Government of Malawi further requested Government of Japan to undertake the proposed Study. After the dispatch of preliminary survey mission, Government of Malawi and Japan International Cooperation Agency agreed on the Scope of Work and Minutes of Meeting on the Pilot Study on Community Vitalization and Afforestation in Middle Shire in Malawi on October 11, 2001. The agreed Study takes a period of three years for verifying what have been proposed in M/P report, from 2002 to 2005.

1.2 Objectives of the Study

As mentioned above, this Study has a definite objective of verifying what have been proposed in MP study report, where six major components have been proposed, viz., 1) utilization of agro-forestry, 2) forestry promotion, 3) promotion of income generating activities, 4) social infra-structure, 5) strengthening of village organizations and 6) enlightenment, capacity building and effective application of extension services. These components should be envisaged in the Village Natural Resources Management Plan (hereinafter referred to as VNRMP) to be planned at village level in concrete types of participatory works. Here, community vitalization serves as an attractive tool to be realized first then followed by afforestation, thus the name of the Study implies the order to be realized, because Government of Malawi has ample experiences on the well-known behavior of local population always pursuing tomorrow's food rather than forest benefit of ten years ahead. In this respect, the objectives should include the estimation of effect brought about by the coupled component of forestry (duty) and IGAs (incentives).

The watershed rehabilitation in the Study Area has thus be addressed and verified by those who live therein though it takes far-reaching period to attain. The proposed pilot Study herein could serve as a threshold of rehabilitating action with sustained efforts of the villagers and counterparts concerned to challenge their long-term task of environment conservation. Though the Study proposed herewith should cover above-listed six components or works to be

implemented in the model area, some of them are prioritized than the others due to very limited period of verification.

Targets of the Study are placed on improved livelihood and enhanced agricultural productivity although they are difficult to exactly quantify. Agro-forestry (hereinafter referred to as AF) should come first among the components on the time sequence of implementing Pilot Study followed by IGAs, and community forestry should come last because the result can be manifested very late as compared to other components. The Study had a period of three years, but the actual starting of the activities delayed because fairly long preparatory period was required to smoothly initiate the envisaged activities especially for the preparation of inputs where procurement of material was not so easy because of limited availability. Social infrastructure like tube-wells was most expected component but the Study could not help excluding it because of limited time span and budget. Rather, it has aimed at capacity building of the villagers in the course of various activities including site training, study tours, demonstrations and workshops. The Study itself aims at examining whether the proposed Model in M/P report is effectively workable in the Study Area or not. Through the whole process of the implementation of the Pilot Study, relevance of the Model should be verified, and the lessons learnt from the Study should rightly be reflected in the implementation of the whole M/P, to be later implemented by the Government of Malawi.

Another important objective of the Study resides in technical transfer from the Study Team to the counter parts and from them to grass-root villagers. Traditional society has many obstacles and constraints towards modernization and development but these should be rectified through the introduced activities. The basic stance of this Study lies in the point where villagers are intrinsically intellectual, capable of absorbing modern concept, but only they have failed to have chances or no adequate service has ever been provided. Whether they can radically change their concept or they can really recognize environmental significance around them should be surveyed and assessed through this technical transfer.

The last objective of the Study is to provide a practical manual for villagers, making full use of data and findings through the Pilot Study, so that they can fully be sensitized, develop willingness to address environment conservation for their welfare in future. Such basic manual is currently very difficult for them to obtain, though many villagers want to make use of for improving their skills of vocation and life style.

Besides, creation of comprehensive partnership among related Ministries at regional and district level was sought for a smooth and efficient implementation of community vitalization and forestry activities, since inter-ministerial coordination must play a leading role to assist local population in such a multi-disciplinary trial. Commonly, extension staffs of different expertise render their services independently without mutual liaison, however, local population require a series of simultaneous services ranging different fields. The Study aims at establishing coordination in such a way that the proposed Pilot activities enable the target community to receive a set of concentrated services for three years. Since such a special occasion rarely happens in developing countries, it was expected that the impetus created by partnership can urge development in rural community is worth monitoring during the Pilot implementation.

Chapter 2 The Study Area

2.1 The Study Area

2.1.1 Location, Topography and Physiography

The Study Area is located at the north of Chileka International Airport, the location coordinates of which extends 15 ° 35'~ 15 ° 43' S in latitude, 34 ° 58'~ 35 ° 03' E in longitude, with the total surface area covering 40.08 km^2. It forms central part in the watershed of Lunzu River, the altitude of which ranges from 395 ~ 780 m above the sea level. Topography thereof has a typical feature of peripheral Chileka peneplain in the southern villages with flat, not much dissected remnant plain where two dams, Ntenjela and Milala are located. Northern part develops on a terrain with a remnant hill of Chilangoma. Hilly area covers Nanjiwa, Mdala, Kaumbata, Makonokaya, Siyamudima and Chakana villages, while flat area includes K.Chigumula, Kateya, Kumponda, Kamwendo, D.Mbeza, M.Ngondo, T.Kenji, Kammata Chilangali villages, and the rest have undulating topography.

Two major streams run along the eastern edge and western border of the Study Area. Lunzu River (catchment area: 327.2 km^2, length: 49.3 km, mean streambed gradient 1/75) flows eastern border of Makanokaya, Siyamudima, Kaumbata, Kamwendo, Ndemanje, Maluwa and S.Mpombe villages, supplying perennial surface flow to these villages. Nkkokozdi River, largest tributary of Lunzu River (catchment area: 72.7 km^2, length: 17.6 km, mean streambed gradient 1/125) flows along western border of Makonokaya, Kaumbata, Manjelo, Teula and Chakana villages and along eastern border of Mdala and Nanjiwa villages, also supplying perennial surface flow to these ones. Other villages are not faced to major streams, but some small tributaries flow therein like Ntenjela, Nasonje, Namilango and Milala Rivers that tend to deplete surface flow during late dry season, hence villagers in these villages have difficulty in procuring daily water during dry season.

2.1.2 Geology and Pedology

Mountains and hills surrounding Chileka Peneplain had been formed in Cretaceous age, while the penenplain itself was leveled in mid-Tertiary age. The basement rocks under these mountains and remnant hills consist of country gneiss-granulite (metamorphic / metasomatic rocks observed in the stream bed of Shire River) covered by perthosites (alkaline), perthite-gneiss and granite striped with basic orthogneisses (acidic), accompanying with charnockitic granulite. The latter is found also in Mount Ndilande laying south of the Study Area, while calc-silicate granulites are most abundantly distributed in the south~eastern part. These acidic rocks have derived coarse sandy soils (Entisols, psamment) developed in the center to north of the Study Area, infertile due to lack of humus, whereas Lateritic soils (Oxisols, fragiustox) widely covers Chileka peneplain. Stripes of alkaline rocks such as perthosite and tonalite (acidic~alkaline) and also limestone intervene acidic base rocks that have been weathered into relatively fertile soils found in the southern half of the Study Area.

Soil physical property, i.e., content of capillary pores has close bearing to the survival rates of out-planted seedlings. Entisols with coarser textures are mainly distributed in the northern part have less capillary pores, hence showing lower water retentive capacity than Oxisols and Vertisols distributed in southern part. The former has very low level of phreatic surface, whereas the former has comparatively higher groundwater surface because Chileka peneplain acts as an underground reservoir during dry season. Apart from this swampy structure of Chileka, Milala Dam has similar hydrological function to the peneplain, where fertile soils are distributed along stream banks of Milala River.

2.1.3 Meteorology and Climate

There has been consistent declining trend in annual rainfall in the Study Area for the decade, evidently leading to accelerated desertification to semi-arid zone. The basic reason stems from global greenhouse effect, but topographic condition also contributes to the lower precipitation prevailing therein.

Table 2-1 Daily Rainfall Data in Chileka Airport

month	NOV	DEC	JAN	FEB	MAR	APR	month	NOV	DEC	JAN	FEB	MAR	DAY
Year	2002	2002-	2003-	2003-	2003-	2003-	Year	2003	2003	2004	2004	2004	2004
1	0.8	0	9	6.6	0	0	1	0	4.7	0	0	59.1	1.3
2	0	0	27.1	26	0	0	2	14.1	0	0	0	0	3.1
3	0	0	11.1	1.6	16.4	0	3	0	0	0	9.6	0.6	0
4	0	0	1.3	22.2	0.7	0	4	1	6.1	0	0	0	0
5	0	22.1	5.5	9.3	0	0.7	5	0	0	0	0	11	4.1
6	10.8	0	0	2.9	7.9	0	6	0.2	0	0	0	18.3	3.1
7	0	0	0	3.8	2.9	0	7	0	0	0	0	0	11
8	0	0	0.2	0	11	0	8	0	0	11.2	0	0	16.3
9	0	0	15.3	1.1	5.6	0	9	0	0	0	0	0	0
10	0	10	11.6	16.5	0	0	10	0	0	0	0	0	0
11	0	6.8	17.3	0.1	0	0.5	11	0	0	0	0	0	0
12	0	2.5	0	0	0	0	12	0	1.8	15.8	0	0	0
13	0	4.1	0	0	0	0	13	0	0	0	10.2	0	0
14	0	1.2	0	0	0	0	14	0	0	0	4.6	3	0
15	0.2	0.6	0	0	0	0	15	0	0	0	1.1	0	0
16	0	2.8	0	0	28.1	0	16	2.7	0	0	0.5	0	13.6
17	0	0	0	0	14.5	0	17	0	0	0	0.9	0	0
18	0	0	0	0	11.4	0	18	1.4	0	26.1	1.4	0	4
19	0	7.5	3.4	0	0.5	0	19	0	12.6	1.7	0.6	0	0
20	0	17.5	5.5	0	29.9	0	20	0	0	75.6	1.7	0	0
21	1.2	12.9	1.7	26.2	0.3	0	21	0	0	41.8	0.3	0	0
22	1.1	0	2.2	13.7	0	0	22	0	0	13.7	0	0	15.9
23	0	0	0	0.2	0	0	23	0	0	0	0	0	0
24	5.1	20.1	0	18.8	0	0	24	0	0.6	0	0	0	0
25	0	0	0	0	6.4	0	25	0	5.7	18.1	3.2	0	0
26	0	2.8	0	0	44	0	26	0	0	33.5	11.4	0	0
27	0	0	0	0	17.3	0	27	1.2	14.5	3.8	0.7	0	0.6
28	0	0	43	0	11.9	0	28	0.8	0	20.1	0.3	0	0
29	0	0	0.2		0.6	0	29	1	0	7.4	0	0	0
30	0	0	0		5.6	0	30	0	0	24.9		2.5	0
31		0	29.4		0		31		0	6.1		12.3	
Total	19.2	110.9	183.8	149.0	215.0	1.2	Total	22.4	46.0	299.8	46.5	106.8	73.0

Trend of a Decade

Annual Rainfall Record at Chileka Airport for Last Decade (average: 818 mm/year)							
year	89 / 90	91 / 92	92 / 93	93 / 94	94 / 95	95 / 96	96 / 97
annual RF	778.1	833.5	652.5	743.5	695.5	546.0	969.2
comparison	comparabl	comparabl	low	comparabl	low	low	high
year	97 / 98	98 / 99	99 / 00	00 / 01	01 / 02	02 / 03	03 / 04
annual RF	1431.2	986.3	954.8	706.3	884.9	679.1	594.5
comparison	anomal	high	high	low	comparabl	low	low
Monthly Rainfall Record at Chileka Airport							
period	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	average
1989~1998	84.3	164.1	236.1	180.8	98.2	44.7	134.7
2002~2003	19.2	110.9	183.8	149.1	215.1	1.2	113.2
2003~2004	22.4	45.9	299.8	46.5	106.8	72.9	99.1
comparison	low	low	equiv.	low	high	equiv.	declining

The Study Area is located in a concave pocket surrounded by hills and mountains where rain-clouds stay hanging and precipitating. Therefore, land with higher altitude receives higher annual rainfall by 70~80% than lowland. Lunzu River has a part of watershed in this

mountainous area sustaining basic perennial flow. Table 2-1 gives monthly rainfall in Chileka Airport, a few kilometer away from the southern border of the Study Area.

Precisely, annual rainfall pattern in southern Malawi follows a bimodal with major season falling on November to April and minor one from July to September. Albeit, actual precipitation has not been recorded in the Study Area during minor season though large hills and mountainous area often receive foggy showers called "chiperoni". As to monthly precipitation, most stable rain.can be expected in January.

Table 2-2 Monthly Rainfall (2004) at the Observatories near the Study Area

unit: mm

Name of Observatory	altitude	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
Chileka Airport	767m	4.2	22.4	46.0	299.8	46.5	106.8	73.0	598.7
Chileka Dip-Tank	640m	0.5	0.0	51.0	320.9	71.1	0.0	95.2	538.7
Chilangoma A. Station	801m	0.0	11.0	37.8	221.5	183.2	114.4	83.9	651.8
Khungulu A.Sattion	886m	9.0	4.0	78.0	331.0	114.5	100.0	54.5	691.0
Kanjedza A. Sattion	790m	10.0	11.0	109.0	247.5	124.0	0.0	105.5	607.0

General character of rainfall is observed as site specificity on account of orogenic nature, because rain intensely falls only beneath strips of proceeding cloud. It often occurs that villages on a line receive enough rain but adjacent ones do not receive a drop, thus causing a wide diversity by village.

Table 2-3 Meteorological Data Other Than Rainfall in Chileka Airport

month	mean minimum tem-perature ° C	mean maximum tem-perature ° C	mean atmos-pheric humidity %	mean diurnal sunshine hours hr/day	mean monthly evapora-tion mm	mean wind velocity m / sec
Jan.	20.2	28.5	79	6.6	163.1	3.8
Feb.	19.8	28.3	78	6.8	142.1	4.0
Mar.	19.4	28.1	74	7.1	140.5	4.9
Apr.	18.0	27.5	74	8.1	146.3	5.2
May	15.7	26.0	66	8.2	151.3	5.2
Jun.	13.7	24.2	66	8.0	146.2	5.5
Jul.	13.4	24.0	60	7.4	156.9	4.9
Aug.	14.6	26.3	54	8.6	187.2	5.7
Sep.	17.2	29.4	51	9.2	179.3	6.1
Oct.	19.5	31.3	54	8.9	295.3	6.4
Nov.	20.5	31.1	61	7.9	284.4	5.5
Dec.	10.3	29.3	71	6.7	220.4	5.0

Another outstanding climatic character is found in higher evaporation rate particularly in pre-rainy season. This gives detrimental effect to crops and seedlings susceptible to drought. For other meteorological factors, no particular problems are found.

2.1.4 Flora and Fauna

Last decade was epoch-making period for rapid disappearance of canopy cover observed by local aged people. In the Baseline Survey conducted in 2002, surveyors also identified that biodiversity in the Study Area underwent a typical decline represented by vanishing of *mopane* forest dominated by *Colophospermum mopane*. Although quantitative canopy cover cannot be

obtained from the result of the baseline survey, frequency of occurrence by tree specie in the villages of Study Area can be indicated. Mango tree, Eucalyptus (mostly *E.terticornis* but also some *E.camaldulensis* and *E. grandis* are found) and Cassia are by far common throughout the Area. These are not indigenous but planted exotic species. The characters of these are also tabulated in the Annex, among these mango is most important for the villagers because it gives nourishing fruit during famine season. Eucalyptus suits land conditions in the Area, and villagers have experienced its out-planting through the projects sponsored by MASAF etc. Cassia, along with *Gmelina arborea* and neem tree (*Melia azaderach*), has tough proliferation and surviving power than other exotic species, accrimatizing themselves to drying climate with deeply reaching root systems.

All the exotic species ranked higher in the inventory list of transect records are tolerant to drought spell and show faster growth than others. Frequently recorded species do not necessarily cover larger land area because observers' eyes tend to watch them planted at homestead or near housing quarters as hedge plant (*Thevetia peruviana*) etc. Generally speaking, exotic species are by far more commonly observed in the Area than indigenous ones mainly because of vanishing natural Miombo forest during deforestation process and substitution of indigenous canopy with exotic ones planted later. Deforestation has been accelerated since 1980s through charcoal production for vending in urban consuming areas.

Villagers fell trees that are suitable for charcoal production (for example *Brachystegia speciformis* and *Julbernardia spp*.) , while those that yield poor charcoal quality have left standing (such as *Adansonia digitata*, *Steculia quinqueloba* and *Terminalia sericea*). Shrub trees that are hardly browsed by goats, such as agro-forestry leguminous species including *Senna sepium*, *Tephrosia vogelii* and *Senna (Cassia) spp.,* tend to survive, giving additional advantage to these fast growing species.

As regards indigenous species, *Terminalia sericea*, *Lonchocarpus capassa* and *Brachystegia spp.* are most frequently found, but their occurrence is mostly confined to hill-side shrubs and cemetery yards where villagers traditionally do not enter to fetch firewood. Only *Lonchocarpus capassa* is widely found in cropped field owing to vigorous proliferation and deep rooting. Indigenous species tend to be concentrated in northern part of the Area (in the villages of Mdala, Nanjiwa, Makonokaya, Siyamudima, and Kaumbata) presumably on account of sparse population density and relatively higher firewood availability. In densely populated southern part where many households have to buy firewood, they only remain in grave-yards after rampant collection of firewood and production of charcoal.

In common, growth of indigenous tree species is much slower than that of exotic ones, and this would lead to faster disappearance of indigenous canopy than that of planted or exotic ones, particularly, hard wood species particularly *Terminalia sericea* (villagers use this timber for making mortar), *Pterocarpus angolensis* or *Kaya senegalensis & anthotheca* grow very slowly but their timber can be sold at dearer prices. *Terminalia sericea* and *Lonchocarpus capassa* bear abundant seed in younger age and this fosters higher survival rate than other indigenous species. Villagers do not have custom to plant indigenous tree species and this serves one of the causes of depleting lignous resources in and around their villages. Seed of indigenous trees is still available within their villages, but villagers have no idea to use it.

Some indigenous tree species are useful for medicinal use because majority of villagers cannot afford to go to medical doctors and clinics even though they seriously suffer from diseases. Bark or leaves of *Afzelia quanzensis*, seed and bark of *Melia azaderach* and *Cinchona succirubra* (material of anti-malaria medicine) are useful as free of charge herbal drugs for poor families. Villagers more and more feel difficulty in sustaining their families as resources available within their reach are depleting and failure of access to hitherto available ones may cause theft and other crimes. In fact, untapped tree stands in secondary forest around

Chilangoma Hill (especially Nanjiwa and Chakana villages) are recently subject to increasing poaching (theft felling) by strangers.

As regards fauna, natural resources related most closely to villagers comprise inland fish, rodents like wild mice and hares, monkeys and insects like bees and ants because many tribes serve these as food. Population of these fauna has traced a declining trend in proportion to the decrease in suitable area of habitats as a result of expanding reclamation and housing. Villagers catch fish by angling in major streams and Dams, where the majority species consist of cichlids, mostly exotic tilapia including *Oreochromis shiranus, O. mossanbicus, Tilapia rendalli*, *Barbus trimaculatus, Barbus paludinosus,* and *Clarias gariepinus*. Annual yield was estimated at a rate of 318 kg/ha/year, or about 1 ton/ year in this dam (with the catchment area of 210 ha only).

2.1.5 Social Features

The Study area is characterized as an average of population density, vegetative cover and topography among the watershed area of Lunzu~Lilangwe Rivers.

Table 2-4 Socio-Economic Conditions of Target Villages

Village	Population		No. of house-hold	Land area	Arable Land / HH	Wood lot / HH	Village (tube) Well	Peren-nial Stream flow	Soil-water condi-tion	Annual rainfall	Distance to market
	male	female		ha	ha	ha	number			mm/yr	km
01. Makonokaya	109	121	56	164	1.36	0.32	0	Lunzu	Dry	600	8
02. Siyamudima	118	105	168	119	0.35	0.06	0	Lunzu	Dry	600	8
03. Kaumbata	308	406	112	316	1.54	0.77	1	Lunzu	Dry	600	6
04. Mdala	278	454	306	801	0.63	0.21	2	Nkokod	Drier	550	3
05. Nanjiwa	116	373	120	234	0.61	0.49	1	Nkokod	Mediu	650	1
0. Chikoja	246	269	169	233	0.33	0.08	1	Namilango	Dry	650	6
07. Manjelo	76	109	67	69	0.34	0.15	1	Milalad	Humid	600	7
08. Teula	231	213	142	127	0.22	0.06	0	Milalad	Humid	600	6
09. Chakana	57	75	50	49	0.29	0.04	0	Nkokod	Dry	600	2
10. Lemu	420	578	496	349	0.41	0.27	1	Nkokod	Humid	600	3
11. M. Ngondo	109	121	82	107	0.65	0.18	1	Nkokod	Humid	600	3
12. Kammata	534	659	244	171	0.12	0.04	1	no	Mediu	650	4
13. Kumanda	130	147	46	127	1.15	0.24	0	no	Dry	600	3
14. T. Kenji	116	137	56	36	0.11	0.04	1	no	Mediu	600	5
15. Chilangali	70	170	40	51	0.5	0.31	1	Ntenjela	Mediu	600	6
16. D. Mbeza	41	71	41	70	0.73	0.34	1	no	Mediu	600	6
17. Kamwendo	260	372	59	315	0.99	0.18	1	Ntenjela	Mediu	650	5
18. Peter Bilila	195	240	72	129	0.19	0.08	1	Ntenjela	Humid	700	5
19. Ndemanje	127	108	38	144	1.11	0.52	0	Lunzu	Humid	700	5
20. S. Mpombe	119	156	65	45	0.32	0.26	1	Lunzu	Humid	700	5
21. Kateya	21	22	23	15	0.15	0.03	2	Nten-	Mediu	700	4
22. Maluwa	73	55	62	45	0.32	0.03	1	Lunzu	Medium	700	4
23. Kumponda	102	144	264	190	0.53	0.09	1	no	Dry	700	3
24. KChigumula	595	295	890	102	0.09	0.05	1	Ntenjel	Medium	700	2
mean / village	4,151	5,700	2,938	4,008	0.49	0.14	0.83	0.9	Medium	635	4.6

Note: Data were collected from MP Report 1999, and up-dated by the Baseline Survey 2002 for population / household

They are chosen according to the selection criteria of the Model area in the M/P among the major tributaries of Shire River in the Middle Shire basin.

Administratively, 17 villages located in the central to the northern part of the Study Area belong to TA Kuntaja and 7 others located in the southern part to TA Kapeni. Socio-economic conditions of the Study Area are tabulated in Table 2-4.

Salient features of social dimension include relatively higher proportion of female population. This is partly attributable to immigrant labor power of male from villages to urban center and

also to longer life expectancy of female family members. Recently, many cases happen where one parent or both of parents die leaving one or two children per household, leading to fewer family members in a household (2.5 persons/ household) and rapid increase of orphans. Arable land per capita accounts for 0.2 ha from which 160 kg of maize grain is expected. Woodlot availability per household is estimated at 2,100 m^2, or 840 m^2 per capita, from which only 500 stands remain per person. About half of currently standing trees are standing in the grave-yards, hence they cannot be used as firewood. A village has only 0.8 well for drinking water where 500 villagers rely on per tube-well. Also, one out of five villages does not have perennial stream, and villages without perennial streams cannot but ask favor of riverside villages to fetch water. Half of arable land has dry soil where risk of drought damages is higher. Annual rainfall shows only 633mm, implying that some villages actually receive precipitation equivalent to that of semi-arid zone like Sahel zone. The mean distance to the nearest market shows 4.6 km (more than 9 km to and fro, indicating remoteness of these village sites. Thus, living atmosphere is not necessarily acceptable to the inhabitants in the Study Area.

2.2 Environmental State of the Study Area

The Study area has experienced an explosive expansion of population during 1980s and 1990s, although now turning into a declining trend triggered by a prevalence of AIDS during late 1990s. It had abundant deposit of firewood at that time that sustained the expanded population through their own consumption and sale of charcoal. As an aftermath of accelerated wood consumption, the crown coverage of the Study Area dropped from over 20% to only 4% in the end of 20th century (Surrounding TAs, like TA Makata and TA Machinjili lost more forest to less than 2%).

Very few of these villagers are aware of future outcome of measureless exploitation. In other TAs like Machinjiri and Mpama (adjacent to Blantyre~ Limbe City), villagers now have to pay 10~20 MK for buying day to day firewood in spite of their meagre annual income (mostly less than ten thousand MK per family). As demand for firewood increases, price will naturally escalates and it never fails to make additional burden on villager's livelihood. Yet, there is not any concrete prospect of fuel substitution because other energy (electricity, oil, coal, gas and even briquette) costs are evidently higher than firewood in Malawi.

In the Study Area, forests remain in graveyards where villagers have traditionally refrained from fetching firewood, currently accounting for 40% (over 4 ha per village) of the remaining canopy cover as a whole. After villagers felled wood to burn charcoal within their villages, they didn't replant any trees, partly because seedlings were not available or they cost dear for them, partly because they needed to expand maize field to offset eroding yield level. As no data is available as to former land use in the Study Area, there is no way other than deducing from the past development through the memory of elder villagers. During eighties and nineties arable land area in the Study Area increased by about 60% (from 25% to 40%) according to the estimation of Blantyre RDP based on hearing of village cadres during workshops in 2002. It meant that area under woodlot and natural forests shrank from about 30% to 15%.

The extension staffs involved in the Pilot Study identified a number of limiting factors to restore the lost natural resources and deteriorated environmental structure, as listed below:

(1) Vicious circle of poverty~ lack of inputs and techniques~ no means of development,
(2) Shortage of land to plant trees, both village woodlots and private ones.
(3) Shortage of manpower to participate in participatory works to plant trees,
(4) Lack of background education, basic knowledge, experience and organization,
(5) Insufficiency of assistance by extension services, official aid arrangements,
(6) Difficulty in finding threshold of rehabilitation, leaders or initiative takers and
(7) Undermined villager's health, power and spirit by lingered malnutrition.

Table 2-5 gives land use in the Study Area as of May 2002. According to this breakdown of land use, forest/ woodlot and natural shrubs account for a sixth of the surface area, but the area viable for fetching firewood is only a third of this area, including reforested part in the Pilot activities. 20 households rely on 1 hectare of viable woodlot against the optimum rate of 6 - 7 household per hectare. Wasted land is currently under fallow, earth borrowing area of brick production and idle land owned by absentee landholders.

Table 2-5 Land Use in the Study Area

unit: ha

Village	Village Area	surveyed Area	Rainfed Arable L.	Forest & Shrubs *	Grave-yard	Irrigated dimba L.	Home stead	Wasted Land	Other Land Use	* of which viable lots
01. Makonokaya	164	164	76	18	22	4	22	1	21	11
02. Siyamudima	119	119	58	9	1	3	20	9	19	3
03. Kaumbata	316	316	176	82	6	4	24	8	16	20
04. Mdala	801	362	192	57	7	5	37	55	9	10
05. Nanjiwa	234	197	97	75	3	3	12	5	2	5
0. Chikoja	233	233	115	23	5	3	36	30	21	11
07. Manjelo	69	69	23	10	0	2	6	20	8	4
08. Teula	127	127	55	7	9	4	15	13	24	7
09. Chakana	49	49	16	6	2	3	9	4	9	6
10. Lemu	349	349	145	88	5	4	57	24	27	12
11. M. Ngondo	107	98	52	14	0	1	8	14	9	3
12. Kammata	171	87	36	3	9	1	18	9	11	3
13. Kumanda	127	102	38	9	0	3	20	25	8	9
14. T. Kenji	36	18	6	2	1	0	4	3	2	1
15. Chilangali	51	51	21	13	0	0	9	4	4	1
16. D. Mbeza	70	70	30	14	0	0	4	12	10	1
17. Kamwendo	315	315	152	24	16	1	62	38	22	24
18. Peter Bilila	129	45	14	5	1	1	6	9	9	3
19. Ndemanje	144	144	88	30	17	2	7	0	0	30
20. S. Mpombe	45	54	21	16	1	2	7	4	3	1
21. Kateya	15	15	5	1	0	0	2	3	4	1
22. Maluwa	45	45	20	2	2	1	8	5	7	2
23. Kumponda	190	51	23	4	1	1	4	9	9	1
24. KChigumula	102	45	15	3	5	1	9	4	8	1
mean / village	4,008	3,125	1,474	515	113	49	406	308	262	170

Details of the 7 limiting factors listed above will be discussed in the following section. Judging from current composition of land use, there seems only one solution, to use wasted-land, cropped land and fallow as mentioned in Chapter 4 and 5.

Although forest and woodlots occupy 16% of the total land use in the Study Area, actually available part accounts for only 4% thereof (based on photo-interpretation of M/P Study). Such meager canopy coverage has fostered soil loss and erosion along farm paths and unpaved roads, sometimes reaching as deep as 2~3m below the ground surface. Luckily, since livestock density has been kept low on account of frequent robbery by foreign invaders happened during the past decades, environmental damages by overstocking could have been avoided. Nevertheless, loss of both desirable soil structure and plant nutrients has occurred since denudation of surface vegetative cover has started, eventually affecting agricultural and livestock productivity.

By the way, the jurisdiction of RFO(S) covering 21,162 km^2 of the southern part of Malawi, 11,019,673 and 16,778,600 tree seedlings were planted in 2002 and 2003 respectively. This was equivalent to 6.6 trees/ha, or accounting for 0.11ha/ km^2. The number included those planted in National Forest Reserves. As regards village woodland, about 1,100 existing villages has 491 village forests that cover the area of 713.3 ha or 1.45ha/village.

2.3 Baseline Survey and Results of Workshops by PIU

Baseline survey was conducted at the initial stage of the Pilot Study through a subcontract to an NGO (The Wild Life and Environment Society of Malawi). It was carried out in workshops held in each of target villages where villagers were invited and facilitators led them to a discussion on daily life in the villages, where extraction and identifications of constraints, issues and problems, their inter-relationships, vicious circles, social structure, characters of gender issues, villager's and their groups' activities were made. The obtained results were analyzed village-wise, and the base of village data was created so that they could be compared with later results obtained each year from Pilot activities. In parallel with this survey, PIU staffs carried out introductory workshops where villagers in a target village were called to involve in a consultation with PIU on what components were applied to, how they were implemented and what concept and understanding they kept in mind as to village environment and resource conservation.

Table 2-6 Social Division of Daily House-keeping

Boys	Girls	Men	Women
➢ Digging rubbish pits, pit latrines ➢ Building houses ➢ Molding bricks ➢ Chopping firewood ➢ Washing plates ➢ Gardening ➢ Commuting to Miller ➢ Shearing maize ➢ Mice digging ➢ Drawing water ➢ Income generating activities	➢ Sweeping ➢ Smearing floors ➢ Gardening ➢ Drawing water ➢ Pounding maize ➢ Cooking ➢ Income generating activities ➢ Caring for children ➢ Washing ➢ Firewood collection ➢ Commuting to Miller	➢ Looking for food ➢ Farming ➢ Molding bricks ➢ Holding Cash ➢ (Same as boys)	➢ Cooking ➢ Washing ➢ Fetching relish ➢ Caring for children ➢ Sweeping ➢ Gardening ➢ Cutting grass ➢ Construction of bathrooms ➢ Doing businesses ➢ Firewood collection ➢ Distribution of jobs
➢	➢	➢ Income keeping	➢ Income keeping
➢	➢	➢ Decision maker	➢
➢	➢	➢	➢ Heritage

The major findings obtained from the Baseline Survey are summarized in Table2-1 ~ Table 2-8. In social aspects, villagers belong to a matriarchal society where marked division of works has traditionally been kept with biased role inclined to women. In this society, women are more robust than men and willingly take part in many activities. They have longer life expectancy than that of male household members. Also, women constitute major elderly household member. Throughout the survey, villager's lack of quantitative concept impeded precise grasp of what were aimed at, because no measuring tape, no balance, no watch or no calendar is available in the villages. Consequently, quantitative or time sequential comparison could not be made between two periods, i.e., before the implementation of Pilot Study and thereafter.

More women attended to workshops both in the Baseline Survey and in orientation by PIU staffs than male villagers. Recent development indicates frequent deaths of younger generation leading to increased orphanage families rather than lady-headed ones prevalent a decade ago.

Table 2-2 gives functioning of village organizations. bore-hole, health and school committees consist of major community activities to which villagers attach importance, followed by security, assistance for orphans and forestry. Committees have been established by activity, where villagers' activities for the sector are planned and implemented. The members have provided by-laws, collected maintenance levies, periodically reported routine results and others, but some of

the committees have nominally remained, not necessarily functioned as initially expected Villagers' interests have been focused on these maintenance / management activities. Village development and forestry follow these core activities but attracts less interest. In these years committees of security and orphanage have been increasing because of rising trends of theft cases and orphans. In some cases, they have failed to solve or cope with the issues and problems posed to the committees. Here, leadership of the village chiefs and cadres has influence on their activities and functions of the committees (usually 3~4 committees have been established per village), and the difference of governance among villages has led to differentiation in the state of organizational activities.

Table 2-7 Village Organizations and Their State of Functioning

Village	VDC	Forestry	Borehole	Orphan*	School	Health	Police**	PTA	Others
1.Makonokaya		I		E		I			(W) FWS
2. Siyamudima		A		E	E	I			
3. Kaumbata		E	E		W				
4. Mdala		W			W	I	W		
5. Nanjiwa			I		W	W	E		
6. Chikoja			W			W			(W) R.C.
7. Manjelo			I	I	W	E			(W)Counselor
8. Teula	W					W	W		(W) UDF
9. Chakana			I		I	E			
10. Lemu	A				A	E		I	
11. M. Ngondo		N	W		E	W			
12. Kammata	E		E		I		E		
13. Kumanda	W			W		W			(W)
14. T. Kenji			W		N				(W) R.C.
15. Chilangali	W		W						(W)A.C.
16. D. Mbeza									****
17.Kamwendo	E			E			E		(E) UDF
18. Peter Bilila			W				W		
19. Ndemanje	A		A		A	A			
20. S.Mpombe			A	A		A	A		
21. Kateya			W						
22. Maluwa	I				I	I			
23. Kumponda			A		A	A			(A) S.C.
24.K.chigumura	W	W		W					(W) H.E.
T o t a l	9	6	14	7	13	15	7	1	83 (3.5***)

Note: A; active, E; efficient, W; weak, I; inactive/ inert, N; not at all working, * Sometimes called "Youth Club", NGO called "DAPP" supports it with a fund. ** also called Security /Neighbor Watching. W; willing A; active, E; Effective, I; inactive, N; not functioning Borehole supported by Concern Universal with a fund. UDF; Union democratic front (political party), H.E.; Home Economics, S.C.; Social Committee, R.C.; Red Cross, FWS; Fresh Water Slab, A.C. Advisory Committee, *** average number of committees per village, **** no organization is formed in the village..

The character of function in this table reflects importance attached to the committees, character and intention of village chiefs and committee members. These results of evaluation were deduced from the attendants to the workshops, replying to the questions by facilitators. In most cases, substantial solutions can hardly be brought about by these committees' decisions, but these function as solution seeker who carries the issues to NGOs, government agencies and other assistant organizations, including private orphanages, MASAF and extension offices.

Table 2-3 gives the state of extension activities in the Study Area. The results are characterized by poor visit of extension staff to the Study Area. This is attributable to lack of means of transport to their service area. However, if an assigned staff lives near the village, he/she can visit frequently. If some attracts him/her, for example chance to acquire loans for the extension staff himself/herself, he/she will visit the villages. Usually, an assigned staff should cover a lot of villages by bicycle, hence his/her visiting frequency is affected by distance from residence.

Among various extension services, agriculture has the highest evaluation by the villagers, followed by health. Forestry extension was negatively assessed perhaps on account of rare visit to the villages and most villagers did not make acquaintance with staff in charge of home husbandry due presumably to low attendance to the villages by the staff living in urban areas.

Table 2-8 Extension Activities Delivered to the Villages

Village	Agriculture	Forestry	Health	Community Development
1. Makonokaya	N. irregular visit	N. lack of tools	A. drug delivered	N.service not given for home
2. Siyamudima	W. male, few visit	A. male, helpful	W. irregular visit	N.service not given for home
3. Kaumbata	W. rarely visit	E. nursery built	W. irregular visit	N.service not given for home
4. Mdala	N. no casual visit	N. interest faded	N. no visit at all	N. for livestock care
5. Nanjiwa	E. regular visit	E. nursery planned	A. clinic provided	N.service not given for home
6. Chikoja	VE. manure made	VE. seed supplied	N. irregular visit	N. service not existing
7. Manjelo	A. skill instructed	N. no visit at all	A. drug delivered	W. only nominal activity
8. Teula	E. lady, very useful	E. lady, very helpful	N.service not exist	N.service not given for home
9. Chakana	VE. manure made	VE. seed supplied	N. no visit at all	N. service not existing for home
10. Lemu	W. lack interest	W. irregular visit	W. irregular visit	A. for education, vet. also
11. M. Ngondo	N. no field visit	N. no site visiting	N. but helpful	N. services not existing
12. Kammata	VE. manure made	E. nursery taught	VE. hygiene kept	E. for animal vaccination
13. Kumanda	W. seldom visit	N. service not exist	A. drug delivery	W. seldom visit
14. T. Kenji	E. but livestock W.	N. no visit at all	E. drugs provided	N. service not existing
15. Chilangali	A. manure made	N. staff unhelpful	N. staff is lazy	N. no development staff
16. D. Mbeza	A. good advice	N. irregular visit	E. monitor well	N. services not existing
17. Kamwendo	E. lady staff	N. no visit for 6 yrs	N. male staff	N. lady living too remote
18. Peter Bilila	N.service not exist	N. service not exist	E. male, helpful	N. service not existing
19. Ndemanje	A. lady helpful	N. no visit at all	E. drug supplied	E. for livestock technique
20. S. Mpombe	A. lady helpful	N. no casual visit	N. no regular visit	A. lady staff is helpful
21. Kateya	N weak concern	N. service not exist	N. service not exist	N. service not existing
22. Maluwa	E. skill training	E. created nursery	E. drugs supplied	E. veterinarian's vaccine
23. Kumponda	E. only livestock	N. poor visit	E. staff active	N. service not existing
24. K.Chigumura	W. lady staff	N. no visit for 6 yrs	E. drugs provided	N. lady living too remote
T o t a l (E=A)	VE3, E11, W5, N5	VE2, E6, W1, N15	VE1, E11, W3, N9	E5 , W2, N17

Note: E; Effective, A; Active, W; Weak, N, Not Acting, or not effective, worst one is "service not existing"

As for the extraction of the constraints through "problem tree" approach, the following results are obtained in the Baseline Surveys:

1) Vicious circle of poverty has trapped the villagers in an endless ring, poverty~ lack of inputs and techniques~ no means of development~ impoverishment. Therefore, an injection of inputs may give them to get rid of the circle. However, they do not know how to sustain the proper and efficient use of inputs so that only one chance of receiving them can yield benefit to maintain production cycle. It follows that technical transfer accompanying with the input supply is indispensable.

2) Shortage of land to plant trees for both village woodlots and private lots poses a difficulty in developing forestry activities. It is necessary for the villagers to create their private woodlots near their houses, otherwise frequent poaching damages by invaders would end up their efforts of planting trees in vain. Also, as most village land has already been allotted to individual households, no additional land can be employed to create new village woodlots remain in most villages concerned.

3) Shortage of manpower to participate in participatory works to plant trees would pose another noxious issue as observed in small villages where orphanage households account for fairly large portion. Elderly people are not suitable to be involved in heavy works for raising seedlings and out-planting them on wasted land and other hard ground.

4) Lack of background knowledge, experience or organization also act as hazard in developing new activities in traditionally closed communities. In most villages, no one has sense of improving life, environment and society. Without relevant sensitisation or enlightenment villagers feel difficulty in comprehending what extension staffs or facilitators explain to them on thee matters.

5) Insufficiency of assistance by extension services, official aid arrangements for helping villagers to take actions for something new may inhibit development of villager's will to tackle a new trial in their villages. Rural society without outer communication is just like an isolated island where only inertia predominates.

6) Difficulty in finding threshold of rehabilitation, lack of leaders or initiative takers to mobilize villagers may also retard implementation of environment conservation.

7) Undermined villager's health, power and spirit by lingered malnutrition attenuate resolution of their actions to rehabilitate or conserve living environment, even if they intended so. In particular, ephemeral life of rural inhabitants fosters inertia, reluctance or rejection to struggle with far-reaching activities like forestry, land conservation and watershed rehabilitation. Food security and nutritional amelioration are essential preconditions for villagers to evoke their intention to be engaged in conservation works for their own sake.

These facts imply importance of prior approach to the target population to motivate them to take measures for improving aggravated and devastated living environment.

Table 2-9 Problems Encountered by Village in May 2002

Village	Hunger famine	Theft	Prosti-tution	Defore-station	Village	Hunger famine	Theft	Prosti-tution	Defore-station
1.Makonokaya	O			O	13. Kumanda	O	O		
2. Siyamudima	O	O	O	O	14. T. Kenji	O	O		O
3. Kaumbata	O		O		15. Chilangali	O	O		O
4. Mdala	O	O		O	16. D. Mbeza	O	O		O
5. Nanjiwa	O	O			17.Kamwendo		O		O
6. Chikoja	O	O		O	18. Peter Bilila	O	O		O
7. Manjelo	O		O	O	19. Ndemanje	O	O	O	
8. Teula	O	O	O		20. S.Mpombe	O			O
9. Chakana		O		O	21. Kateya	O			
10. Lemu	O	O	O		22. Maluwa		O		
11. M. Ngondo	O			O	23. Kumponda	O	O		O
12. Kammata		O	O	O	24.K.chigumura	O	O	O	
Rate suffering	83%	67%	33%	62%	Total 24 villages	20	18	8	15

Table 2-10 shows survey results of firewood availability. The whole Study Area has already been suffering from firewood scarcity to the extent that 40% has failed to supply within the village though 45% can meet village demand. Villagers have to travel about 2km taking 3 hours to fetch firewood a few times a week. About 60% uses primitive, three stone type fireplace for cooking. The observed changes in firewood supply was brought about since a few years back because villagers admitted that firewood trees were enough to supply firewood in 1990s. As shown above, villagers have to sell firewood amidst acute shortage to sustain their families and 18 villages out of 24 actually sell firewood (some even charcoal), and they fear dwindling depletion of firewood resources within their reach. Amidst such scanty resource situation, some northern villages still continue to produce charcoal for illegal sale.

Graveyard constitutes a major portion of wood, accounting for 40% of canopy cover in the Study Area, but this is traditionally sacred place where no firewood fetching is allowed. This is

one of the reasons why housewives and girls have to walk hours to fetch firewood. Nowadays, villagers use crop residue, dried grass and shrub cuttings as daily firewood and sometimes the rate of these subsidiary fuel occupies major portion of household fuel consumption.

Table 2-10 Firewood Availability by Village

Village	relative availability of wood in village	distance & time of fetching wood	recent change in firewood resources	pattern of firewood use in households
1. Makonokaya	some buy from neighbors	0.5km, 1~2hrs, daily	have to use residue stalks	only 3 stone type
2. Siyamudima	use also residue stalks	0.5~1km, 1~3hrs,1/w	1~2.5 hrs to cook a day	people want mud stove
3. Kaumbata	shrubs along streams	1~2 km, 2hrs. daily	difficult to fetch headload	only 3 stone type
4. Mdala	getting scarce these years	0.5 km, 2~3 hrs	difficult to fetch headload	only 3 stone type
5. Nanjiwa	fairly easily available	0.5 km, 30min. daily	local trees often stolen	only 3 stone type
6. Chikoja	Nkokozi river basin	2~4km, 5~7 hrs, 3/w	difficult to fetch headload	people want mud stove
7. Manjelo	Milala Dam basin	2~3km, 1.5hrs,daily	a felled tree lasts a week	only 3 stone type
8. Teula	barely self-supplied	3~4km, 5 hrs, once/w	a headload lasts 3 days	only a house has mud stove
9. Chakana	very scarce in hills	1 km, < 1hr. daily	difficult to fetch headload	only 3 stone type
10. Lemu	use also residue stalks	1.5 km, 3 hrs, 1/week	< 3 hrs. a day to cook	only 3 stone type
11. M. Ngondo	hill & indigenous trees	2 km, 6 hrs	headload lasts 7days	3-stone, digging hole
12. Kammata	using Eucalyptus branches	2 hrs. 1~2km, daily	also use residue stalks	3 hrs a day by 3-stone
13. Kumanda	shrubs of Milala Dam	1 km, 15min. 2~3/week	a headload lasts 2 days	only 3 stone type
14. T. Kenji	at times using stalks	3~4km, 5 hrs, once/w	headload lasts 7days	mud stoves destroyed
15. Chilangali	scarcity problem arises	1 ~2 km, twice a day	headload lasts 7days	few use charcoal stoves
16. D. Mbeza	barely self-supplied	2 km. < 1 hr.	headload lasts 3~7days	people want mud stove
17. Kamwendo	fetching within village	1 km, 3 times a week	3.5 hrs a day by mafuwa	only 3 stone type
18. Peter Bilila	barely self-supplied	2 km, 2~3 times/w	cooking 6 hrs/day	only 3 stone type
19. Ndemanje	riverside shrub	1 ~ 2 km, 1.5 hrs	resource declining	mostly 3 stone type
20. S. Mpombe	from hill, also m. stalks	3 ~ 5km, 2 hrs /day	fetching twice a day	few use mud stoves
21. Kateya	at times buy roadside	0.5~2km, 1hr	headload lasts 3~7days	usually 3 stone type
22. Maluwa	getting much scarcer	5~10km, 2~3times/w	headload lasts 7days	few use mud stoves
23. Kumponda	wood remains riverside	0.3~3 km, 0.3~1hr	2.2 hrs to cook a day	mostly 3 stone type
24. K.Chigumura	75% buying wood	100m, < 1 hour	cost = MK20 / day	very few use charcoal
T o t a l	S:10, SS: 3, A:11	1.4~2.4km, 3.2hrs	BF; 2, DTFH; 4, O;18	3S only; 14, mix;10

Note: Abbreviations; m; maize, S; scarce, SS; still barely self supplied, A; available, DTFH; difficult to fetch head-load, BF; Buying firewood, O; other situation. hrs; hours, /w; per week

Table 2-11 Available Village Natural and Livelihood Resources, Labor Opportunity

Village	Firewood availa-bility	Goat head equivalent of livestock per villager	Irrigable field (ha)	Dry season months of vegetable production	Grass-land area (ha)	Bamboo & sedge growing area (ha)	Recent planting of trees (ha/year)	Labor force for tillage/ fetching wood/water	Chance of IGAs in village	Chance of wage earning in village
Makonokaya	1.5 medium	0.5	4	4	29	10	0.1	126	0	0
Siyamdima	2.0 medium	0.5	3	4	24	8	0.06	124	0	0
Kaumbata	1.5 medium	0.1	4	4	38	13	0.3	393	1	0
Mdala	2.5 poor	0.8	5	3	48	16	0.06	402	1	0
Nanjiwa	0.5ample	1.0	3	3	24	8	1.1	269	1	0
Chikoja	6.0 low	0.3	3	3	22	7	0.5	282	1	0
Manjelo	3.0 poor	0.2	2	5	6	2	0.4	102	0	0
Teula	5.0 low	0.1	4	5	11	4	0.2	244	0	0
Chakana	0.5ample	0.1	3	2	9	0	0.0	72	0	0
Lemu	3.0 poor	0.2	4	5	31	10	0.3	549	1	0
M. Ngondo	6.5 low	0.0	1	3	14	2	0.1	127	1	1
Kam'mata	0.3ample	0.1	1	3	6	1	0.56	657	0	1
Kumanda	1.0 medium	0.1	3	3	5	1	0.2	153	0	0
T. Kenji	0.3ample	0.0	0	0	2	0	0.5	138	0	0
Chilangali	0.4ample	0.3	0	0	7	1	0.3	152	0	1
D. Mbeza	0.5ample	0.3	0	0	17	0	0.2	61	0	0
Kamwendo	1.5 medium	0.5	1	3	11	1	0.36	347	0	0
Peter Bilila	1.5 medium	0.4	1	3	5	1	0.5	239	1	0
Ndemanje	2.0 poor	0.3	2	4	22	5	0.36	130	2	0
S. Mpombe	2.0 poor	0.1	2	4	3	2	0.24	152	1	0
Kateya	5.5 low	0.1	0	0	1	0	0.44	23	0	0
Maluwa	0.4ample	0.0	1	4	12	1	0.0	70	0	0
Kumponda	0.7 medium	0.3	1	4	6	1	0.3	135	1	0
K. Chigumula	0.5buying	0.1	1	3	2	0	0.1	489	1	0
Total /mean	2.1 poor	0.3	49	3	15	4	0.3	227	0.5	0.1

Note: firewood availability; figures indicate fetching hours by one way., Chance of IGAs within villages is found in gardening in dimbe, and wood processing or brick baking. Only MASAF road construction has given wage earning opportunity to villagers.

Table 2-11 indicates a general base of income generating sources by village, where results of workshops (with transect) held in parallel with the Baseline Survey has been input for quantification. From this table it is understood that villagers kept very few heads of livestock, few tree planting with very limited availability of firewood for sale and self-consumption, few chance of IGAs within their village. On the other hand, they had enough grass land to pasture, enough bamboo source for cottage industry and comparatively sufficient area of year-round irrigation and idle labor force though most of them were too hunger stricken to work hard. Labor opportunities offered waged schemes of road construction or reforestation sponsored by MASAF, NGOs and other supporting agencies.

Table 2-12 IGAs available in the villages in May 2002

Village	Retail hawking	Beer brewing	Sale of firewoo	vegetabl e	Village	Retail hawking	Beer brewing	Sale of firewood	vegetable marketing
1.Makonokaya	M		O		13. Kumanda	M, B			
2. Siyamudima		O	O		14. T. Kenji	G		O	O
3. Kaumbata		O	O		15. Chilangali	Q	O	O	
4. Mdala		O	O		16. D. Mbeza		O	O	O
5. Nanjiwa	L	O	C	O	17.Kamwendo	S, G	O		O
6. Chikoja	C	O			18. Peter Bilila	C	O	O	
7. Manjelo					19. Ndemanje	M, H			O
8. Teula	F	O	C		20. S.Mpombe	Q, C	O	O	
9. Chakana	C	O	C		21. Kateya		O	O	O
10. Lemu	M, F		O		22. Maluwa	Q	O	O	
11. M. Ngondo	G	O	C	O	23. Kumponda	Q, C	O	O	
12. Kammata		O	W	O	24.K.chigumura	Q, F			
Rateengaged	71%	71%	75%	33%	Total 24 villages	17	17	18	8

Note: M;mat, L; livestock, C; charcoal, F; food, G; grocery, F; fish, Q; querry products, S; sand, H; honey, B; brick, O; existing

Table 2-13 Summarized Brief of Baseline Survey

Village	Population and Density	House -hold No.	Resource village land area	Resource Crop field (ha)	Resource woodlots (ha)*	Resource woodlot & G. yard	Village organi-zations	Benefit of Extension Activities	Grave Yard	Major Economic Activities
Makonokaya	230, 1.3	56	164	54	4	buying	3 inert	poor	22.1	reedmat sale
Siyamdima	232, 1.4	119	119	61	3	depleting	4 efficient	poor	1.2	brewing beer
Kaumbata	714, 2.3	112	316	126	22	remaining	3 efficient	poor	6.3	firewood sale
Mdala	732, 0.9	306	801	136	16	depleting	4 weak	no visit	6.9	vegetables
Nanjiwa	489, 2.1	120	234	94	17	self supply	4 ordinary	efficient	2.5	charcoal sale
Chikoja	515, 2.1	169	233	135	7	remaining	3 weak	ordinary	4.7	brewing beer
Manjelo	185, 2.7	67	69	47	3	remaining	4 efficient	ordinary	0	vegetables
Teula	444, 3.5	142	127	51	4	depleting	3 weak	ordinary	8.9	vegetables
Chakana	132, 2.6	50	49	27	2	depleting	3 inert	ordinary	2.5	vegetables
Lemu	998, 2.9	496	349	244	23	remaining	4 active	poor	4.5	firewood sale
M. Ngondo	329, 3.1	82	107	37	3	remaining	4 efficient	no visit	0	vegetables
Kam'mata	1,193,7.0	244	171	51	3	self supply	4 efficient	efficient	8.7	firewood sale
Kumanda	277, 2.8	46	127	61	2	remaining	3 weak	poor	0	brick sale
T. Kenji	253, 3.6	56	36	12	2	scarce	2 weak	poor	0.9	vegetables
Chilangali	379, 7.4	40	51	26	3	scarce	2 weak	poor	0	firewood sale
D. Mbeza	112, 1.6	41	70	18	3	depleting	0 nothing	ordinary	0	vegetables
Kamwendo	632, 2.0	59	315	205	7	depleting	3 inactive	poor	15.7	firewood sale
Peter Bilila	435, 3.3	72	129	52	2	depleting	2 weak	some	1.4	firewood sale
Ndemanje	235, 1.6	38	144	48	3	depleting	4 active	som	17.3	firewood sale
S. Mpombe	275, 5.1	65	45	31	4	remaining	4 active	some	1.4	brewing beer
Kateya	44, 2.9	23	15	2	1	buying	1 weak	no visit	0	vegetables
Maluwa	128, 2.9	62	45	10	1	depleting	3 inactive	efficient	2.3	firewood sale
Kumponda	746, 3.8	164	190	106	2	remaining	3 active	poor	1	firewood sale
K. Chigumula	890, 8.8	160	102	38	1	buying	3 weak	some	5.3	cutgrass sale
Total	10,599, 2.6	2,7	4,008	1,672	138	depllet:9	3 weak	poor:9	113.6	wood:9 veg:8

Note: excluding area under grave yard, data in 2002

Table 2-12 indicated IGAs villagers had been engaged in before the Pilot activities, where sale of firewood including burned charcoal accounted for highest rate of engagement, followed by hawking and local beer brewing (from malt of finer-millet). A third of the target villages were marketing vegetables grown in marshy area (dimba).

2.4 Summary of Inventory Survey

Inventory survey was conducted on a subcontract basis to use as a reference of formulating Pilot components and planning management of established component activities. The survey covers major projects so far implemented in Malawi with similar objectives on environmental observation to what is aimed by the Study, including 9 cases of environmental observation such as forestry, 1 case of resource saving and 9 cases of income generating activities. A number of NGOs, parastatal organizations and government agencies have extended projects and schemes for IGAs, environment conservation, forestry and agro-forestry activities. In this survey, a subcontractor has prepared outlines and briefs of these on-going activities through the site survey and summarized them in a report. The Study Team made use of the report in selecting the sites of study tours for villagers, in collecting data and information concerned to provide IGAs, in procuring material and basic inputs for use in the Pilot activities. Table 2-14 presents the list of the survey. It can be learnt from this survey that many projects have been launched for taking measures to rehabilitate degrading environments, and they have been effectively utilized by local communities to sustain measures to cope with necessity arising from degradation.

Table 2-14 List of Inventory Survey

Project Name	Objectives	Supporting Agency	Period / Target	Place / Area
Team Tree Planting P.	Tree nursery/ outplanting	Limbe leaf tobacco Co.+	2003~ two village covered	Chiradzulu/Kapeni
Matindi Youth O.	Agro-forestry development	UNICEF, OXFAM etc.	2000~2002 6 villages	Matindi, Chigaru/Kapeni
Greenline Movement E.R.*P.	Agro-forestry development	OXFAM	2002~2003 5 villages	TA Stora, Machinga
Kamwamba SMIF** Pr.	Comprehensive IGAs	GTZ under SADC	1997~2006 13 villages	Mwanza East, 6,154 ha.
Mphuka Area Development P.	Agro-forestry/ Forestry	World Vision German	1994~ 36 villages Tyolo	Mphuka, Bvumbwe
Kachera Farmer's Club	Forestry~ IGAindustry	PROSCARP, NASFAM	1993~ 3 villages	TA Chiseka, Lilongwe
Chiradzulu C.H.# Gardens	Tree Planting	COMPASS, DAPP	2000~2004 34 villages	Chiradzulu District
National H & B Gardens	Plant specimen collection	GTZ, GEF (S.Africa)	2002 opened ~	Zomba City
Chikankheni B.M.***Club	Briquette Manufacture	OXFAM	2001~2003 20 villages	TA Mpama, Chiradzulu
Chikwewe Apiary Club	Bee-keeping	GTZ ~ WESM	1998~2002 1 village	TA Symon, Mofnza East
Chitsanzo Apiary Club	Bee-keeping	COMPASS	2001~2002 7 households	Lilongwe Natur
Magomero F.P.**** P.	Fruit Planting/processing	COMPASS, Dutch Soc.	2002~2003 3 villages	Magomero College
Mwambananji T.U.## Club	Vending Scones & IGAs	NGO(USA Trickle up)	2000~ 1 village15women	TA Chikodi, Zomba
Katunga Fish Farming P.	Fish Farming/ farming	OXFAM through ELDP	2000~2003 11 households	Zomba, Domasi
Mbwatalika Fish F.## P.	Fish Farming in fishpond	CPAR fund to 91 families	2000~2001 3 villages	TA Maliri, Lilongwe
Madalitso E.M.G. Club	Mushroom production	COMPASS	2000~ 11 households	Chiwembe, BlantyreCity
Kumbo Oil Refinary	Oil Extraction	self-Family savings	1996~ single family	TA Kuntaja, Michiru
Kachera T.P.### Club	Treadle pump /agro-forestry	DANIDA	1999~ 6 villages	TA Chadza Lilongwe S.

Note: P; project, O; organization, Pr.; program, * E.R.: Environmental Rehabilitation, **: Sustainable Management of Indienous Forests, ***;: Briquette Making, ***:* Food Processing, #: C.H.: Community Herbal, ##: Trickle Up, ###: F: Farming, ####T.P.: Treadle Pump, + Co: Company,

Major findings of this Survey are summarized as follows:

Links between Sustainable Village Natural Resource Management and the livelihoods of present and future generations manifest themselves in the economic, social and environmental context in which the majority of people depend for their well being which stems from the productive use of rural natural resources. Smallholder farmers, it has been claimed, mismanage the resource base and as such they are both agents and victims of soil erosion, degradation and deforestation.

It has lately been acknowledged that most policies aimed on agriculture and natural resources have not achieved the desired goals due to failure in incorporating local communities in planning and implementing programs. The top-down tendency that has been the approach whereby communities were simply told what to do without seeking and reflecting their opinion resulted in resistance among the local communities to fully comply with what the policies stipulate.

During the course of this Study it became more and more apparent to the Study team that if people have to adopt a programme innovation, they need to be convinced that it meets an important felt need. On the hand it became clear to the Study team that not all interventions were a response to a felt need from the communities. Inevitably development institutions that have adopted an integrated approach to development are guilty of introducing certain packages without properly consulting with the communities to assess their needs.

Environmental Rehabilitation

Environmental problems in Malawi are adversely affecting the lives of population. People depend on food, fuel and water from natural resources within their reach thereby making the community the main stakeholder in the management of resources such as forests, tress, the soil and water. The urgent need to combat rural poverty and to regenerate the deteriorated resources has stimulated a number of NGOs as well as government departments to actively search for new kinds of development and resource management strategies. The Study team therefore found that technologies and related practices were tried and tested to improve the management and conservation of natural resources in order to address the inter-related problems of soil erosion and water runoff, declining soil fertility and crop yields, wood shortages and deforestation being promoted through the following activities:

Agroforestry

For smallholder farmers the main thrust in AF remains the improvement of soil productivity, production of fuel wood for energy and domestication of indigenous fruit trees for improved nutrition and cash income. Communities were practicing a number of technologies such as homestead boundary woodlot planting, alley cropping with *Tephrosia vogelii* and contour vegetation strips using vetiver grass and elephant grass. It is however observed that this is common in farmers' gardens and they were actively involved with the particular institution promoting the technology. In most gardens especially vegetable, maize, tobacco, gardens orchards farmers were practicing live fencing using sisal (*Agave*), *Leucaena* and *Tephrosia*.

It is also observed that contour ridging, alley cropping and systematic tree intercropping technologies had very low adoption rate amongst farmers although they were available in a number of farmers' fields. With contour ridging which involves construction of contour ridges and re-aligning of planting ridges households found the technology labor intensive. On the other hand systematic intercropping with such tree species like *Faidherbia albida* is found to give long lasting benefits due to sluggish growth in most parts of areas visited. However the tree would grow faster in low-lying areas (especially in Dimba, or marshy land patches).

Households also did not seem to know amount and frequency of application of biomass in the planting stations and the magnitude of yield levels were not appreciated by many. Perhaps this is due to the farmers being used to chemical fertilizer. Another reason cited especially in the southern region is land pressure since the technology requires ample land to be made available. With regard to *Tephrosia vogelii* some households felt that it did not give them much benefit in terms of by products.

Considering that most of agriculture activities in Malawi are done by women whose opportunities to engage in productive work are limited due to competing demands on their time in terms of child care, household tasks, and their responsibilities as the main economic providers, alley cropping, which involves raising of tree seedlings, plucking of leaves, storage, and burying of biomass among other activities is considered to be rather too labor intensive and so had low adoption rate. The other factor for low adoption rate for the above technologies had to do with the fact that some activities were project driven. Therefore, after the project has phased out beneficiaries either become less interested in the activity or abandon it completely.

Reforestation

The Study team saw a number of communal woodlots in the villages, graveyards, riverbanks even in marginal lands and steep slopes. There were also some individual as well as institutional woodlots. The establishment of tree nurseries with production of tree seedlings in nurseries is one of main activities done by both individuals as well as communities. Discussions with farmers revealed that initially the idea on reforestation came from Department of Forestry although eventually communities appreciated having woodlots in the villages due to scarcity of fuel wood, loss of permanent water sources, soil degradation and erratic rainfall pattern. Some communities were motivated in the monetary aspect of technology. Others admitted having been involved through the annual tree planting week event. There were also homestead woodlots that provided them with fuel wood and shelter but in some cases acted as homestead fencing.

A number of communities mentioned lack of seed, equipment such as watering tins and wheel burrows as some of problems they faced. fuel-wood requirements did not match the rate of reforestation due to the demand. One observation the team made is the low level of male participation in the activity. It is observed that most people's interest is in growing food and cash crops other than trees. In some cases it is the village headman's lack of interest to mobilize the community for action and this led to a number of villagers leaving their village to join in a reforestation activity in another village. In other cases it is the institution that insisted that communities should be involved in a reforestation activity in order to benefit from a particular project. For example, people were asked to establish a nursery close to where a borehole would be drilled so that water from the borehole could run through the nursery.

However one is able to observe that there is active participation by the communities in afforestation activities. Another observation is that mostly it is the exotic type of trees that were being planted on wider scale. It is however observed that with the fuel wood scarcity situation people opted for faster growing exotic types, to the slow indigenous ones. There were evident benefits from those involved in the practice in terms of constant supply of fuel wood for household use from tree branches. Poles from the trees provided material for construction of houses, kraals, and tobacco barns. In other cases farmers planted some indigenous fruit trees such as *masuku* (*Uapaca kirkiana*) while in other cases the trees helped in arresting soil erosion. There were cases where the trees provided river-bank protection while some provided herbal medicine.

Resource Saving Activities

One of objectives of agro-forestry as well as the reforestation programmes is to solve the problem of fuel wood scarcity amongst households. Resource saving activities look at sustainable utilization of fuel wood in terms of fuel consumption rate, - how much fuel wood is consumed. Secondly resource saving activities look at alternative sources of fuel. The surveyor observed two main activities in this area – fuel-efficient clay stoves and the use of briquettes as source of fuel. Beneficiaries using both clay stoves and briquettes as energy saving devices confirmed that they were able to save time they would otherwise spend going to look for firewood. Saved time, they said, can be oriented to other household activities. Using fuel-efficient clay stoves, it is learnt, reduces the amount of fuel wood that would be used for cooking. In turn, this leads to less trees being cut down but also reduces the amount of time for cooking.

Income Generating Activities

Natural resource management without alternative ways of enabling communities earn income from the forests is considered insufficient. Most of visited IGAs had to do with natural resource utilization. These IGAs included bee keeping, guinea fowl rearing, indigenous fruit processing,

rabbit rearing, fish farming, vegetable growing, mushroom production and oil extraction. Most farmers growing vegetables were using watering cans however there were some who had acquired treadle pumps on loan. It was felt that one needed to operate on a fairly large piece of land for treadle pumps to be used to maximum advantage.

Income levels at household level seemed to have been increased as a result that communities were involved in these activities. Most families also sought food security where IGAs were used to purchase either agricultural inputs or food supplement. These activities were also responsible for change of people's status in terms of lifestyles. Most of activities were initially done at group level but later on individually some people embarked on individual basis. It is also noted that finding for these IGAs came from those institutions promoting natural resource management programs. Villager's attitude towards natural resource management changed for the better influenced by benefits gained from IGAs.

It is observed that some IGAs were donor driven while others were demand/community driven and that IGAs such as bee keeping, guinea fowl rearing, plant oil extraction and mushroom growing had the potential for viability but that this also depended on how they were carried out. Some activities such as bee keeping and guinea fowl rearing were male-specific while mushroom production and oil extraction required substantial investment. Fish farming, on the other hand, seemed labor intensive initially, because of investment costs of pond digging.

Role of Institutions

Different institutions were playing different roles amongst the communities. Development institutions brought in interventions that were addressed to villagers' felt needs. This, it is expected, would be done in close collaboration with the beneficiaries in a participatory manner. In some cases however it is observed that participatory approach to the introduction of an intervention was not complied with. This is generally the case where institutions introduced conditions for beneficiaries to benefit from an intervention. There were cases where beneficiaries had to grow some crops, such as Soya been for example, in order to benefit from an intervention where the Soya did not address the beneficiary's felt need.

Discussing with research institutions that are propagating technologies it is observed that the local farmers viewed chemical fertilizer as the quickest solution to their food security problems. There is, however, apparent desire for both parties to come to a compromise with respect to the practicability, viability in terms of boosting farmers' production levels, sustainability in terms of farmers being able to continue and share the technology with others after assistance has been phased out. According to the farmers, the issue of land investment; how much land had to be put to a new technology, is only justified in terms of expected benefits from the technology.

Approaches

It was commonly observed that technologies were first being tried at institutional level where there were demonstration plots. Though most villagers were quite indifferent of what others were doing, the second stage was found where these plots were being mounted at selected farmers' fields, where other farmers would learn from, before the technology was shared with the rest of farmers.

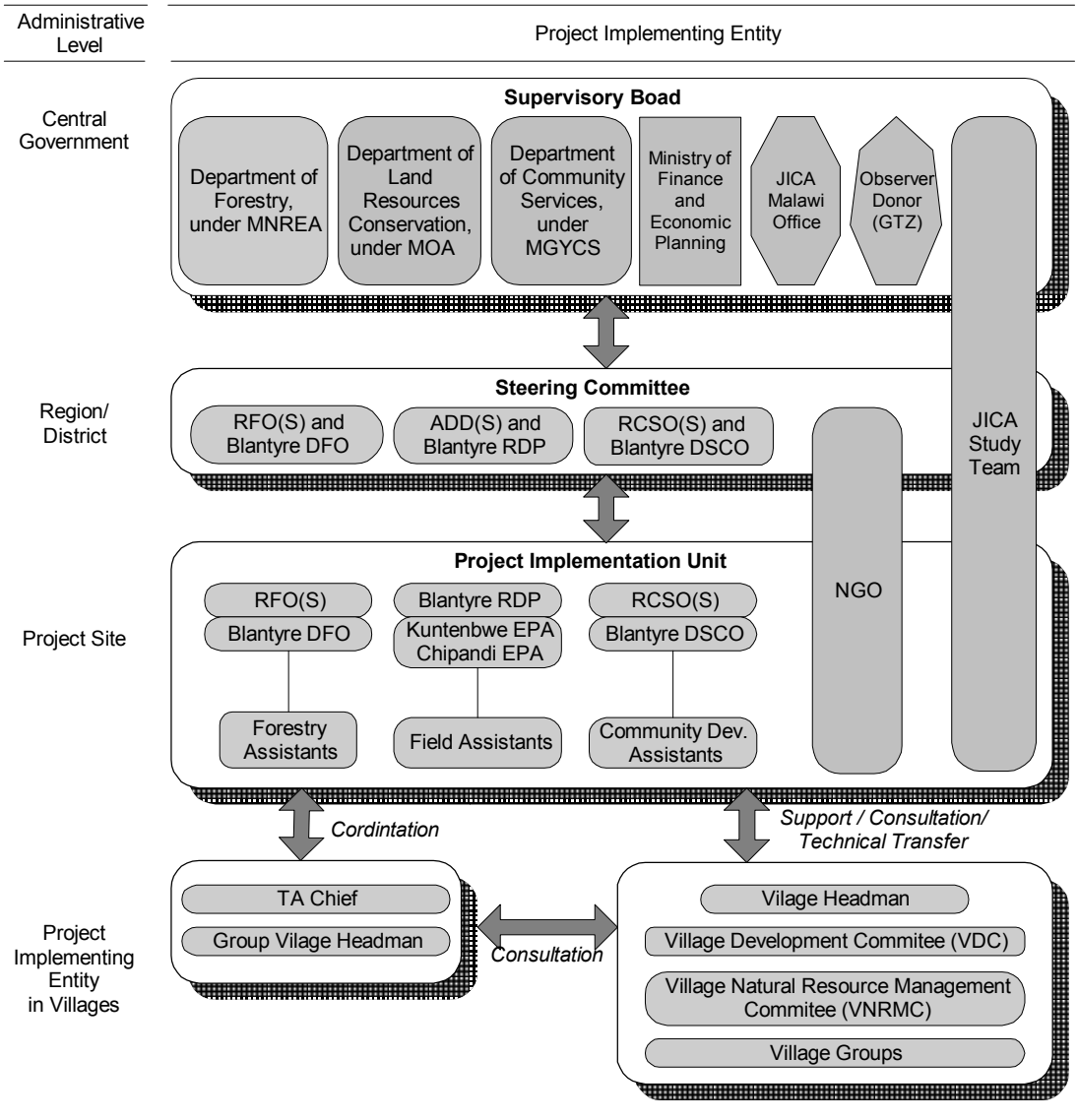
Chapter 3 The Model and Contents of the Pilot Study

3.1 Implementation Agencies and Relevant Government Organizations

The government agencies in charge of the Pilot Study are:

1) Department of Forestry, under Ministry of Mine, Natural Resources and Environment Affairs (MMNRE),
2) Department of Land Resources Conservation, under Ministry of Agriculture, Irrigation and Food Security (MOA), and
3) Department of Community Services, under Ministry of Gender, Youth and Community Services (MOGYCS)

Figure 3-1 Administrative System and Project Implementing Entity



These central official agencies have established the Supervisory Board (SB) of the Pilot Study where meetings have been held to supervise the Steering Committee (SC), to coordinate among

the related agencies and institutions, and to negotiate the foreign agencies concerned. The SC consists of the following three agencies under the above ministries at regional and district levels in order to supervise, advise, support and monitor the activities of PIU:

1) Regional Forestry Office South (RFO (S))and Blantyre District Forestry Office (DFO), under MMNRE),
2) Land Husbandry Division and Blantyre Rural Development Project (RDP) of Agricultural Development Division (ADD) South, under MOA), and
3) Regional Community Services Office (RCSO) South and Blantyre District Community Services Office (DCSO), under MOGYCS

Project Implementing Unit (hereinafter referred to as PIU), the executing organ of the Pilot Study, consists of extension staff from the above three regional and district offices. PIU, SC and SB also include advisable expertise staff belonging to an environmental NGO.

It comprises a chief (principal forestry officer), four forestry extension staffs, five agricultural extension staffs, two gender extension staffs and three (four in 2002, 2004) NGO staffs. These fifteen (sixteen in 2002, 2004) regular members have been grouped into three teams (Group P, Q and R), and each group visits eight fixed villages grouped as their service areas. A team is composed of one or two forestry extension staff, one or two agricultural extension staff, one (circulating) gender staff and one NGO staff.

Each team has demonstrated, trained and instructed villagers on various forestry, agro-forestry and IGAs planned therein. It visited activity sites in eight jurisdictional villages three to six times a week, mostly in the morning, where villagers are engaged in participatory activities such as nursery works and IGAs. A team can visit three to four villages a day, that is to say, it visits a village at least twice a week. To give homogenous technical transfer, staffs were reshuffled among village groups so that the same skills or techniques could be learnt by all village groups. Once in a week or in two weeks, PIU has held regular meetings where results of activities achieved in the preceding week has been reported from each team and plans or measures for later weeks have been discussed. Advantages of this team supervising system include:

1. Multidisciplinary teamwork where techniques of agronomy, forestry and home gender can be served by expertise specialists,

2. Creation of close contact among members of three groups,

3. Creation of responsible care for the given tasks, etc.

There are, however, drawbacks in this fixed team system such as growing mannerism in day-to-day instruction, different contents/ways of instruction to different groups of villages, etc. In order to minimize differences and to attain equitable technical transfer to all villages, staff belonging to a team visits other jurisdictional villages to exchange and diffuse techniques.

PIU holds regular meetings weekly or biweekly to report progress and feed back the results to the villages in order to rectify, improve and facilitate villager's performance as well to cope with confronting issues. Staffs bring information of other villages for villager's challenges and satisfaction with their performances. PIU also acts as a promoter of participatory works through monitoring villager's performances and progress of the planned works, instructions and checking on proper utilization of distributed inputs. It gives encouraging events to the villagers through inter-location tours and study trips, processing demonstration of sweet potato and provision of improved seed varieties for distribution of vine and installation of improved fireplaces. The final task of PIU constitutes implanting of a concept that nursery, planting trees and IGAs are not separable components but a combined activity in which all the arising benefits should be imputed to the committee and pooled within the group for further development.

3.2 Target Villages and Villagers' Organizations

The administrative position of 24 target villages in the Study Area was mentioned in 2.1.5. Each TA has hierarchy system of appointed group villages that supervise several villages. Out of 24 target villages, 4 villages (Mdala, Lemu, Kammata and Kumponda) are functioning as group villages, and other 19 belong to these four, but one (Chakana) is under Kuntaja, or village of TA.

Table 3-1 List of 24 Target Villages of the Pilot Study

District	Traditional Authority	Village Group		Village Name
Blantyre	Kuntaja	Mdala	1	Makonokaya
		Mdala	2	Siyamudima
		Mdala	3	Kaumbata
		Mdala	4	Mdala
		Mdala	5	Nanjiwa
		Lemu	6	Chikoja
		Lemu	7	Manjelo
		Lemu	8	Teula
		(Kuntaja)	9	Chakana
		Lemu	10	Lemu
		Lemu	11	Magombo Ngondo
		Kammata	12	Kammata
		Kammata	13	Kumanda
		Kammata	14	Tamvekenji
		Kammata	15	Chilangali
		Kammata	16	Daniel Mbeza
		Kammata	17	Kamwendo
	Kapeni	Kumponda	18	Peter Bilila
		Kumponda	19	Ndemanje
		Kumponda	20	Simon Mpombe
		Kumponda	21	Kateya
		Kumponda	22	Maluwa
		Kumponda	23	Kumponda
		Kumponda	24	Kumisati Chigumula

Note: Village group name in brackets is not included in the Study Area.

In all the target 24 villages, there have nominally been Village Development Committees (VDCs), but they had often been dormant without any particular activity. PIU advised to establish nursery committee and component wise IGA committees in these villages. Based on this advice, all the villages have established these committees though written by-laws have not yet mostly provided for these newly established ones due mainly to prevalent illiteracy. These committees convene regular or casual meetings to discuss action plans, to review results, to propose and decide future schedules, burden/benefit sharing, to evaluate results of activities, to communicate with stakeholders and to supervise performances of the activities. So far as participatory approach is concerned, attendance of the participants to field works determines the outcome of implementation, where such characters of village chiefs and committee members as their prudence, activeness, administrative and coordinating capacity influence participation and participant's willingness/motivation to work, solidarity and performance.

In the Baseline Survey, three to four different committees were counted in a target village, like VDC, borehole, orphanage, school, health, police, PTA, the Red Cross, political party etc. Half of them were active and the rest were inert. The activeness depends on supporting, demand, leadership of chairmen and other social factors affecting the members/ villagers. Committees that are managed in a democratic way in decision-making tend to be activated, but many of them do not have any particular activity due to lack of technology, fund, resources, and benefits.

Village Natural Resources Management Committee (VNRMC) must be established in every village, according to acts related to Natural Resources Conservation, though few of existing rural communities so far have established this legal organization. Such inertness in rural society might have stemmed partly from traditional governance system with multi-ethnic composition in rural population, partly from lack of chance to get acquainted with gazetted ordinances. Since it's evident that proper management of village natural resources leads to both public and private benefits in the long run, it is possible to attract villagers, by appealing benefits of managing available resources, so that they can join management activities, sharing benefits and duties of public management. It is essential to make a rigid framework to guarantee the participants in resource management with equitable sharing of current and future use of managed resources, where equal share of norm and fruit of work plays key role to satisfy all the participants with the participatory activities. As to what activities the villagers should be engaged in and what level of targets they should set under the participatory actions, the village organizations responsible for participatory activities must decide them within the available alternatives or inputs, making full use of guidance and instructions given from assistants. Through the envisaged process of the Pilot Model, PIU determines technical and substantial assistance based on their decisions for efficient implementation of the planned approach.

The Middle Shire Area had once been shrubby steppe where wild beasts throve as their habitats. As population increased, about 50 years ago, some tribes began immigrating from hilly areas (Ndilande, Soche and Michiru Mountains) and lowland (Chikwawa) to the Study Area where sparsely located hamlets were built. Later, fast-expanding population pressure forced other tribes (Chewa, Ngoni, Lomwe, Yao etc.) to merge into the communities of pre-occupied inhabitants as later-comers. Villages were named after village creators who generously allowed other tribes to enter into their societies. As a matter of course, social status of creators (village chiefs clan or kinship) was much stronger than later-comers or minor ethnic components of a society, and land ownership in the village depends on the village chief. Descendants of earliest settlers who hold influential power have become TA chiefs and group-village headmen/head-women. However, since the democratic system was introduced decades ago, theory thereof was by and by understood among people in the rural area, though some of them claimed that only freedom in life might cause mere occurrences of theft and burglary. Anyway, rural community undergoes transformation from dictatorship to democratic society.

Such dual village structure still remains affecting villager’s daily life and land use, and it’s commonly found that village headmen/head-women and their kinship have held wider and better quality land, have used more natural resources available in their villages and have been much more eligible to use equipment granted through donors’ projects that can quite often hardly cover individual needs of swollen village population. Current livelihood situations in the Area can be briefed as follows:

(1) Land area owned by villagers becomes smaller and smaller as the village population is increasing more and more.

(2) Recent drying climatic trends adversely affect crop yields and growth stability, bringing about chronic famine during pre-rainy and rainy season.

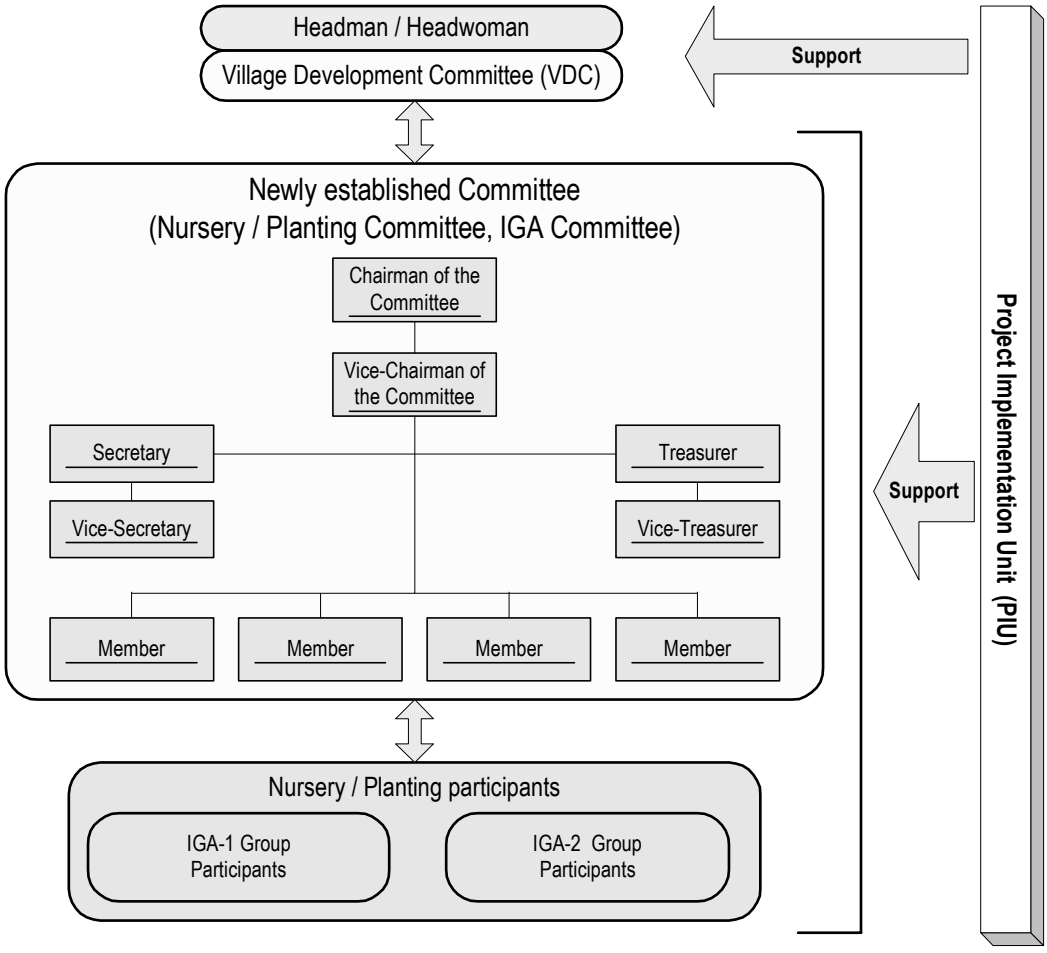
(3) Villagers cannot avoid hunger that lasts for months without staple foods other than dried pumpkin leaves, eventually entailing to occurrence of contagious diseases and frequent theft cases.

(4) There has prevailed chronic unemployment even among school graduates and younger generation. Some housewives and daughters earn day-to-day ration by prostitution, which have fostered infection of HIVS to many villagers, converting higher rate of local population into HIVS positive, followed by subsequent sudden deaths of economically

active generations.

(5) There have been such food aid actions by donor NGOs as Stephen Orphanage Help, Save the Children through Agora flour milling company, but they are only targeted to particular strata of rural population, not covering all hunger stricken people therein. Also, the government distributed starter-packs (5-10 kg pack of maize seed plus chemical fertilizers per family) for years through EU funds, but the resources have been depleted and finally lifted.

Figure 3-2 Village Organizations to Develop Pilot Activities



*Almost all members of IGA Committee are those of Nursery / Planting Committee.
*Almost all members of Nursery / Planting & IGA Committees are those of VDC.

PIU discussed what system was relevant to mobilize villagers in the participatory approach, and came to a conclusion that village chief and his/her clan should be included in the planned participatory activities under currently prevailing traditional administration in order to create a sustainable working system for forestry and IGAs. The applicable system to a target village was formulated as below. In the proposed system, the chief of a target village was responsible for all the activities, playing leading roles to develop participatory activities. He/she organized an executing committee functioning as a core promoter to plan, mobilize and manage the participatory activities. The committee should keep and utilize inputs for the activities, keep records, communicate with participants in the planned activities also with PIU staffs who supply

inputs, give technical training or advice, monitor and lead them. It should hold meetings attended by the chief, committee members and as case demands all the participants so as to reflect their opinions in a democratic way into the plans, implementation and benefit sharing.

A village committee usually consists of around ten members appointed by the chief. Most members have already experienced those of existing various committees of social activities. However, PIU considered it necessary for them to receive thorough orientation on forestry and IGAs prior to starting Pilot Activities, and held workshops to make them fully aware of their objectives and goals.

With regard to the contact with PIU staffs, supporting activities have been delivered directly to the committee members and the participants in the sites of activities, but the staffs always keep close communication with village chiefs or the chairpersons of the committees as to input delivery, workshops, meetings, training, demonstration and other events.

3.3 Structure and Functions of the Verified Village Natural Resources Management Model

3.3.1 Concept of the Village Natural Resources Management Model

As stated in the previous chapter, the Study Area had various constraints for adequate natural resources management. In particular, recent erratic climate conditions got many villagers into self-insufficiency of daily foods and, in turn, chronic famine severely deteriorated villagers' physical strengths. As it will take around seven years, equivalent to 20% of their life expectancy, to acquire benefits from the planted trees that constitute major part of village resources, it is not easy for them to endure until they get profits from their participatory efforts if forestry alone is proposed to them. Managing works for natural resources in their villages require not merely one year but also many years of consistent rehabilitating in proportion to the degree of degradation that should continuously be sustained by mobilizing majority of village population. Because participants in resource management cannot expend their energy and time only awaiting benefits expected from rehabilitated resources in the future, it is imperative to procure any means of livelihood sustenance making use of currently available village natural resources, in addition to the conservation and management works for them, so that the latter works can long been sustained. Simultaneously, measures for securing crop production are indispensable for getting rid of chronic hunger. To this end, AF must be adopted along with provision of tree seedlings in nurseries to utilize it as an incentive similar to IGAs.

Under these circumstances, the PIU assumed that income generating activity making the villagers' livelihoods more stable was indispensable to proceed to the next step of the forestry activities. In general, the out-planted fast growing tree species would be able to generate income about 7 years after the out-planting, but until trees grow up, villagers definitely need to survive with other cash incomes. Therefore, the income generating activities (IGAs) that bring quick returns on villagers' livelihoods are introduced as incentives for the forestry activities, and the processes of the income generation activities are also utilized to organize the participating villagers who will engage in forestry activities. Hence villagers are gradually organized and can get alternative income because the forestry activities require heavy physical labors in the beginning without income. Moreover, AF is also combined together because it brings relatively quick effects and contributes to the improvement of their daily activities, agriculture. At the same time, agro-forestry coupled with forestry nurtures better, stable yields of staple that can again enhance forestry activities by procuring more food to their participants.

As stated above, IGAs are supposed to bring following effects.

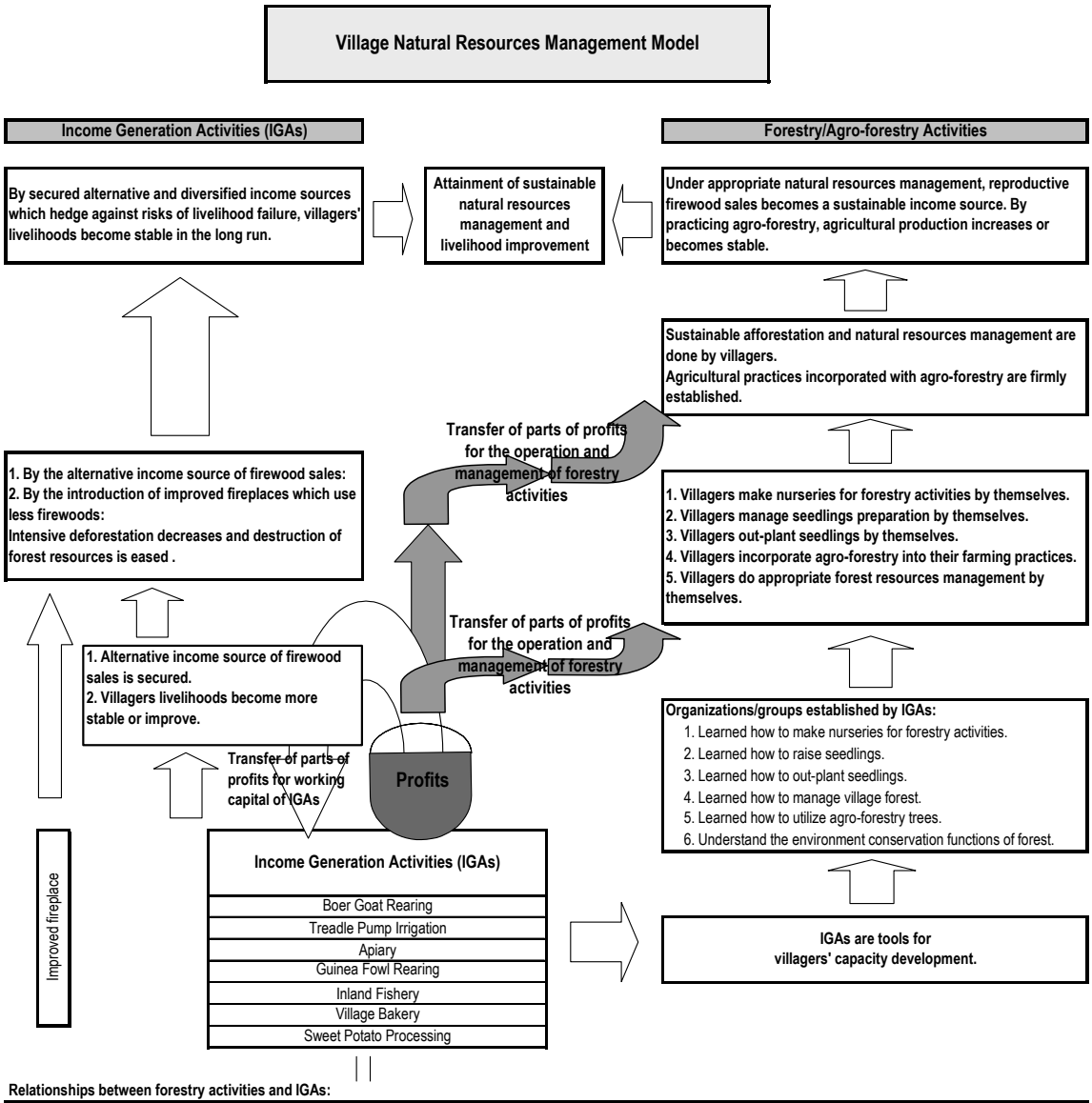
1) They secure alternative cash income of the presently widespread income source, firewood sales.

2) The villagers' groups are gradually organized and strengthened in the course of various IGAs.

3) They secure desirable operation and maintenance of forestry activities if profits of IGAs are obtained for improving their ration.

The first two of them constitute the essential features of this Village Natural Resources Management Model of the Pilot Study. In the Figure, left-hand flows indicate livelihood improvement and income generation as village vitalization, and the easing of forest destruction by securing alternative cash income of the present firewood sales. While, right-hand flows indicate the organizational strengthening which starts from IGAs, and the groups/organizations of IGAs will also work independently for forestry and agro-forestry activities such as technical training and nursery management. In the end, the sustainable Village Natural Resources Management Plan will be realized by these groups/organizations. On the other hand, far left-hand flow describes the introduction of improved fireplace (cooking stove) to aim at the reduction of firewood at household level.

Figure 3-3 Concept of the Village Natural Resources Management Model



Relationships between forestry activities and IGAs:

IGAs	Year Started	Relationships between forestry activities and IGAs
Boer Goat Rearing	2002	Goats eat many tree leaves in a dry season and these feeding trees are introduced.
Treadle Pump Irrigation	2002	To have enough irrigation water, function of rainwater retention of forest is dispensable.
Apiary	2002	Trees are necessary to put beehives and as sources of nectar.
Guinea Fowl Rearing	2002	Forest provides various kinds of feeds such as insects and tree leaves. (Originally, they live in the forest.)
Inland Fishery	2003	Without forests in the upstream of ponds, sediment flows into the ponds and habitat of fishes deteriorates.
Village Bakery	2003	Because firewoods are necessary to bake breads, villagers recognize the importance of firewoods supply.
Sweet Potato Processing	2003	Because firewoods are necessary to steam sweet potatoes, villagers recognize the importance of firewoods supply.
Improved fireplace	2002	Less firewoods are used and ashes can be applied in the nurseries.

Understandings of the Present State	Forest resources are deteriorating because of expanding farmlands and gathering firewoods from forests. => Rainwater retention function of soils is deteriorating. => Water conservation function of forest is deteriorating. Annual food production is not enough for villagers' livelihoods. => Villagers need to earn money to buy foods. => Villagers collect firewoods from the forests and sell them. Primarily, cash income is indispensable for villagers' daily lives. => Villagers collect firewoods from the forests and sell them. => As a result, forest resources diminish except for graveyards and self-sufficiency of firewoods collapse.

3.3.2 The Framework of the Pilot Study

(1) Forestry and Agro-forestry Activities

As the target villages consist of many scattered households, it requires enormous administrative efforts and budgetary resources to encompass and mobilize all of them. To cope therewith, it has been decided to establish a village nursery (size; 10m x 10m) in each target village as a base of development, to accommodate around 20 households as participants to raise as much seedlings as to offset their annual consumption of firewood in to maintain sustainable supply. The capacity of seedling production in this size of nursery holds at most 5,000 per year, or 200 seedlings envisaged to out-plant per participant, though the number seems too many for a participant suffering from hunger during planting season. To make the planting activity as sustainable as for 6 years to plant enough seedlings that can compensate for forest destruction rate by firewood exploitation, the PIU considered necessary to couple the forestry works with IGAs that can maintain incentives and energy required for additional works incurred by free of wage based Pilot works. Though villagers initially expected in the workshops to benefit from wage labor or food for work, PIU managed to convince them to join proposed participatory works without wage or food, instead, with inputs for IGA. Then, the sites for creating village and private woodlots were sought and PIU identified them through transects after holding workshops.

Before launching this Study, villagers used to participate in donor supported public works at paid basis, and actually some of the target villages, Manjero, Teula, Magonbo Ngondo, etc. have benefited from the wage paid to road construction works by MASAF in 2004. In the workshops held in each village, PIU persuaded villagers the necessity of planting trees on free of wage basis, though some expressed reluctance to participate in the proposed works. However, they changed their attitude when they were told about the inputs supply promised to participating villages. It should be reminded that in spite of the official promotion of Village Natural Resources Management Plan (VNRMP), Village Natural Resources Management Committee (VNRMC) had rarely been established in the target villages, partly because of lack of supporting efforts from outside, partly of ignorance of villagers towards such administrative campaigns. PIU also decided to organize villager using existing frame of VDC so that members of VDC can be involved in the proposed Pilot activities. They considered realizing minimum burden for the envisaged participants, avoiding concentrated peak labor in particular season or dissipating labor burden in a broader season.

The long-term targets lies of course in the self sufficiency of firewood and pole wood to meet internal demand arising from villager's daily life, including firewood and pole wood supply without giving damages to vegetative cover, but not including wood for charcoal production or sale of firewood outside their villages. Most land in the target villages has already been allocated to the villagers, and the remaining space for creating village woodlots is estimated at 170 ha in total, or 7 ha per village, accounting for 4.2% of the village area. A household requires at least 1.548 cubic meter (0.43 m^3 x 3.5 persons/ household) equivalent of wood per year to cook food and warm houseroom, counting on use of crop residue as practiced widely. Actually, a considerable portion of this wood equivalent is substituted with stover and other plant debris. On the other hand, to achieve self-sufficiency of firewood, it is further necessary to plant trees (provided that all 140 households per village participate in tree planting) on 211 ha, the already allocated private land for actually required woodlot, in addition to 138 ha existing usable woodlot. Thus, total 4,669 cubic meter firewood demands for 10,857 person is required woodlot area of 349 ha which produces 1,379 cubic meter from wood (assuming 4m^3/ha as annual increment of growing stock), excluding 1,737 cubic meter from residues and 1,552 cubic meter from agro-forestry wood. In terms of woodlot management, existing wood needs care with inter-planting to keep current productivity.

Table 3-2 Estimated Area Requirement to Sustain Firewood Demand

Demand firewood Total (m3)	Supply by wood (m^3)	Supply by crop residues (m^3)	Supply by agroforestry (m^3)	Required firewood area (ha)	Existing woodlot (ha)	Actual required woodlot (ha)
4,669	1,379	1,737	1,552	349	138	211

PIU members suggested mild target from the standpoint of villagers' physical capacity, because tree planting should be done during peak labor months of agricultural activities. A villager can dig 30 to 40 pits per month during three months from December to February. It comes to 100 pits in total per villager, and on average 40 to 50 villagers can be mobilized in this planting in a participatory work. Then, 4,500 seedlings will be planted per year per village and at least 3,500 of them will survive, equivalent to 0.7 ha per village (unit 5,000 seedlings/ha in forestry), or 16.8 ha in the 24 villages in the Study Area. Then, it will take around 12.6 years for the actual required woodlot 211 ha to complete envisaged norm of wood self-sufficiency, provided with firewood from residues and AF. However, it would be too difficult to dig pits during dry months because rocky soil is too hard to excavate. This target is more realistic because tree planting under Pilot Study already achieved 4,500 per village per year.

(2) Income Generating Activities (IGAs)

Participatory activity can be sustained only by the will of participants. Whereas, majority of the participants in forestry practices suffers from hunger during peak forestry season, so they need compensatory means of acquiring alternative incentive for forestry practices including raising seedlings and planting and tending them. During famine months their physical capacity to be engaged in farming remains in critical condition and many young farmers are suddenly dying on their plots during field works and rainy season is literally equal to peak funeral season. In such a critical state, IGAs should be introduced to bringing forestry practices. The Pilot Study introduced forestry and IGAs simultaneously, but the main aim resided with forestry. Since IGAs require natural resources like water sources, feeding sources and skills to manage them, PIU first established a short list that is in compliance with the available resources within the villages and presented it to the target villages. Villagers themselves should select the most suitable IGA based on the proposal and they have seriously been engaged therein.

Many villagers have already been aware of need to plant trees, but actually their physical malaises cannot allow them to practice as routine works. A decade ago their major income came from firewood, charcoal and brick sale, so they know trees are salable resources, but they also know their growth takes so long time to harvest them.

Thus, IGAs are prerequisite for launching a forestry activity in order to make it fully sustainable. Then, they debated on the short list and concluded that it was applicable to the target villages, and proposed it to the villagers. Villagers finally understood the way of IGA selection and selected the best one based on the proposal. The IGA distributed in 2002 could not cover all the participants engaged in forestry activity, so in 2003 another or the same IGA was given to each village so that all the forestry participants can receive at least one IGA. The most important matter to choose them constitutes seasonality. As cited above, villagers are not always healthy due to nutritional scarcity and due consideration is necessary to avoid overlapping of peak season of an IGA with that falling on farming and forestry activities. Thus, four major components have been chosen to meet the requirement.

3.3.3 The Verified Village Natural Resources Management Model

Based on the above-mentioned framework, PIU established the following Model.

(1) Details of Village Natural Resources Management Model

A. Principles of the Model

- Make participants viable so as to create forest and rehabilitate environment
- Use available resources within the village to develop sustainable /viable IGAs
- Secure the benefit of both IGAs for the participants of nursery/out-planting
- Combine forestry activities and IGAs based on the resource availability
- Utilize location advantage for promoting IGAs

B. Relationships between Forestry Activities and IGAs

In order to make the combination of forestry and IGAs fully sustainable, it is essential to select relevant component of IGAs taking account of the following requirements and interrelationships wth site-conditions:

IGAs	Relationships between forestry activities and IGAs
Goat Rearing	Goats eat many tree leaves in a dry season and these feeding trees are introduced. Droppings are useful as manure for tree seedlings.
Treadle Pump Irrigation	To have enough irrigation water, function of rainwater retention of forest is dispensable. Irrigation works can be done simultaneously to both of tree nursery and irrigation filed.
Apiary	Trees are necessary to put beehives and as sources of nectar.
Guinea Fowl Rearing	Forest provides various kinds of feeds such as insects and tree leaves. (Originally, they live in the forest.)
Inland Fishery	Without forests in the upstream of ponds, sediment flows into the ponds and habitat of fishes deteriorates.
Village Bakery	Because firewoods are necessary to bake breads, villagers recognize the importance of firewoods supply.
Sweet Potato Processing	Because firewoods are necessary to steam sweet potatoes, villagers recognize the importance of firewoods supply.
Improved fireplace	Less firewoods are used and ashes can be applied in the nurseries.

C. The ways how Forestry Activities are coupled with IGAs

ITEMS	FORESTRY		I G A s	Accordance
	Nursery	Out-Planting		
Activity Period	Aug. - Nov.	Dec. – Feb.	Mar. – Aug.	No overlapping
Organization	Under the same committee or large part of committee			Mostly overlapping
Participants	Villagers (a)	Villagers (a) and others	Parts of (a)	Completely matched
Location	Near water source	Vacant places and filed	Near villages	No overlapping
Benefit share	The same account of management		Individual	Allocation
Resource Use	Seeds, labor	Labor	Water, grass	No overlapping
Complementarities	use by-products of IGAs	use by-products of IGAs	use produce of forest	mutually inter-related
Benefit cycle	Longer grace period		Fast yielding	Opposite character
Burden sharing	The same participant enjoys IGAs and endure forestry burden.			Compensatory
Binding Power	Leadership of village cadres, rules and regulations			To all participants
Long-term effects	Conserving, restoring environment by securing water, soil & productivity		supporting livelihood	significance of coupling each other

D. Calendar for Forestry Coupled with IGAs

Component \ Month	Rainy			Dry							Rainy	
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Forestry Agro-forestry	Pruning Hardening Pitting Out-planting	Pruning Hardening Pitting Out-planting	Weeding Fill-planting	Weeding Fill-planting	Dormant Period		Fencing Shading Seed collection	Manure Preparation Pot filling Sowing	Pot filling Sowing Watering	Germinating Weeding Pest control	Tending Seedling Land preparation Pruning	Pruning Hardening Pitting Out-planting
Goat Rearing	Hay/silage making Vaccination Grazing in field	Hay/silage making Vaccination Grazing Spraying	Hay/silage making Vaccination Grazing Spraying	Spraying goats Grazing Feed collection	Field Pasturing Grazing	Grazing in field	Grazing in field	Grazing in field	Feeding	Feeding	Feeding Deworming	Feeding Deworming Vaccination
Treadle Pump Irrigation	Dormant Period			Repairing pumps Manure preparation	Cultivation Planting Sowing Nursery	Transplanting Watering Pest control	Watering Pest control	Harvesting Manure preparation	Cultivation Planting Sowing Nursery	Transplanting Watering Pest control	Watering Pest control Harvesting	Harvesting Caring field
Apiary	Dormant Period		Beehive relocation Cleaning	Swarming attraction Colonizing	Inspecting Harvesting	Inspecting Harvesting	Inspecting	Inspecting	Inspecting	Expelling predators Harvesting	Inspecting Harvesting	Cleaning
Guinea Fowl Rearing	Laying Hatching Feeding	Laying Chicks rearing in cages	Laying Pasturing in woodlots	Laying Hatching Pasturing in woodlots	Separating chicks Rearing in cages	Pasturing in woodlots Dormant Period			Pasturing	Fattening Marketing	Mating	Laying

Note: Inland fishery, village bakery, sweet potato processing and improved fireplaces are not indicated in the above table since they do not have seasonality in works.

E. Selection Processes of IGAs

1) Collect the following basic determinants.

- Available resources in the village

- Requests from each village

2) Investigate and discuss the determinants in PIU meeting.

3) Propose the selected short list of IGAs suitable to each village.

4) Together with villagers, discuss and decide the IGA component.

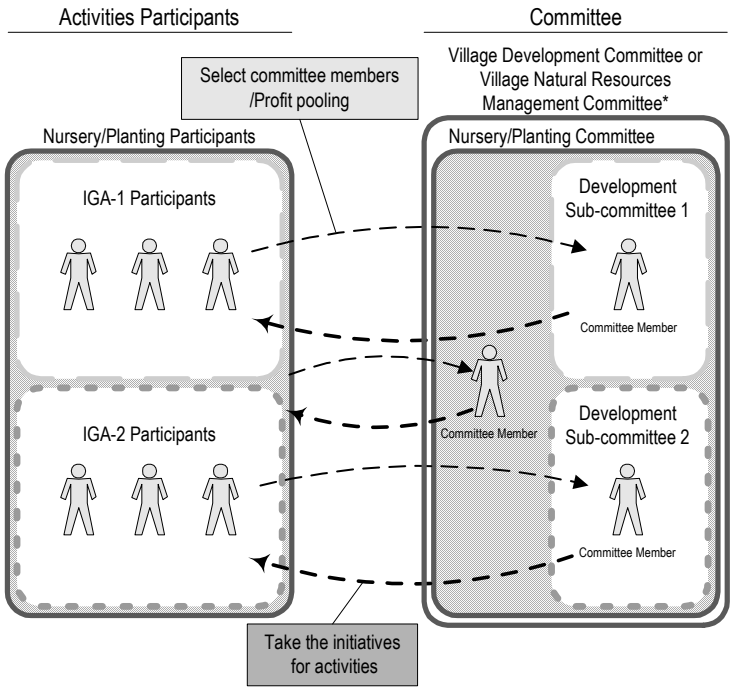
F. Number of Villages by IGA Components

IGAs	No. of Villages Introduced (2002)	Resource Availability before 2003/04	No. of Villages Introduced (2003)
Goat Rearing	4	Still available	18 (16+2)
Treadle Pump Irrigation	10	Still available	5
Apiary	7	No more resources	0
Guinea Fowl Rearing	3	Scarce resources	1
Total	24		24
New IGAs			
Inland Fishery	-	Use of idle resource	1 place
Village Bakery	-	Use of idle resource	1
Sweet potato processing	-	Use of resource	10

(2) Establishment of Sub-committee for Management

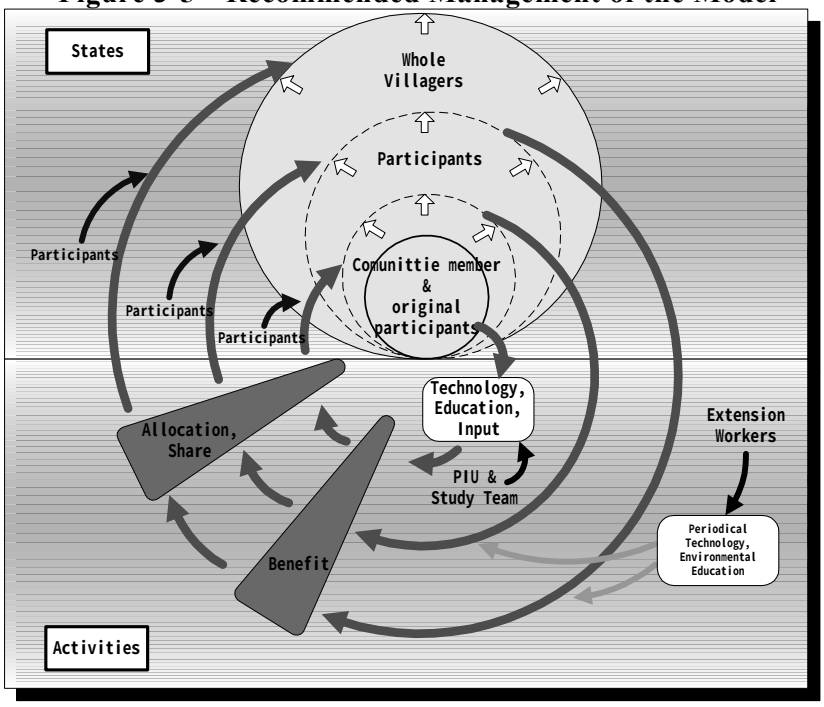
In order for participants to reach inputs of IGAs, PIU oriented villagers to organize a sub-committee, through which group members who is to be engaged in IGA were decided to guarantee the benefit therefrom for those who toil for forestry activities.

Figure 3-4 Accordance of Beneficiary under Forestry and IGAs



* : Village Development Committee take charge of Village Natural Resources Management if its Committee is not available.

Figure 3-5 Recommended Management of the Model



(3) Verification Viewpoints

What should be verified in the Pilot Study as to the function of the proposed Model is described below.

1. Viability and Effects of the Model on Environmental Conservation

(1) Villagers understanding on environment conservation
(2) Reasonable targets of villager's efforts of rehabilitating their resources
(3) Possibility of diffusing forestry development coupled with IGAs
(4) Effect of extension on sensitization and empowerment of villagers
(5) Sustainability of participatory forestry and agro-forestry activities

2. Efforts paid by the villager participants to implement the proposed model and actual gain received by them

3. Targets by component to be achieved by the end of 2004 has been set as follows:

   Participants to nursery and out-planting activities: 20/village, planting number of trees per annum: 100/participants (5/villager), AF practice: half the village participants to nursery activities plant 50 AF species over 100m^2/person, IGAs: at least one IGA component is allocated per forestry participant who can earn half of annual livelihood expense per capita from IGAs by the planned period (see Chapter 4.8.2~3). These have been determined considering physical capacity of average villagers.

3.4 Supply of Inputs for the Pilot Study Activities

Equal set of farm implements, from sowing to planting materials, is to be supplied to the target villages to establish nursery and clear the land for village wood-lots. At the stage of completion of nursery establishment, allocation of IGAs to each target village was agreed between PIU and village committee members. Then, technical orientation and training were provided by PIU for smooth introduction. At the same time, inputs for IGAs were supplied to the members who manage them for efficient and equitable use. PIU taught committee members how to keep them and use them properly, and recommended to keep records of works for afforestation and IGAs. Villagers discussed in their committees and decided to make rules/codes that guide members for proper use of supplied inputs equitably. PIU made technical transfer on the sites where both forestry practices and IGA works were conducted by the hand of participated villagers. The same committee in a village dealt with both forestry activities and IGAs.

Inputs for implementing the Model consisted of extension services and material supply as initial and additional procurement. Both extension services and material supply has equally been applied to all the target villages. At first, PIU planned to allocate the second IGAs to the target villages according to the efforts and management state of each target village, but their performances were too comparable to identify any differentiation. Inputs for IGAs were also evenly distributed among villages, for if PIU dared to do discriminatory input supply to the villages, the differential treatment would have threatened the created harmony among the target villages. The quantity of inputs for the same component of the second IGA to be distributed per village was determined at PIU meetings at even rate without introducing any differential treatment among villages. Although some differentiation had been observed on the efforts for forestry and AF activities, PIU could not perfectly distinguish whether it had been attributable to the difference of villagers' efforts or to the difference of site-conditions or instructing methods. This was the reason why the inputs for the second IGA were equally delivered to the villages that were engaged in the same IGA components.

Table 3-3 Major Inputs Distributed to the Target Villages

2002					2003				
N.V	Input Item	Purpose	Qtty.	Per H.hold	N.V	Input Item	Purpose	Qtty	Per H.hold
24	Shovel	Nursery	240	0.077	24	Shovel	Nursery	374	0.119
24	Stone pick	Nursery	120	0.038	24	Stone pick	Nursery	360	0.115
24	Sickle	Nursery	480	0.153	24	Sickle	Nursery	310	0.099
24	Slasher	Nursery	240	0.077	24	Slasher	Nursery	0	0
24	Hutchet Knife	Nursery	240	0.077	24	Hutchet Knife	Nursery	302	0.096
24	Water Drum	Nursery	72	0.023	24	Water Drum	Nursery	104	0.033
24	Water Bucket	Nursery	120	0.038	24	Water Bucket	Nursery	308	0.098
24	Trowel	Nursery	240	0.077	24	Trowel,Handsaw	Nursery	260	0.083
24	Hoe & Rake	Nursery	240	0.077	24	Hoe & Rake	Nursery	326	0.104
24	Watering tin	Nursery	120	0.038	24	Watering tin	Nursery	326	0.104
24	Wheelbarrow	Nursery	72	0.023	24	Wheelbarrow	Nursery	16	0.005
24	Bicycle	Nursery	24	0.008	24	Bicycle	Nursery	0	0
24	Poly-pot	Nursery	352,500	112.512	24	Poly-pot	Nursery	240,000	76.604
24	Fertilizer Bag	Nursery	480	0.153	24	Fertilizer Bag	Nursery	260	0.083
24	Tree seed kg	Nursery	282	0.09	24	Tree seed	Nursery	206	0.066
24	AgroF. seed	Nursery	120	0.038	24	AgroF. seed	Nursery	192	0.061
24	Seedlings	SeedBank	19,200	6.128	24	Seedlings	SeedBank	0	0
24	Punphlet	Nursery	240	0.077	24	Panphlet	Nursery	0	0
10	Treadle Pump	Irrigation	30	0.013	5	Treadle Pump	Irrigation	15	0.007
10	Delivery Hose	Irrigation	30	0.013	5	Delivery Hose	Irrigation	15	0.007
10	Fixing Tools	Irrigation	30	0.013	5	Fixing Tools	Irrigation	15	0.007
10	Spare Parts	Irrigation	30	0.013	5	Spare Parts	Irrigation	15	0.007
10	Vegetable Seed	Irrigation	36	0.016	5	Vegetable Seed	Irrigation	20	0.009
10	Fertilizer Bag	Irrigation	72	0.032	5	Fertilizer	Irrigation	36	0.016
7	Beehive	Apiary	28	0.012					
7	Smoke Fumer	Apiary	28	0.012					
7	Bee Suits Set	Apiary	28	0.012					
7	Honey Tools	Apiary	28	0.012					
7	Panphlet	Apiary	140	0.061					
3	Guinea Fowl	G.FowlR	60	0.101	1	Guinea Fowl	G.FowlR	20	0.034
3	Fertilized Egg	G.FowlR	72	0.122	1	Fertilized Egg	G.FowlR	24	0.041
3	Roof sheet	G.FowlR	24	0.041	1	Roof sheet	G.FowlR	8	0.014
3	Wire net, Door	G.FowlR	3	0.005	1	Wire net, Door	G.FowlR	1	0.002
3	Incubator	G.FowlR	1	0.002	1	Incubator	G.FowlR	0	0
4	Boargoat Stock	Goat R.	44	0.239	18	Boargoat Stock	Goat R.	198	0.129
4	Tether-rope	Goat R.	44	0.14	18	Tether-rope	Goat R.	198	0.102
4	Starter Brun	Goat R.	4	0.06	18	Starter Brun	Goat R.	18	0.096
0	Vet. Medicine	Goat R.	1year		0	Vet. Medicine	Goat R.	1 year	
					1	Baking Oven	Bakery	1	0.015
					1	Tray, Bowl	Bakery	3	0.045
					1	Starter Material	Bakery	100	1.493
					3	Raft Material	Fishery	1	0.015
					3	Fishing net	Fishery	1	0.015
					10	Cooking Pan	Processing	40	0.033
					10	Utensil Set, Mat	Processing	40	0.033
					24	Seed Vine	Processing	12,000	3.83
24	Brick, Cement	Store Hut	12,000	3.83	24	Cement Bag	Store Hut	170	0.054
24	Roof sheet	Store Hut	192	0.061	24	Roof sheet	Store Hut	304	0.097
24	Door, nail	Store Hut	24	0.008	24	Door, nail	Store Hut	34	0.011

Number of villages received, Number of Households is counted as those in the target villages

However, as to the additional supply of inputs for forestry and AF in 2004, differential distribution was made according to the efforts and attitudes towards forestry and AF practices, because the reasons of differentiation among them were evidently verified, giving more material

and implements to those who expanded the scale of forestry performance as compared to those who did not pay particular efforts thereon. Table 3-3 indicates major material inputs for forestry activities and IGAs.

The same quantities of inputs for forestry and AF, 20 sets per village were supplied to all the target villages regardless of their population, but they were shared for use because more than 20 participants per village participated in nursery and out-planting works.

The supplied inputs have properly been used and managed by the committees responsible for the activities, creating storerooms by village where inputs were locked up for storage after use. They have been well kept though minor cases of theft have taken place. Even though some cases of misuse of the supplied inputs had happened, they have been rectified to bring overall satisfaction by the efforts of PIU staffs and inter-location monitoring by related villagers.

The numbers of inputs so far distributed for nurseries and out-planting, mainly consisting of farm implements, have not been sufficient if all of the participants should use one set of planting tools. Initially, it was expected that 15-20 households would have participated in nursery works and the Study Team provided the number of inputs just to cover these participants, falling within the range of fiscal budget received for purchasing them. At least two participants had to use the same implement to do nursery works at the same time (see the last column of the following table). For out-planting the participants brought their own farm utensils and implements for the purpose of tree planting, but such tools used to have short life, getting torn out within a year or two. This is the reason why some participants are reluctant to use their own implements for tree-planting purpose, because their priority of using farm implements must be put on annually recurrent farming practices to produce food. From this reason, the Study Team decided to supply implements to the participants for nursery practices and out-planting works.

Supply in the first year had been delayed mainly because treadle pumps were not available in the markets due to large purchase by a donor project. In the second year, supplemental supply to nurseries and supply of second IGAs including newly introduced components were performed. In the final year, most supply was confined to fortification of nursery implements and their storage huts. The supplied material and equipments were properly utilized in the participatory activities in many villages, though some misuses happened in a few villages where village headman/head-woman did not regard common benefit. PIU staff repeatedly made efforts in rectifying such misconducts by the village headman/head-woman and his/ her clans. In a case of poor administration, the TA chief dismissed the former village headman/head-woman and appointed a new person in place who has improved the situation.

Table 3-4 Supply Rate of Inputs for 3 years

often used tools	1st year supply	2nd year supply	3rd year supply	Life of tools	Current usable	Partici-pants	number / participant
Shovels	240	374	90	1.5	276	1,358	20%
Stone-picks	120	360	15	1.5	195	1,358	14%
Sickles	480	310	365	1.0	520	1,358	38%
Slashers	240	0	42	2.0	42	1,358	3%
Hutchet knives	240	302	160	1.25	235	1,358	17%
Water buckets	120	308	40	3.0	468	1,089	43%
Trowels	240	260	0	1.5	130	1,089	12%
Hoes & Rakes	240	326	430	1.5	593	1,358	44%
Satering tins	120	326	270	1.5	433	1,089	40%
Wheelbarrows	72	16	16	2.5	68	1,089	6%
Poly-pots*	352	240	60	3.0	150	1,089	14%
Seed**	282	206	50	1.5	153	1,089	14%

Note; * in thousand. ** in kg. Participants in out-planting count 1,358, and those in nursery works 1,089. by Interim Report

Throughout the study period, total numbers of tools/implements supplied to the target villages had been in short to cover all the participants, but some of them brought their own for raising and planting seedlings. Most of them are expendables rather than fixtures, judging from average life. When all the participants fully recognize annual tree planting as prerequisite practice, they won't feel any resistance in bringing their own farm implements to plant their own seedlings.

The supplied inputs have properly been used and managed by the committees responsible for the activities, creating storerooms by village where inputs were locked up for storage after use. They have been well kept though minor cases of theft have taken place. Even though some cases of misuse of the supplied inputs had happened, they have been rectified to bring overall satisfaction by the efforts of PIU staffs and inter-location monitoring by related villagers.

3.5 Contents, Methodology and Processes of the Pilot Study Activities

3.5.1 Contents and Methodology of the Pilot Study Activities

In this study, major task of the Study Team has been placed on how the proposed model functions to develop rational use and conservation of village resources in line with the principles of VNRMP (Village Natural Resource Management Plan). The sustainability can be judged from the attitude of the villagers towards participatory activities and basic understanding on the exigency of taking actions for better conservation of their living environment. Final goal has been set at villager's voluntary and willing actions dedicated to environmental conservation evolved from deep concern on the deterioration of current resources in their villages. Villagers have already observed, recognized progressive depletion of perennial flow in the streams or of water yield in borehole-wells they rely on. They feel difficulty in fetching not only water but also daily needed firewood and even grass for thatching and mat weaving. However, the largest issue still lies in food security and all the villagers' efforts are inevitably concentrated on food procurement and day-to-day earning. Villagers have not yet obtained the knowledge of tree planting, because they haven't any experiences to plant trees and to be learned how to make the nursery. Another issue has arisen from shorter life expectancy by prevailing HIV. Concern for implementing environmental conservation should be oriented to a worry that aged and infantry strata should play major role of implementers. According to an estimation of an NGO, villagers nowadays can live only for 30~40 years after their birth. Concern for a long-term resource balance would be fading away if people have such short life expectancy. Current concern tends to be oriented to how to accommodate orphans and feed them.

Setting these social issues aside, the Study Team tried to verify the following items within the given three-year term. Actual achievement has so far been recorded for two consecutive years, but as to the third year, the activities have covered only a half of the planned schedule. Villagers' performances and achievement have been recorded in the form of the following table:

Table 3-5 Indictors of Achievement to Judge Efficiency of the Proposed Model

Activities/ indicators	Participation	Participation	Products	Benefits	Constraints	Sustainability
Nursery	work days	participants	seedlings	planting rate	remoteness	activeness
Out – Planting	work days	participants	seedlings	survival rate	land scarcity	tending
IGAs	work days	participants	gain from inputs	shared gain	theft/diseases	management
PIU services	work days	attendance	awareness	Empowerment	traditions	office budget
Supporting Agencies	meetings	attendance	experience	useful data	mobility	will of support

During the process of applying the model to the target villages, PIU collected data from time to time listed in the above table and feed back to the villages in the form of advice, rectifying help, input supply and technical instructions / demonstrations. In the numerical analysis in Chapter 4,

these indicators are employed to find out what interactions govern the outcome of applying the model.

Three groups consisting of 15 PIU staffs have visited their target villages in charge, contacting villagers, identifying and examining progress of the scheduled works, giving them relevant instructions and advice, holding demonstration displays, extracting and clarifying problems if any, making necessary site surveys to correct data to evaluate for feeding them back to the villages. PIU has held meetings once a week or in two weeks where exchange of information, data has been conducted to fix, to adjust or to alter the schedule planned ahead, measures have been discussed to tackle the problems.

3.5.2 Processes of the Pilot Study Activities

Since a village has 127 households and 452 villagers on average, it's very difficult to involve all households to a participatory activity in terms of budgetary scale. So, the proposed model covers 20 to 30 households including village chief and chairman of VDC, as an appropriate size of implementing the Pilot Study. Actually, attendants to the workshops in a village seldom exceed 30 because many villagers who don't belong to chief's clan have not been engaged in past group activities and they actually live remote from the village center. The involvement of village chief is essential from security of inputs, mobilization of potential participants, and sustainability points of view.

Image of the verifying model was explained in the workshops held in each of the target villages where chiefs and most VDC members attended. At the same time, PIU helped villagers organize committees for the receptor of the model, Pilot Activities. All the target villages accepted to join the proposed activities because IGAs were promised to follow forestry activities. Otherwise, most villages had been reluctant to be involved in mere forestry activities without wage payment, because hitherto most of assistance project had been carried out on wage payment basis. Villagers have rarely had experiences of purchasing seedlings and of planting them around their homestead, and this means that they were not fully aware of necessity to plant trees. However, raising seedlings and planting works fall on just hunger season and many villagers feel difficulty in the mere involvement in forestry works that incur loss of physical energy and necessity of technology.

Therefore, PIU staffs promised villagers to couple forestry works with IGAs together with the technology transfer, so that participants in forestry activities were guaranteed to gain benefits from IGAs. PIU sought for sustainable IGAs in the target villages and reached a conclusion that they should be based on currently available resources in the villages. PIU concluded that only giving to a village one component of IGAs each was not enough to keep the participants in full participation, because scale of input supply was very much limited. It also concerned for sustainability of recurrent management if IGAs that were completely dependent on the material supplied from outside, like poultry, cloth weaving, tin smith and other processing activities the villagers had learned in the study tour to a poly-techniques center. PIU finally decided to introduce only four resource-based IGAs in the first phase in 2002 and proposed to the target villages. Then, most villages requested treadle pump irrigation, even from the villages without suitable water source. PIU reviewed all the requests and finally recommended three components per village based on resource availability assessment and past experiences. After ample adjustment debates, finally requested first priority component was agreed on with all the target villages as the best-suited IGA component to the village from the standpoint of resource availability. Thus the actual activity progress based on the model was started in each village.

Table 3-6 IGA sorting process by Target Village in 2002

Village	First Priority of villagers among PIU suggested	Second Priority of villagers among PIU suggested	Third Priority of villagers among PIU suggested	reasons why Villagers requested these IGAs	Reason to recommend first priority IGA from PIU
Makanokaya	Boer Goat r.	Apiary	T. pump	resources are available	Other IGA is difficult
Siyamdima	G. fowl r.	T. pump	Apiary	resources are available	Resources are scarce
Kaumbata	T.pump	Apiary	Soap making**	resources are available	Resources are available
Mdala	Apiary	T. pump	Boer Goat r.	resources are available	Nectar sources are available
Nanjiwa	Apiary	T. pump	Boer Goat r.	resources are available	Nectar sources are available
Chikoja	T. pump	Tinsmith**	G. fowl r.	** suggested by others	Resources are available
Manjelo	T. pump	G. fowl r.	Apiary	resources available	Resources are available
Teula	T. pump	Apiary	Soap making**	**observed in study tour	Milala dam water is available
Lemu	T. pump	G. fowl r.	Poultry**	**observed in study tour	Milala dam water is available
Chakana	Apiary	Poultry	Knitting**	**observed in study tour	Other IGA is difficult
M. Ngondo	G. fowl r..	T. pump	Boer Goat	resources are very scarce	Resources are scarce
Kam'mata	T. pump	Weaving**	Boer Goat r.	**observed in study tour	Others IGA is difficult
Kumanda	Boer Goat r.	Soap making**	Apiary	**suggested by others	Plenty of grass thriving
Tamvekenji	Apiary	T. pump	Knitting**	**observed in study tour	Nectar sources available
Chilangali	T. pump	G. fowl r.	Poultry**	**observed in study tour	Ntenjela dam is available
Daniel Mbedza	G. fowl r.	Poultry	Boer Goat r.	resources are available	Resources are scarce
Kamwendo	Apiary	T. pump	Boer Goat r.	resources are available	Nectar sources are available
Peter Bilila	Apiary	T. pump	G. fowl r.	resources are available	Nectar sources are available
Ndemanje	Apiary	Boer Goat r	Furniture**	**observed in study tour	Apiary were already practiced
S.Mpombe	Boer Goat r.	G. fowl r.	T. pump	resources are available	Plenty of grass thriving
Kateya	T. pump**	Poultry**	Apiary	** once experienced	Others IGA is difficult
Maluwa	Boer Goat **	G. fowl r.	T. pump	** once reared	Plenty of grass thriving
Kumponda	T. pump	Bakery**	Boer Goat r.	** suggested by others	Villagers business oriented
K.Chigumula	T. pump	Knitting**	Poultry**	** suggested by others	Others IGA is difficult

Note: After all, IGA without self supply of material was rejected, and first priority IGAs were introduced.
**; Villagers wanted to be engaged in these activities after visiting poly-technique center thou PIU did not recommend them.

As seen in the above table, PIU chose only four components to apply to the target villages judging from the base of available resources therein and gave priority according to the degree of abundance or availability of resource items, and suggested it to the village committee so that they discussed and finally agreed. Almost all the villages followed the suggestion by PIU. It also suggested the same components as the second IGAs in 2003 to the target villages letting them to choose by themselves. In addition to the conventional four components, PIU decided to introduce home bakery into a village, inland fishery to three villages surrounding Milala Dam and sweet potato processing accompanied with distribution of vine cuttings to all the villages (processing kits to 3 villages) with a view to making efficient use of resources and demand for inhabitants. These activities were already successful around the Study Area under community development projects and PIU staffs had already experienced instruction thereof in these ones. These additional components have so far been going on well, yielding profits for the participants because of strong demand for bread, fish and sweet potato in the Study Area.

Participants in these IGAs (the same as the participants in the nursery and planting works) have been satisfied with IGAs they have chosen by themselves, as revealed in the results of villager's self-evaluation on the Pilot Study, implying that they have done the right choice and benefit sharing has well been realized (see Chapter 4-4).

Table 3-7 Process of IGA Determination

Village	Grass land availa-bility	Perennial streamwater availa-bility	Nectar source availa-bility	Yard space for pastur-ing fowls	PIU's recommend-ation with priority	Actual IGA – 1 introduced in 2002/03	Actual IGA – 2 introduced in 2002/03
Makanokaya	widely av.	plenty	plenty trees	Yes	BG – AP - TP	B.Goat	T. Pump
Siyamdima	widely av.	Plenty	plenty trees	Yes	GF – TP - AP	G. fowl	B.Goat
Kaumbata	widely av.	Plenty	plenty trees	Yes	TP – AP - GF	T. Pump	B.Goat
Mdala	widely av.	Plenty	plenty trees	has G. fowl	AP – TP - GB	Apiary	T. Pump
Nanjiwa	widely av.	too low head	plenty trees	Yes	AP – BG - GF	Apiary	B.Goat
Chikoja	widely av.	Available	plenty trees	Yes	TP – AP - GF	T. Pump	B.Goat
Manjelo	widely av.	plenty (lake)	few trees	Rare	TP – GF	T. Pump	Bakery
Teula	widely av.	plenty (lake)	plenty trees	Rare	TP – AP - BG	T. Pump	B.Goat
Lemu	widely av.	plenty (lake)	plenty trees	Yes	TP – GF - BG	T. Pump	B.Goat
Chakana	available	too low head	plenty trees	Rare	AP – BG	Apiary	B.Goat
M. Ngondo	only some	Available	few trees	Yes	GF – TP	G. fowl	T. Pump
Kam'mata	widely av.	Plenty	few trees	Rare	TP – BG	B.Goat	T. Pump
Kumanda	widely av.	Available	some stands	Yes	BG – GF - TP	T. Pump	G. fowl
Tamvekenji	only some	Available	plenty trees	Yes	AP – TP - GF	Apiary	T. Pump
Chilangali	widely av.	Plenty	some trees	Yes	TP – GF - BG	T. Pump	B.Goat
Daniel Mbedza	widely av.	not available	few trees	Yes	GF – BG	G. fowl	B.Goat
Kamwendo	widely av.	Available	plenty trees	Rare	AP – TP - BG	Apiary	B.Goat
Peter Bilila	widely av.	Plenty	plenty fruits	Yes	AP – TP - GF	Apiary	B.Goat
Ndemanje	widely av.	too low head	plenty trees	has G.fowl	AP – BG	Apiary	B.Goat
S.Mpombe	plentily av.	available	few trees	Yes	BG – GF - TP	B.Goat	B.Goat
Kateya	widely av.	Plenty	available	Rare	TP – AP - BG	T. Pump	B.Goat
Maluwa	plentily av.	too low head	very few	Yes	BG – GF	B.Goat	B.Goat
Kumponda	widely av.	Plenty	some trees	Rare	TP – BG	T. Pump	B.Goat
K.Chigumula	widely av.	Plenty	few trees	has G. fowl	TP – BG	T. Pump	B.Goat

Note: as to resource availability, Baseline Survey Results and identification by PIU were referred to. BG: Boa Goat rearing, TP: Treadle Pump Irrigation, AP: Apiary, GF: Guinea Fowl Rearing

In the second year, there appeared differentiation in the performance of tree planting among the target villages, but most failure was deemed attributable to drought during planting season. So did the performance of IGAs, but as a whole, goat rearing could get rid of climatic vagary, attaining very fast stability. This was the reason why many villages requested goat rearing as the second IGA. Thus, two IGAs or the same but doubled IGA have been equally distributed to a target village. In short, one resource-based IGA has been allotted to a participant in forestry activities. In the management of IGAs, the target villages selected two different ways, one was pooled system and another was individually divided one. The former makes pooled benefit to be distributed equally to the participants, but the latter allows villagers to pursue individual benefit. PIU admitted that the former was more desirable to keep the participants in forestry activities, because those who failed in IGAs tend to drop out. Because Boer goat rearing had been successful with favorable reproduction of offspring, most villages requested to employ it as the second IGAs. Thus, 75% of the target villages employed it since there was ample room for grass resource to accept herds, there was no concern for marketing unlike vegetables, and initial expense of rearing was negligible. Since goat can develop 3 generations within 2 years, very little failure arises only if theft damage does not take place and enough grass is available in the villages.

In the third year, it has been revealed that fairly large differentiation has taken place in the forestry performance, but similar differentiation also has occurred in that of IGAs. As regards forestry activities, climatic conditions and input supply has been considered equal to all the

villages, but for IGAs components and quality of inputs have been quite different and many negative factors like theft damages and prevalence of livestock diseases have intervened. A tendency has been identified that successful villages in tree planting have also succeeded in the management of IGAs.

PIU also repeatedly instructed the villagers stressing that only pursuing IGAs will destroy ecological equilibrium in the village environment. For example, provided that all the villages keep goats at its maximum rate of stocking without planting any trees, over-grazing hazard would follow causing such heavy gully erosion everywhere as observed in Republic of South Africa, that in turn will limit grass cover, thus decreasing size of goat herds. If people pump up too much water without planting trees in their watershed, water retentive capacity will greatly be deteriorated and perennial flow will disappear from currently using streams. As a matter of course, detrimental effect of dwindling canopy coverage further threatens ground of apiary by decreasing blossoming trees that bestow nectar to swarms. It may also adversely affect pasturing ground of shrubs that can feed a flock of Guinea fowls with worms and fruits. Such a common knowledge on the possible aftermath of villager's ignorance seems very important, worthwhile to disseminate among them, and the model employed a manual booklet to serve for this purpose.

After all, whatever sophisticated models one may formulate and apply, success or failure of them would heavily depend on understanding of villagers who are the actors of their implementation. Therefore, PIU has added environment education to hitherto villagers training on forestry skill, know-how of IGA as a component of technical transfer to the villagers in this model. In similar projects such educational components have been taken up, for example, refraining from charcoal making serves as a slogan in indigenous wood conservation project in Mwanza District (in Kamwamba assisted by GTZ and facilitated by WESM).

3.6 Contents and Methods of Technical Transfer

There have been many occasions of technical transfer from The Study Team to PIU staffs, and PIU to villagers though various measures. The following table indicates the place, opportunities, donors and receptors of transfer and major contents. Technical transfer is made through material, input supply and also through real management of launched activities without particular need of substantial supply. In particular, demonstration provides effective means in transferring techniques to the targeted villagers, though ample time with repeated displays is required until all the stakeholders enough acquire what is transferred to them.

Transfer can be made in many opportunities including workshops, committee meetings, study tours, demonstrations and work sites where use, management and maintenance of supplied inputs and material, farming and rotation systems, seedling rearing, seed collection, nursery establishment and management, AF practices, installment of improved fireplace, arrangement of water sources, soil conservation, general surveys, managerial techniques of accounting, marketing, livestock hygiene, reproduction and rearing, leadership training, organization management, food processing and storage etc. can be transferred. Very limited technical transfer has been made from the Study Team, adapting original Japanese skills to local conditions such as use of indented or blade sickles and sharpening with whetstone, measurement of soil physico-chemical properties, provision of fermenting manure, and preparation of illustrative manual. As for rearing techniques of honeybees, fowls and goats, transfer was subcontracted to local experts belonging to NGOs.

What should be considered in transferring skills and techniques are how they match with the traditional and conventional ones that villagers have followed. Since it seems difficult to drastically change traditional skills into modern ones, the newly introduced techniques should be in consistent with hitherto practiced system. This is required so as to make currently working community system enough sustainable and functioning. However, it happens that traditional

skill can hardly be maintained due to outbreak of new hazard. For example, villagers have used chicken to hatch fertilized eggs of Guinea fowls but it has become difficult because of prevalence of New Castle disease all over TA Kuntaja. Preventive vaccine must be injected every three months to immunize chicken, but veterinarians have suffered short supply. It follows unavoidably that people must rely on artificial incubators irrespective of whether they really want to use them or not.

Table 3-8 Location, Occasion and Contents of Technical Transfer

Occasion	Workshop	Meeting	Study Tour	Demonstrations	Site Works
StudyTeam to PIU staff	formulation of participatory activities	strategies, input use, resource inventory,manual	evaluation and interpretation of the model case	manual to use equipments, measurements	seed treatment, manure provi-sion, planting
Frequency	twice a year	once two weeks	twice a year	once in a month	week days
Occasion	Workshop	Meeting	Interlocation.tour	Demonstrations	Site Works
PIU staff to Villagers	formulation of participatory activities	how to arrange nursery works, tending saplings, pruning/hardening	mutual assess-ment, absorb-ing techniques, sensitization	displaying new planting method new farming practices	use of imple-ments , inputs, maintenance of infrastructures
Frequency	once in 2 months	once two weeks	twice a year	once in a month	week days

The promoters dealing with technical transfer should regard the following points in planning and delivering new techniques in the groups devoting to traditional skills.

- Repeated transfer until the whole members of a group come to fully understand the objectives and details of the techniques, sometimes with retraining for review,
- Introduction of some alternatives of equivalent or similar techniques in compliance with current resource availability within the village, depending on availability of alternative implements, material or resources,
- Provision with pamphlets, brochures or manuals, desirably with pictures or photos, to the literate villagers and partial illiterate ones for fast understanding and mastering,
- Preference of labor-saving skills / techniques taking due account of villager's nutritional situations,
- Preference of resource-conserving skills / techniques to dispense exploiting abusing of resources that should carefully be conserved, and
- Promotion of intra-complementary skills / techniques so that by-products of a skill or input can relevantly used for another skill or input.

In addition to the above, three PIU members at the beginning of 2003 and five PIU members in 2004 were sent as trainees for one month respectively to Kenyan Forestry Research Institute (KEFRI) in Kenya for third country training in order to obtain the advanced knowledge and technologies. They had been selected at their offices respectively consulted by SC members. They consist of two extension officers belonging to forestry office and other to agriculture office for the former trainees as well as two belonging to forestry office, two to agriculture office and one to regional gender office for latter trainees. Course contents of training program include eight modules such as social forestry (SF)/agro-forestry (AF) concepts, principles and practices, technology of SF/AF, gender issues, assessments and analysis, socio-economic and cultural aspects of SF/AF, training, extension and development of SF/AF, etc.

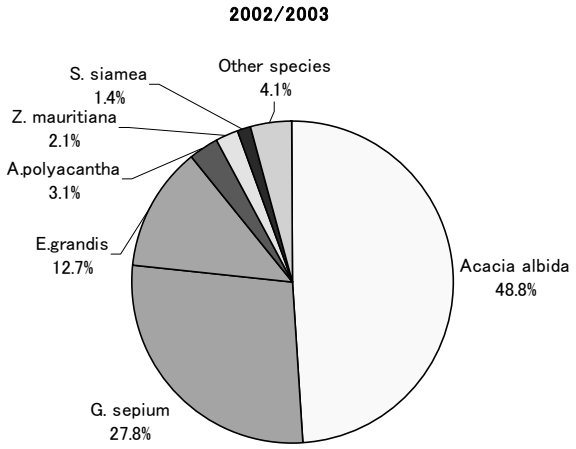
Chapter 4 The Result, Analysis and Evaluation of The Pilot Study

4.1 The Survey on Forestry/ Agro-forestry and the Results

4.1.1 Species, Number of Seedlings and Out-planting of Trees

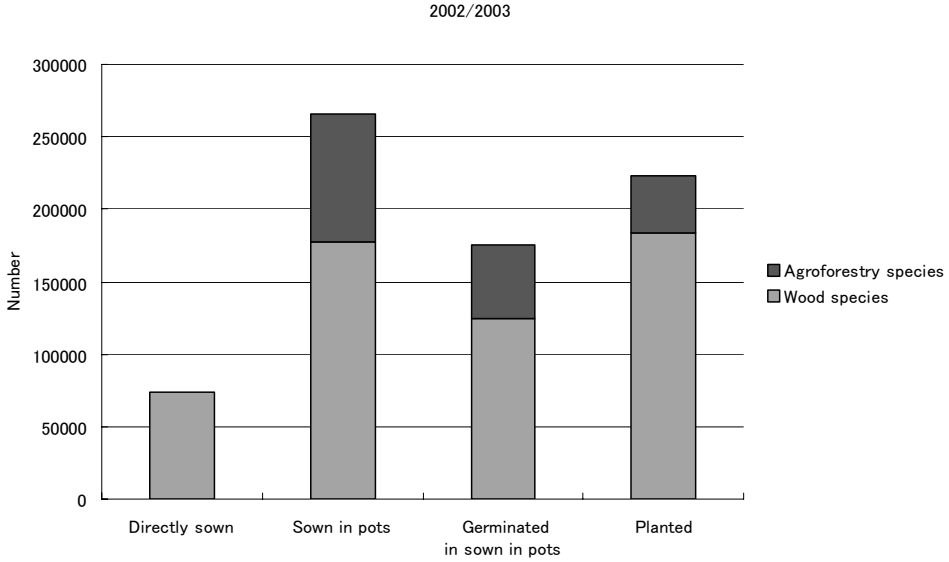
In 2002~03 the villagers raised 223 thousand seedlings and planted most of them on village woodlots and roadsides, river banks, homestead and existing crop field. 49% of the seedlings were *A. albida* followed by another AF species, *G. sepium* accounting for 28% and fast growing exotic tree species, *E. grandis* for 13%, and 9 other minor species. Out of which, 128,000 seedlings have been survived as of 2004, including *A. albida* showed low rate, 56%, *G. sepium* gave higher rate, 65% and *E. grandis* recorded the lowest, 43%. Among minor species *M.azadirach* and *S.spectabilis* gave around 90%, indicating high resistance to drought.

Figure 4-1 Major Species of Tree Seedlings Planted in the planting season 2002/03



More than half of the seedlings consisted of AF species though some of them were planted in homestead and along the farm paths, on the border of farmland, including *G. sepium*, *Lonchocarpus capassa*, half of *A. albida*, other species like *Tephrosia vogelii*, *Leucaena leucocephala* and *Sesbania sesban*. For example, 100 *Caryca papaya* seedlings were germinated in Kumanda village where fruit species were planted in homestead and on farmland. Villagers collected seed inside their villages as instructed by PIU staff and sowed in poly-tubes in their nurseries. Generally, AF species showed higher germination and survival rates, and faster growth than forestry ones.

Figure 4-2 Result of Nursery Seedling Production in 2002/03



In 2003/04, villagers filled seedling pots as much as 70% of the previous year's performance, partly because availability of viable seed was less than the previous year level, partly because villagers had been fatigued by lingered famine. (As early as August 2003, farmers' granaries were empty, and they ate maize bran, weed vegetables and boiled pumpkin leaves for eight months until harvest in 2004). PIU also instructed them how to dispense pots and instructed to sow and raise seedlings directly on seedbeds in their nursery, where *Acacia. albida, Albizzia lebecca,* and some other indigenous species were raised in each nursery. Around 36,000 seedlings were raised in nursery beds, however, most of them (90%) had been scorched away by long drought spell because soils have poor water retention capacity and watering was limited by scarcity in the water sources for the nurseries.

Villagers collected indigenous and fruit seed to meet the requirements. However, the germination rates were higher but actually planted number decreased due to pest damages and scorching of seedlings owing to recurrent drought spells occurred too often from November to February. It was very lucky that villagers out-planted most of the raised seedlings in January, the wettest month amidst the heavy drought year. The timely planting improved survival rate by almost 20%, reaching 85%. Around 113,000 pot-sown seedlings were out-planted to village woodlots, private lots and homestead, out of which about 40,000 were planted in crop field. More seedlings were distributed among nursery participants and those who wanted to plant them but not worked in village nurseries (nurseries install limited number of tool/implements and limited area that limit capacity of accommodating more participants).

Figure 4-3 Result of Nursery Seedling Production in 2003/04

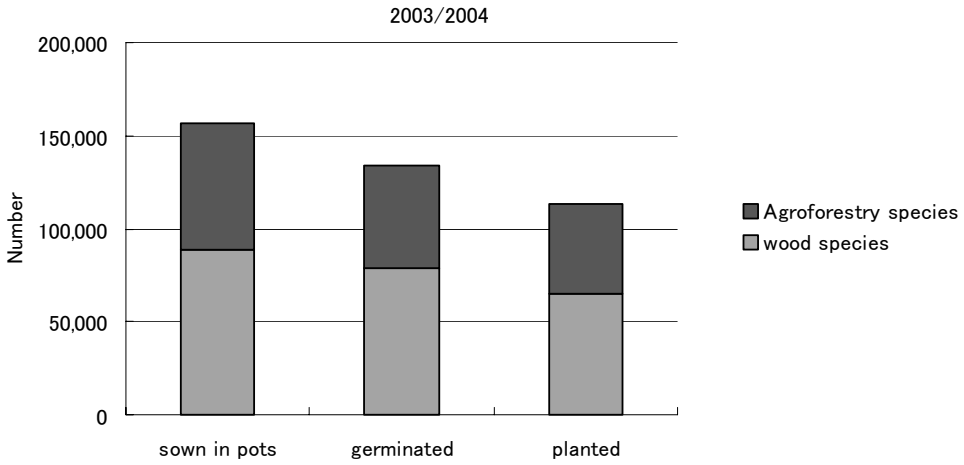
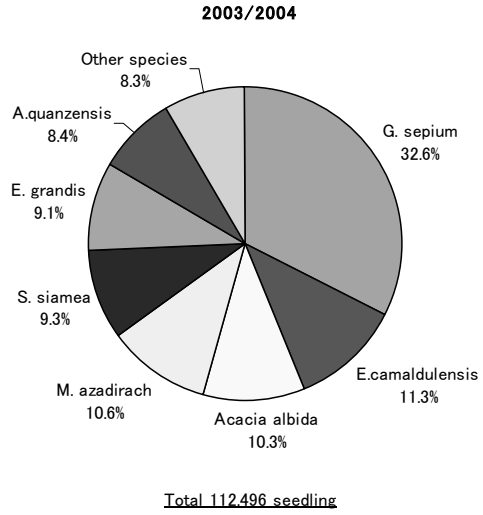


Figure 4-4 Major Species of Tree Seedlings Planted in the Planting Season 2003/04



4.1.2 Survival Rate of Out-planted Tree Seedlings

Surviving of out-planted seedlings raises major issue in semi-arid zone (if defined as annual rainfall less than 600mm), affected mostly by drought spell over one week or longer, because of poor water retention of soils (mostly Oxisols derived from Archaean granites and gneiss, with some Entisols and Vertisols) distributed over target villages. These soils contain too little organic matter that governs soil water in surface horizons (refer to Annex B-11). Soil moisture reaches the level of initial wilting point 7-8 days after effective rainfall, and old seedlings damaged by root pruning are typically susceptible to scorching due to weak water absorbing capacity of injured root system through pruning. It has been observed that shorter seedlings of the same varieties can survive as compared to taller ones, partly owing to less damage on their root, partly to less number of apertures on leaves that dispense transpiration.

PIU also found that survival rates are high in 2003/04. Early months in 2004 received less rainfall than the previous season but *G. sepium* showed marvelous surviving. This legume specie has vigorous rooting capacity, cuttings of which can soon root after planting into soil. Possibly it has faster vertical growth of root reaching aquifer-capillary zone faster than that of other species. It sheds leaves during dry months but flowering occurs even after leaves shed off.

As shown in Fig. 4-5, some indigenous species have high drought resistance including *Senna spectabilis* and *Malia azadirach*. Also, *Afzelia quanzensis*, *Senna siamea* and *Molinga oleifera* showed higher tolerance to drought, because these species can temporary shed leaves during dry season and develop new leaves from leaf-buds at lower stem. Most of them are deciduous. Other indigenous ones give lower surviving rates including *A. quanzensis, Z. mauritiana, B. thonningii, A. albida* and *T. sericea*. These are evergreen species but they can also shed leaves but their stems are still surviving during dry season.

Termite damages are closely related with drought during which termites give heavy damage to young seedlings, but they become less active in wet climate. Damages mostly coincide with withering stunting of planted seedlings of *E, grandis, E. camaldulensis* and some other species, but *A. indica, S. siamea* and *A, quansensis* are almost immune to attack. Seedlings planted over granite-derived Oxisols have seriously been attacked especially in 2003/04, where long drought spells have prevailed in post-planting period. It has been observed that termites tend more to attack scorching tree seedlings than healthy ones. Also, termite damages continue even 1~2 years old seedlings because some trees grown up to taller than 1m are dying by the attack on their stems at ground surface level. It was monitored that taller seedlings had lower survival rates than younger ones, most probably because they tended to get damaged by root pruning and higher transpiration from wider leaf area. It implies that younger seedlings should be planted before they develop roots beyond the bottom of tube-pots. According to forestry extension staffs, mean viability rate for ordinary year ranges 30 ~ 40%.

Figure 4-5, Table 4.1 and Table 4.2 indicate survival rates by major tree specie, planted village and planted month with monthly rainfall. It shows that survival rates vary from species to species and villages to villages, and higher overall survival rates have been recorded in 2003/04 despite lower annual rainfall. This was because planting was concentrated on January 2004 and this was the month with highest rainfall in these years. In some villages like Chakana, planting had been delayed on account of long mourning period after funeral, and this led to catastrophic scorching just after planting. Fruit trees showed highest rate of survival just because they were planted in homestead where watering could be frequently done.

Figure 4-5 Survival Rates by Tree Species

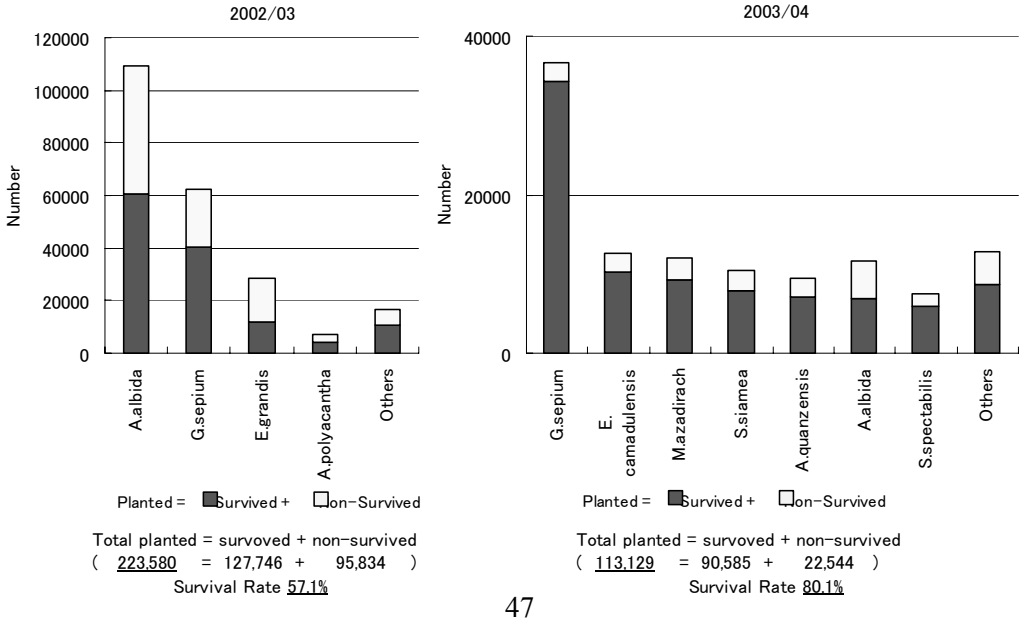


Table 4-1 Survival Rates of Out-planted Seedlings in Sampled Wood-lots

YEAR	2002 / 03 (overall survival : 57.1%)					2003 / 04 (overall survival : 80.1%)				
Planted month	Dec	Jan	Feb	Mar	Apr	Dec	Jan	Feb	Mar	Apr
rainfall (mm)*	111	184	149	215	1	46	300	47	107	73
drought spell**	10	-	10	-	31	14	-	10	-	31
01. Makonokava										
02. Siyamdima			5%					5%		
03. Kaumbata		32%	17%				32%	17%		
04. Mdala		68%			55%		68%			31%
05. Nanjiwa			35%	76%				35%	76%	
06. M.Ngondo			68%					68%		
07. Chakana					1%					
08. Lemu		50%				28%	50%			
09. Chikoja	44%		64%	88%				64%	88%	
10. Manjero		43%					43%			
11. Teula	41%									
12. Kam'mata		55%					86%			
13. Kumanda				78%			78%			
14. Tamvekenji	4%	66%				90%	94%			
15. Chilangali		61%	80%	81%			85%			
16. D. Mbedza		36%				29%	72%	58%		
17. Kamwendo			28%				71%			
18. Peter Bilila				92%			98%	63%		
19. Ndemanje			11%			92%				
20. S. Mpombe			22%				72%			
21. Kateya			47%					41%	57%	
22. Maluwa				72%						
23. Kumponda				72%						
24. K. Chigumula		65%						48%		
Total in woodlot	30%	53%	38%	80%	28%	68%	84%	52%	41%	31%
planted rate	4%	35%	22%	36%	3%	4%	75%	11%	7%	3%

Note: * data at Chileka airport, 10-25 km away from the Study Area
** consecutive days without effective rainfall

Table 4-2 (1) Survival Rates of Out-planted Seedlings by Species and by Month in 2002/03

specie	*Faidhe. albida*	*Glirici. Sepium*	*A.polyac antha*	*Zizipus Maurit*	*Senna siamea*	*Senna specta*	*Albizzi rebeca*	*Afzelia quanze*	*Eucaly. grandis*	*Termi.n sericea*	*Moring oleifer*	*Melia azadir*	Fruit trees
Dec.02		3.8%	0.3%										
Jan. 03	18.2%	12.3%	1.6%						2.9%				
Feb.03	9.8%	5.6%		0.9%	0.8%				4.8%				
Mar.03	17.8%	6.1%	1.4%	1.4%	0.6%	1.1%	0.8%	0.2%	4.9%	0.2%	0.6%	0.3%	0.5%
Apr.03	3.0%												
	48.8%	27.8%	3.3%	2.3%	1.4%	1.2%	0.8%	0.2%	12.7%	0.2%	0.6%	0.2%	0.5%
Dec.02		8,493	700										
Jan. 03	40,626	27,475	3,475						6,555				
Feb.03	21,918	12,606		1,997	1,900				10,731				
Mar.03	39,709	13,536	3,093	3,086	1,330	2,542	1,786	386	11,030	500	1,377	586	1,024
Apr.03	6,806												

Table 4-2 (2) Survival Rates of Out-planted Seedlings by Species and by Month in 2003/04

	E.cama dulensis	*A.quan zensis*	*F. albida*	*G. sepium*	*M. azadira*	*P. thonni*	*S. siamea*	*Z. maurlit*	*Eucaly grandis*	*fruit trees*	*Kaya anthoth*	*A.polya canth*	*S.spect abilis*
Dec.03			0.1%		1.1%	1.1%	0.2%	0.2%	0.3%				0.8%
Jan. 04	38.7%	25.7%	3.2%		0.3%	0.5%		0.1%	6.6%				
Feb.04	3.4%	4.4%	0.8%	1.4%					0.8%	0.1%			
Mar.04	3.5%	0.6%		0.7%	0.1%	0.1%	0.0%		1.4%	0.0%	0.7%		
Apr.04	2.0%				0.2%				0.4%			0.4%	
	47.5%	31.4%	3.3%	2.1%	1.7%	1.8%	0.3%	0.3%	9.5%	0.2%	0.7%	0.4%	0.8%
Dec.03			92		1,349	1,495	270	230	429				1,042
Jan. 04	49,472	33,622	4,118		400	659	0	136	8,399				
Feb.04	4,281	5,731		1,760					1,031	157			
Mar.04	4,422	800		932	184	155	68		1,774	60	956		
Apr.04	2,520				197				503			499	

4.1.3 Results of Pilot Activities during 2004

Participation in the nursery works has continued keeping pace with IGAs and the number of pot-tube filling is now surpassing the level accomplished in the previous year, despite severe drought hit in the target villages. Sowing was going on but quantity of seed was not enough to sow all the tubes so far filled. All 24 villages filled pot-tubes but four out of them failed to sow the distributed/ collected seed because of funeral mourning for two weeks in their villages.

Table 4-3 Nursery Activities in 2004 / 05 Season by Village

Village	Pot filled	Sown in pot	Sown in bed*	Germin-ated in pots	Transplanting to filled pots**	Total parti-cipated	men part-cipated	lady parti-cipated
Makonokaya	6,100	2,200	0.25	0	3,900	31	15	16
Siyamudima	8,200	5,550	0.25	2,450	2,650	48	15	33
Kaumbata	6,050	4,200	0.25	2,189	1,850	21	13	8
Mdala	3,150	2,600	0.25	0	500	23	10	13
Nanjiwa	7,220	800	0.25	0	2,000	38	13	25
Chikoja	11,857	7,579	0.40	4,552	5,377	40	11	29
Manjelo	6,986	5,500	0.25	4,082	736	49	15	34
Teula	7,343	1,300	0.25	0	6,043	29	12	17
Chakana	1,300	0	0.25	0	200	17	4	13
Lemu	4,060	1,950	0.25	0	2,000	23	7	16
M. Ngondo	2,450	700	0.25	0	1,000	17	5	12
Kammata	10,852	3,700	0.30	3,046	7,152	40	9	31
Kumanda	9,523	1,800	0.25	0	7,723	18	5	13
T. Kenji	8,835	2,990	0.25	2,237	3,745	35	16	19
Chilangali	8,840	5,800	0.25	4,084	3,585	21	4	17
D. Mbeza	6,005	5,387	0.25	3,811	600	38	8	30
Kamwendo	11,136	8,250	0.40	4,468	2,800	69	24	45
Peter Bilila	3,600	1,200	0.25	0	1,500	35	9	26
Ndemanje	7,741	1,100	0.25	0	3,000	31	7	24
S. Mpombe	2,051	0	0.25	0	0	26	14	12
Kateya	3,250	800	0.25	0	1,800	30	23	7
Maluwa	1,682	0	0.25	0	0	12	5	7
Kumponda	5,100	1,800	0.25	0	3,300	29	4	25
K.Chigumura	4,624	2,322	0.25	0	2,300	22	12	10
T o t a l	147,955	67,528	6.35kg	30,919	63,760	742	260	482
Average	6,165	2,689	0.3kg	1,288	2,650	31	11	20

Note: * in kg of Eucalyptus seed, all data collected as of September 18th. ** planned for raising Eucalyptus seedlings

When the filled pot-tubes are all direct sown or transplanted from seed-beds, 184 seedlings per participants will be raised and 150 will be survived if the same survival rate as obtained in 2003/ 04 is realized. It is expected that three Eucalyptus varieties, i.e., *E. terticornis*, *E. camaldulensis* and *E. grandis* are main seedlings raised in village nurseries because enough seed (0.7kg / village) has been distributed. Indigenous tree species including *M. azadirach, S. siamea, A. quanzensis, A lebec, F. albida, A. polyacantha, Z. mauritiana, K. anthotheca, P. angolensis,* are also expected to be raised though the amount of seed are much less than that of Eucalyptus. The seed of agro-forestry specie, *G. sepium* was not much available because of pre-harvesting period, and only 800 ~ 1,000 germinated so far per village.

All nurseries have been fenced with new segela (grass mats) and shade ceiling made of grass mat is now under preparation. Some participants have already begun digging planting pits and they are planning to make use of the old pits where out-planted seedlings in the previous season have been scorched away or failed to survive due to termite damage/ dry spell. Participants have provided Changu (fast matured) manure to prepare soil for filling tube-pots and seedbeds. Manure will be used for raising vines of sweet potatoes in and around village nurseries for distributing to the nursery participants to ease their hunger during cropping and out-planting period. It is estimated that over 180,000 seedlings are raised and 150,000 will be out-planted by next March, at the rate 200 seedlings per participants, though survival rate can't be forecast.

Seed banks of AF trees have been established in all the villages, most of them are bearing seed and harvests are envisaged in October 2004. Agro-forestry seed is still difficult to obtain for villagers because quantity of production is limited and price is prohibitively dear.

Table 4-4 Village Seed Banks of *G. sepium*

Village	number of stands	growth of stands	estimated seed yields	Village	number of stands	growth of stands	estimated seed yields
Makonokaya	17	1.2~2.3m, 1cm	1.5kg	Kumanda	75	3.5~4m, 6cm	5.5kg
Siyamudima	16	1.0~1.9m, 0.9cm	0.5kg	T. Kenji	44	1.3~3.2m, 3cm	1.5kg
Kaumbata	14	2.5m, 1.2cm	1.0kg	Chilangali	77	4.3m, 5.1cm	4.0kg
Mdala	12	2.5m, 0.9cm	1.5kg	D. Mbeza	43	1.2m, 0.6cm	0.0kg
Nanjiwa	10	1.3m, 0.4cm	0.0kg	Kamwendo	19	1.8~3.1m, 3cm	1.0kg
Chikoja	45	3.6m, 1.8m	4.0kg	Peter Bilila	22	2.5m, 1.2cm	0.5kg
Manjelo	42	5.5m, 4.5cm	4.5kg	Ndemanje	16	2.5~3m, 2.5cm	1.0kg
Teula	68	6~6.7m, 6.2cm	5.0kg	S. Mpombe	40	1.2~3.5m, 2cm	1.5kg
Chakana	8	1.8m, 0.5m	0.0kg	Kateya	4	2.3m, 1.2cm	0.0kg
Lemu	15	2.5m, 1.0cm	1.5kg	Maluwa	19	1.7~4.0m, 2cm	1.0kg
M. Ngondo	10	2.1m, 0.6cm	0.5kg	Kumponda*	6	*2.1m, 1.0cm	*2.5kg
Kammata	35	5.5m, 3.5cm	3.5kg	K.Chigumura	26	3.5m, 2.0cm	1.0kg
				Total 24	683		43.0kg

Note: *; *Tephrosia vogelii*, instead of *G. sepium*

4.1.4 Spacing and Planting Site

As regards spacing of tree planting, standard intervals have been applied but in some cases limited seedling availability made the spacing wider or narrow planting land led to denser spacing in comparison with standard planting density. In the case of AF species planted in farm plots, conventional practice has given a standard of line planting on alternate hill, or every two hills with an interval of 1m or 1.5-2.0m. Planters count on thinning in the cases of dense spacing in wood-lots, also anticipate some seedlings failing to survive after planting them. On average, forestry species have been planted at a density of 2.25 m^2 or 1.4m x 1.5m, equivalent to 4,444 seedlings per hectare, while those for agro-forestry have been transplanted at 1m (interval on the same ridge) x 2m (every other ridge) or 5,000 ~ 7,000 seedlings / ha. These figures have been used to convert survived seedlings into planted acreage in the estimation. In case of woodlots where forestry species have been planted, thinning will be made few years after planting up to 2,500 stands per hectare (refer to Table 4-5).

After planting nursery-raised seedlings over village woodlots (located on hillside, rocky slope, stream banks, roadside etc.), participants in nursery works plant surplus ones individually over privately allocated land (farm plots and boundaries, homestead, dimba gardens, farm paths, along drainage channels etc.) where they planted in 2002/03 about 70 seedlings of forest species and 43 AF species per planter. Further, they inter-planted seedlings on deteriorated open forests. On their homestead, they plant hedge species, fruit saplings and shade species.

Table 4-5 Adopted Planting Spacing by Site

Specie	Farm plots	Woodlots	Fallow field	Homestead	Inter-planting
Agro-forestry species	1m x 1.5m		1.5m x 2m	1m x 2m	
Forestry species		2m x 2m	5m x 5m	1.5m x 2m	5m x 5m

Villagers do not have enough land space to plant seedlings though they have shared seedlings they have grown in their nurseries. Other than village forest and woodlots, they have to plant them in homestead, on their crop field, along footpaths and stream banks, sometimes to inter-plant into deteriorating secondary indigenous woods as tabulated below. They planted fruit trees and shade/ hedge species in their homestead, while they did agro-forestry species and other leguminous ones (especially *F. albida*) in their farm plots. Some farmers planted also leguminous species in their fallow land left uncultivated for years due to exhausted fertility (especially direct sowing of *Tephrosia vogelii* and up-rooted seedlings of *F. albida)*. In some villages nursery participants planted indigenous seedlings in existing but deteriorating shrubs as inter-planting (in the villages of Lemu, Chikoja, Manjelo, Kamwendo and Tamve Kenji).

Size of village woodlots is narrow in all target villages because there remains little land not yet allotted to individuals. Village woodlots are usually located at hill slope, rocky patches and abandoned plots where futile and coarse sandy soils cover the surface with high susceptibility to drought during dry seasons. In other words, wasted land of poorest quality still remains for planting seedlings raised in nurseries. As a matter of course, survival rates tend to be lower than crop plots and dimba gardens where better quality soils are distributed and groundwater level is much higher than wasted land. Nevertheless, usual survival rate in the semi-arid area (where Baobab trees prevail) ranges 30-40% according to the experiences of forestry extension staffs, whereas the average performance during 2002-2004 in the Study Area outweighed this standard by 20%. Such a high level of survival is attributable to many factors including right choice of species, nursery practices, and above all, all-out efforts of participants in forestry activities.

As summarized in Table 4-6, nursery participants received 70 seedlings of forestry species and 43 agro-forestry species in 2002/03 and presumably less seedlings also in 2003/04, they planted these in private lots and farm plots, respectively. They can finish planting in a couple of days,

and if they continue planting the same number of seedlings for five years, they can self-supply firewood within their private planting sites.

Figure 4-6 Planting Sites of Nursery Seedlings by Village

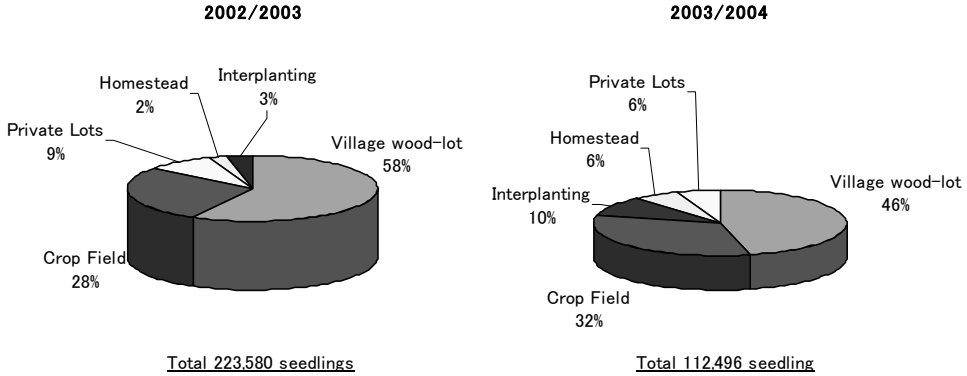


Table 4-6 Seedlings Distributed to Participants and Villagers in 2002/03

Major Species	persons received	E.camal dulensis	Azadir. indica	A.quan zensis	Senna siamea	Kaya an thotheca	Bauhinia thonning	Acacia albida	Ziziphus mauritia	A. poly acantha	fruit trees	Gliricidia sepium
Mdala	21	0	927	63	0	35	9	32	0	0	0	105
Manjelo	7	269	162	30	0	6	0	10	150	15	0	106
Teula	13	0	1,026	78	0	0	91	0	106	92	0	424
Lemu	18	0	0	230	1,305	40	0	80	520	0	0	480
Kam'mata	44	278	172	109	228	160	0	20	85	109	94	2,358
Kumanda	34	174	484	0	0	66	0	690	810	0	205	2,597
Chilangali	19	143	0	822	235	186	0	0	0	83	0	2,386
Maluwa	6	147	176	176	0	0	0	0	0	0	0	0
Kumponda	67	610	0	0	565	85	0	3,775	0	0	112	330
Chigumula	32	518	340	350	235	108	55	78	0	0	0	2,438
mean	26	214	329	186	257	69	15	469	167	30	41	43/ptc

Note: Survey of Sample villages. ptc: participants

Table 4-7 Number and Area of Planting Sites by Village

Y E A R	2002-2003 (unit: square meter, number)					2003-2004 (unit: square meter, number)				
Planted Site	Mean / VWL*	Private Lots**	Crop Field	Number of VWL*	Number of PL***	Mean / VWL	Private Lots	Crop Field	Number of VWL*	Number of PL***
Makonokaya	594	38	18	2	30	79	6	5	2	30
Siyamudima	386	11	48	2	20	512	4	11	3	85
Kaumbata	484	2	22	3	22	55	1	2	3	73
Mdala	551	0	7	2	65	253	6	10	3	65
Nanjiwa	267	0	14	3	30	134	0	4	4	95
Chikoja	1,613	3	1	1	150	995	3	6	2	150
Manjelo	1,837	2	5	1	25	589	1	12	2	45
Teula	1,440	26	0	1	20	265	3	6	1	38
Chakana	338	0	51	2	14	291	5	21	3	25
Lemu	303	23	3	4	31	117	1	10	4	40
M. Ngondo	195	10	29	4	21	23	6	2	4	36
Kam'mata	430	18	123	3	27	168	2	8	5	90
Kumanda	991	18	59	1	19	304	2	16	2	33
T. Kenji	825	43	28	2	13	224	2	15	3	40
Chilangali	512	17	21	3	18	307	6	27	4	40
D. Mbeza	1,413	18	0	1	16	617	1	16	1	35
Kamwendo	375	1	11	3	61	112	2	4	4	92
Peter Bilila	1,155	6	5	1	16	151	2	2	1	72
Ndemanje	139	0	1	2	20	0	0	0	2	79
S.Mpombe	1,354	2	86	1	10	248	0	7	2	65
Kateya	2,357	3	21	1	13	193	1	11	2	30
Maluwa	1,108	0	26	1	20	212	0	3	1	65
Kumponda	1,305	0	7	1	18	168	1	7	2	43
Chigumula	675	4	15	1	11	245	1	3	1	65
Average	860m^2	10 m^2	25 m^2	2	29	261 m^2	2 m^2	9 m^2	2.5	60

Note: * VWL; village wood-lots, ** including homestead, ***;PL; private wood lots including homestead

Table 4-8 (1) Growth of Selected Species of Seedlings

	specie	*G. sepium*			specie	*S. siamea*			specie	*K.anthotheca*			specie	*E. grandis*		
Village	loca-tion	months after p.	height in cm	DBH in cm	loca-tion	months after p.	height in cm	DBH in cm	loca-tion	month after p.	height in cm	DBH in cm	loca-tion	month after p.	height in cm	DBH in cm
Makonokaya	dimb	4	20	0.4	forest	17	235	2.0					wood	5	40	0.7
Siyamudima		7	40	0.9												
Kaumbata	dimb	17	80	1.1	field	5	30	0.4								
Mdala	field	15	100	1.4												
Nanjiwa	dimb	5	60	1.0					wood	6	15	0.4				
Chikoja					forest	5	40	0.5	field	6	25	0.5				
Chakana																
Manjelo																
Teula	dimb	17	600	4.3												
Lemu	field	5	60	1.1					Lban	5	20	0.5				
M.Ngondo	field	6	30	0.6												
Kam'mata	dimb	6	80	1.2	forest	6	35	1.2	field	6	30	0.6	forest	6	80	1.5
Kumanda	dimb	6	56	1.0	wood	6	38	0.5								
Tamvekenji	Hstea	5	90	1.3	forest	6	55	0.7	Hstead	6	32	0.6	forest	6	89	1.2
Chilangali					forest	6	20	0.2					forest	6	78	0.4
D. Mbeza	Hstea	5	150	1.7	Hstead	6	60	0.7	field	6	22	0.5	wood	6	71	1.0
Kamwendo	field	6	70	1.2	Hstead	6	58	0.6					forest	17	160	0.6
Peter Bilila	field	6	58	1.1												
Ndemanje	field	16	280	2.5												
S.Mpombe	field	16	450	3.2	forest	6	40	0.5					forest	16	120	0.5
Kateya	Hstead	2	230	1.2									forest	17	100	0.6
Maluwa	Hstead	6	50	1.1												
Kumponda		6	80	1.4									forest	17	190	1.3
K.Chigumula	Hstead	7	350	2.0					Hstead	7	35					

Table 4-8 (2) Growth of Selected Species of Seedlings

	specie	**Z.mauritiana**			specie	*A.quanzansis*			specie	*M. azadirach*			specie	*E.camaldulensis*		
Village	loca-tion	months after p.	height in cm	DBH in cm	loca-tion	months after p.	height in cm	DBH in cm	loca-tion	month after p.	height in cm	DBH in cm	loca-tion	month after p.	height in cm	DBH in cm
Makonokaya					Hstea	5	15	0.3					woodl	5	40	0.7
Siyamudima																
Kaumbata	Hstea	16	25	0.4												
Mdala																
Nanjiwa									woodl	6	15	0.4	forest	17	225	1.3
Chikoja	Hstea	6	28	0.4	woodl	6	25	0.5	field	6	25	0.5				
Chakana																
Manjelo					woodl	6	32	0.5	Lbank	6	15	0.3	forest	7	75	0.3
Teula					forest	6	36	0.7								
Lemu	Hstea	5	50	1.0					Lbank	5	20	0.5				
M.Ngondo																
Kam'mata	Hste	6	70	1.1	Hstea	6	32	0.6	field	6	30	0.6	fore	6	125	0.6
Kumanda	Hste	6	30	0.4	fore	7	28	0.5								
Tamvekenji	field	16	225	2.8	woo	6	20	0.3	Hstea	6	32	0.6	fore	6	89	1.2
Chilangali					fore	6	30	0.5					fore	15	100	0.5
D. Mbeza	Hste	5	15	0.3	field	5	18	0.3	field	6	22	0.5	woo	6	71	1.0
Kamwendo	Hste	6	120	1.6	Hste	6	32	0.6					fore	5	60	0.3
Peter Bilila	Hste	6	30	0.5	Hste	6	30	0.4	LBan	6	120	0.8	fore	17	230	1.3
Ndemanje	Hste	6	50	0.9	Hste	6	40	0.6					Hst	17	210	1.2
S.Mpombe	Hste	15	235	1.9	field	6	30	0.5					fore	6	75	0.5
Kateya									field	6	30	0.6	woo	6	50	0.2
Maluwa	Hste	6	50	1.1	field	13	45	0.6					woo	6	60	0.3
Kumponda	Hste	6	80	1.4	Hste	7	60	0.7	Hstea	16	80	0.7	woo	17	186	1.1
K.Chigumula					Hste	7	22	0.9	Hstea	16	30	0.6	Hstea	6	72	0.6

Table 4-8 (3) Growth of Selected Species of Seedlings

	specie	*A. polyacanthaa*			specie	*Faiherbia albida*			specie	*Bauhinai thonningii*			specie	*T. sericea* and others		
Village	loca-tion	months after p. o.	height in cm	DBH in cm	loca-tion	months after p. o.	height in cm	DBH in cm	loca-tion	month after p.o.	height in cm	DBH in cm	loca-tion	month after p.o.	height in cm	DBH in cm
Makonokaya																
Siyamudima																
Kaumbata	field		30	0.5												
Mdala					field	15	75	0.9								
Nanjiwa																
Chikoja	forest	5	30	0.5	woodl	5	32	0.5	Hstea	6	28	0.5				
Chakana																
Manjelo					forest	6	50	0.6								
Teula	Hstead	17	150	1.6	forest	6	100	1.2	Hstead	6	28	0.5				
Lemu																
M.Ngondo																
Kam'mata					forest	5	60	0.7								
Kumanda	forest	16	56	0.8	field	6	33	0.5	forest	7	26	0.4	forest	7	13	0.3
Tamvekenji																
Chilangali																
D. Mbeza					field	15	120	2.0								
Kamwendo	dimba	15	290	1.5	field	16	150	1.5	garden	16	110	0.8	field	6	11	0.2
Peter Bilila	field	17	220	1.1	field	16	210	5.7					field	6	11	0.3
Ndemanje	field	6	60	0.7	field	6	50	0.6								
S.Mpombe					field	16	110	1.3					field	6	10	0.2
Kateya					field	16	170	2.2					wood	16	15	0.3
Maluwa					field	16	120	1.3	field	16	90	0.5				
Kumponda					field	16	180	3.9	field	6	22	0.4				
K.Chigumula					field	16	140	2.2								

4.1.5 Relation between Rainfall and Survival Rate

Figure 4.7 and 4.8 give rainfall data collected in Chileka International Airport during the Study period. The observatory is located 4km south of the southern border of the Study Area. From these data it is identified that climatic character of the Study Area is now classified as semi-arid zone. Basically planted trees initially need enough water during 2-4 weeks after out-planting for their survival. In the Study Area, rainfall occurs in wet season around from November to March, though becoming erratic in these few years as seen in recent climatic trends. Considering these situations and watering by labor is a heavy work for villagers, out-planting in this area would be suitable between November and February expecting the much rainfall in March and provided with enough rainfall more than 100mm in each month. On the other hand, this is also verified from the fact that stands of baobab tree (*Adansonia digitata*) as an indicator plant of semi-aridity has been increased in these years. Such a drastic change would give influence to eco-system leading to decline of hydrophytic flora including *Toona ciliata* and *Bridelia micrtantha*, thereby incline to xerophytic ones such as *Adansonia digitata, Steculia quinqueroba*. In this context, climatic drying never fails to threaten the most vulnerable maize crop and this also affects forestry activities that require heavy labor to remove.

Figure 4-7 Rainfall Data in Chileka Airport

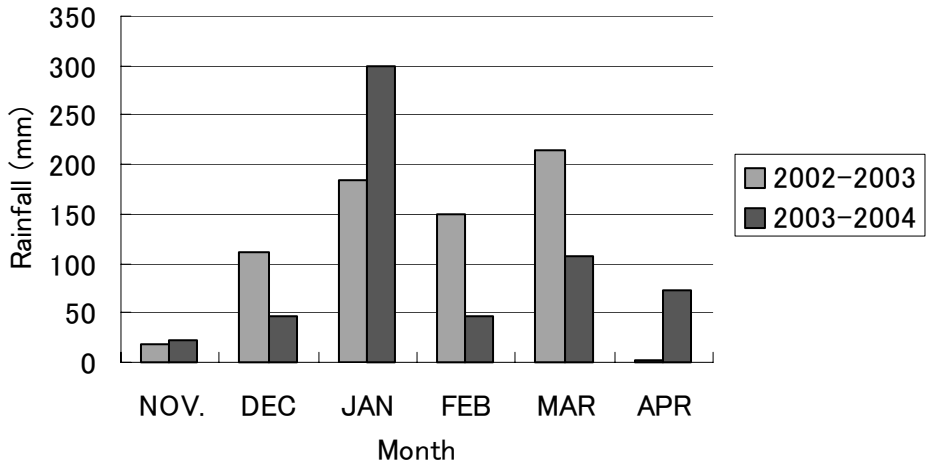
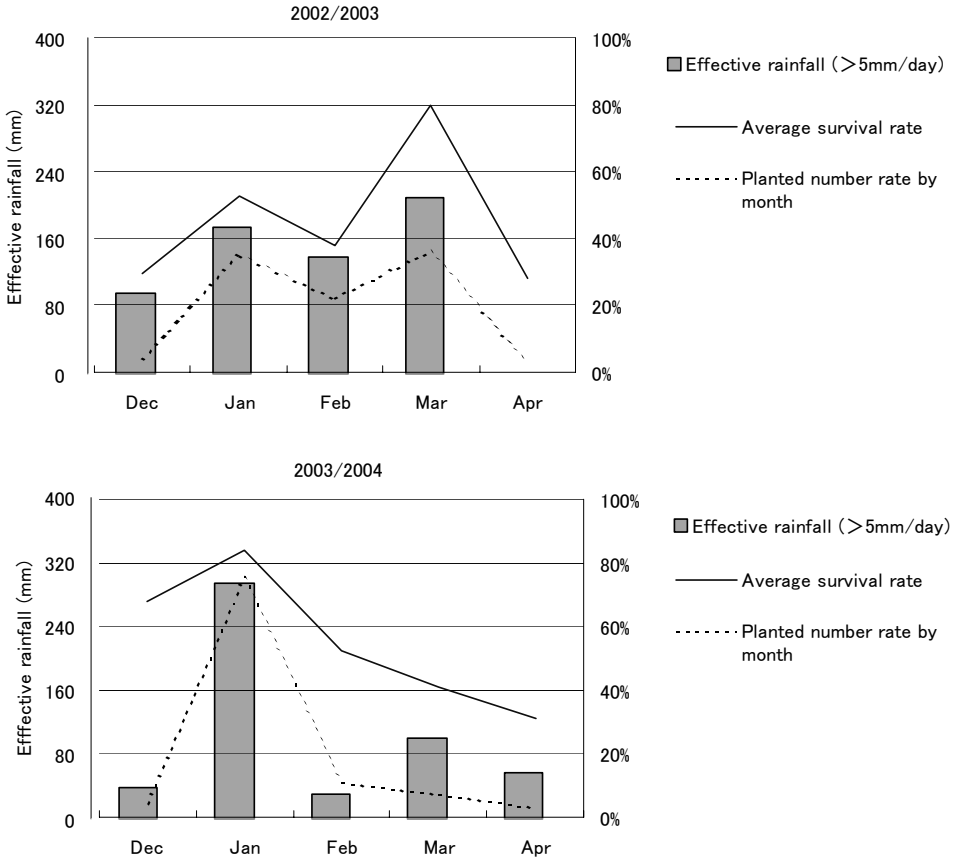
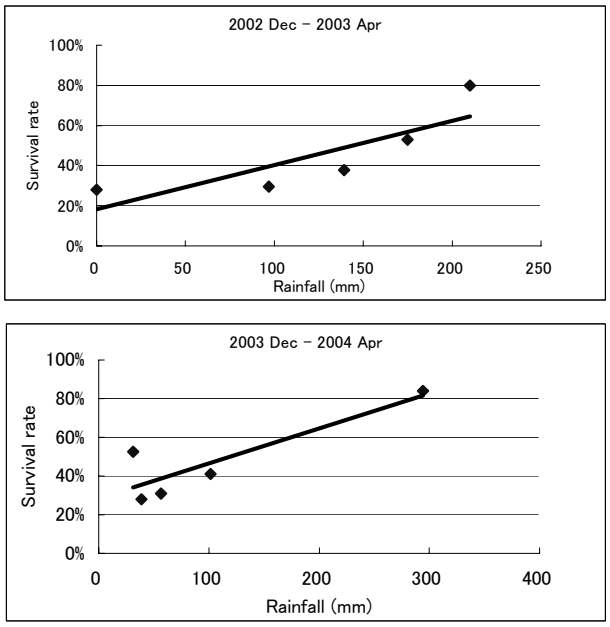


Figure 4-8 Survival Rate of Seedlings and Drought Spells



Relation between Survival Rate of Out-planting and Monthly Rainfall



Correlation coefficient	
2002 Dec - 2003 Apr	0.83
2003 Dec - 2004 Apr	0.87

4.2 The Survey on Income Generating Activities and the Results

In 2002/03, PIU decided to introduce an IGA for all the target villages in order to align the willingness of all village participants in nursery works. The activities to be introduced to a village were discussed and the following criteria were adopted to choose IGA for all villages.

1) a short list is to be provided based on original desire and priority of villagers in the target villages, resource availability and site suitability of each village, based on the results of Baseline Survey,
2) to make the applied IGAs sustainable, what can make use of forest / wood resources, as well as those yielding useful by-products for forestry use should be given priority in order to couple them with forestry activities,
3) as to the size of input to a village, budget availability should be taken into account but membership of each IGA group should accommodate all the participants in village nursery and out-planting works,
4) as a basis of allocating IGAs, villagers' past experiences of desired activity components are given priority for the allocation,
5) as concern villager's capacity dimension, current state of solidarity within participants can be evaluated in the selection and allocation of IGAs,
6) as regards technical fitness, an NGO gives relevant comments and assistance prior to starting IGAs in the target villages. PIU staff members include experts of IGA who belongs to the NGO.

Based on the above criteria for judgment, villagers and PIU finally decided to introduce the following IGAs to the target villages. PIU set a target for IGA that should benefit all the participants of forestry activities to the extent that half of their annual livelihood requirements can be earned therefrom. In this context, it debated difficulty in accommodating all the participants in nursery and out-planting activities by one IGA only, in order to realize this target, so it recommended to distribute the second IGA, desirably different ones within the village, to each village. Reflecting the results of IGAs distributed in the previous year, most villages desired goat rearing but no village desired bee keeping presumably on account of poor colonization. The selection of the second IGAs in 2003/04 was carried out in the same principles where two villages desired expansion of the same IGA, goat rearing.

Also, based on the requests by some villages, new IGAs, to be added to hitherto introduced components, were discussed in PIU, i.e., home bakery and inland fishery, and were finally concluded to introduce into the villages with best suited location, namely the remotest village to the market as concern home bakery, and three villages facing to Milala Dam. In introducing these, PIU aimed at a chain reaction of enhancing existing traditional income generating vocation, sale of firewood in and around home bakery, to maintain bakery activity, thus promoting tree planting for producing firewood for sale. It was expected that villagers in three villages around the Dam were engaged in fishery therein to plant many trees for the purpose of conserving watershed of the Dam lest soil should flow into it thus spoiling fishing ground at its bottom. Planting and processing of sweet-potato was also distributed to all the villages, expecting that it nurtures villagers As the result, the components as tabulated in Table 4-9 have been distributed into the participants in forestry in the target villages for two years (no IGAs added in the third year).

Table 4-9 Number of Villages by Component of IGAs

kind of IGAs	treadle pump	bee keeping	goat rearing	Guinea fowl	home bakery	Fishery	Sweet potato processing
2002 / 03	10	7	4	3	0	0	0
2003 / 04	5	0	16	1	1	1	10
2002 -2004	15	7	20	4	1	1	10

The selected IGAs mostly have close relationship with forestry in terms of use of resources and ecological functions. Besides, nursery activity has bearing to these IGAs because it needs high quality manure that can be supplied from goat huts, fowl cages and vegetable gardens.

Table 4-10 Interrelationship between IGAs and Forestry

Kind of IGA	Treadle pump	Bee keeping	Goat rearing	Guinea fowl
use of by-products	litters of vegetables can be used as manure		dropping for manure applied to nurseries	dropping for manure applied to nurseries
use of forestry / wood	litter of forest can be used as manure material	honey bees rely on the forest nectar sources	goats can browse on fodder tree leaf (AF)	fowls can be fed with forest insects/ leaves
inter-dependency with forestry	water retentive capacity of forest keep surface flow	dark shrubs can protect hives, bees carry pollen	Goat herds fowls can safely be pastured in woods/ shrubs	Guinea fowls can safely be pastured in woods/ shrubs

Table 4-11 Performances of Major IGAs coupled with Forestry Activities

			2002/03 results(End 2003)				2003/04 results(Mid 2004)				2004 results	
	introduced year		Goat	T.Pump	Bee-keepin	G.Fowl	Goat	T.Pump	Bee-keeppi	G.Fowl	sale/ self consumption.	
Village	2002	2003	heads	Acre plots (m^2)	colo-nized	Adult fowl	heads	allotted plots	colon-ized	Adult fowl	Begetable (kw)	Honey (kw)
Makonokaya	G	T	12	200	-	-	14	250	-	-	1,000	-
Siyamudima	F	G	12	-	-	20	16	-	-	17	0	-
Kaumbata	T	G	11	450	-	-	11	450	-	-	4,500	-
Mdala	B	T	0	200	1	-	0	250	3	-	1,500	1,200
Nanjiwa	B	G	12	-	0	-	19	0	2	-	0	800
Chikoja	T	G	13	480	-	-	14	270	-	-	5,500	0
Manjelo	T	G	14	500	-	-	16	500	-	-	3,000	0
Teula	T	G	13	650	-	-	19	650	-	-	3,500	0
Chakana	B	G	14	-	0	-	17	-	2	-	0	800
Lemu	T	G	11	400	-	-	16	400	-	-	3,000	0
M. Ngondo	F	T	0	440	-	20	0	500	-	4	5,200	0
Kam'mata	G	T	13	360	-	-	25	200	-	-	1,500	0
Kumanda	T	F	0	300	-	-	0	300	-	20	2,500	0
T. Kenji	B	T	0	400	4	-	0	320	4	-	2,000	1,800
Chilangali	T	G	17	720	-	-	24	720	-	-	4,500	0
D. Mbeza	F	G	13	-	-	20	20	-	-	3	0	800
Kamwendo	B	G	12	-	2	-	16	-	4	-	0	0
Peter Bilila	B	G	9	-	2	-	14	-	3	-	0	940
Ndemanje	B	G	14	-	1	-	19	-	4	-	0	4,800
S.Mpombe	G	G	38	-	-	-	47	-	-	-	0	0
Kateya	T	G	15	480	-	-	16	667	-	-	1,000	0
Maluwa	G	G	35	-	-	-	36	-	-	-	0	0
Kumponda	T	G	20	800	-	-	25	1,500	-	-	10,500	0
K.Chigumula	T	G	11	750	-	-	22	970	-	-	1,500	0
Total			309	7,130	10	60	406	7,947	22	44	50,700	11,140

Note: (1) G: Goat rearing, T; Treadle pump irrigation, B; Bee Keeping, F; Guinea fowl rearing.
(2) Other minor IGA not included here.

The performance of these IGAs is estimated in the Table 4-11, where goat rearing has been mastered and developed by the participants and only veterinary support is needed to maintain the activity. Treadle pump irrigation has also been favorably going on without any serious trouble for the maintenance, yielding some income for the participants.

Among IGA activities, goat rearing has developed very well but as far as daily income is concerned, small-scaled irrigation with treadle pumps has given sizable income to the groups of participants. Success in 2002 /03 triggered a chain reaction of following villages, leading to over 80% of the target villages now engaged in goat rearing. The favorable results are attributable partly to under-utilized herbal resources with crop residue are available everywhere and easy rearing are also counted as contributing factor of this popularization.

Treadle pump follows this success, however, some minor constraints have impeded proper use of treadle pumps, such as depletion of surface water in the source streams during late dry season, lack or insufficient area of field for use by vegetable producers groups and plant pest control. Table 4-12 presents an estimation of benefits yielding from the introduced so far into the target villages. Since an inhabitant in rural community requires K20 / day for sustenance of livelihood (estimated by PIU, though the requirement level is highly site-specific), it comes to K7,200 per annum. It follows that the target income from IGAs is desirable to reach K3,600 (the rest 3,600 should be brought from crop harvest). The most popular combination of IGAs, goat rearing coupled with treadle pump, can contribute to earning of about K2,600 per year per person, has reached 70% in value of this target, though still requiring to expand the benefit by 30%. In terms of actual sale, the cash amount may lie far below the estimated value.

Table 4-12 Estimated Values Created in IGA by Year

Unit: MK

	Group Members				Goat Rearing		Treadle pump		Bee keeping		Guinea fowl rearing	
Village	2002 / 03		2003 / 04		02 / 03	03 / 04	02 / 03	03 / 04	02 / 03	03 / 04	02 / 03	03 / 04
Makonokaya	G	48	T	10	2,500	5,000	12,700	13,800	0	0	0	0
Siyamudima	F	14	G	75	2,500	10,000	0	0	0	0	8,500	450
Kaumbata	T	10	G	30	0	0	30,900	24,800	0	0	0	0
Mdala	B	18	T	42	0	0	12,700	13,750	0	7,500	0	0
Nanjiwa	B	50	G	10	2,500	17,500	0	0	0	5,000	0	0
Chikoja	T	83	G	10	5,000	2,500	30,600	14,850	0	0	0	0
Manjelo	T	45	G	45	7,500	5,000	31,800	27,500	0	0	0	0
Teula	T	38	G	38	5,000	15,000	41,400	35,800	0	0	0	0
Chakana	B	11	G	10	7,500	7,500	0	0	0	5,000	0	0
Lemu	T	40	G	10	0	12,500	27,000	22,000	0	0	0	0
M. Ngondo	F	20	T	10	0	0	28,100	27,500	0	0	7,000	0
Kam'mata	G	16	T	31	5,000	30,000	23,000	11,000	0	0	0	0
Kumanda	T	10	F	42	0	0	19,200	16,500	0	0	0	7,000
T. Kenji	B	40	T	10	0	0	27,000	17,600	8,000	10,000	0	0
Chilangali	T	23	G	10	12,500	20,000	45,900	39,600	0	0	0	0
D. Mbeza	F	20	G	10	5,000	17,500	0	0	0	0	7,000	0
Kamwendo	B	10	G	10	2,500	10,000	0	0	4,000	10,000	0	0
Peter Bilila	B	10	G	10	0	7,500	0	0	4,000	7,500	0	0
Ndemanje	B	10	G	10	7,500	12,500	0	0	2,000	10,000	0	0
S.Mpombe	G	17	G	17	67,500	50,000	0	0	0	0	0	0
Kateya	T	22	G	10	10,000	2,500	30,600	36,700	0	0	0	0
Maluwa	G	10	G	10	60,000	2,500	0	0	0	0	0	0
Kumponda	T	38	G	10	22,500	12,500	5,100	82,500	0	0	0	0
K.Chigumula	T	16	G	10	0	27,500	53,200	54,800	0	0	0	0
Total	1,286		980		225,000	267,500	419,200	438,700	18,000	55,000	22,500	7,450
Nr. of member					389	389	428	428	149	149	118	118
MK/ member					578	688	979	1,02	121	369	191	63

Based on the above estimation, the economic balances of these four major IGAs are calculated. Initial cost includes NGO service charge in the case of bee keeping and Guinea fowl rearing, but

does not include goat rearing and irrigation of vegetables with treadle pumps. Irrigation reaches fastest cost recovery in the second year, but goat rearing takes double period, or four years to recover cost. Bee keeping takes 14 years but if only material cost was incurred as the initial cost, cost recovery would have been attained within 6 years after the investment. Both goat rearing and treadle pumps are judged as economically viable activities, but bee keeping required too heavy cost to make the activity viable. In this context, dependence on sub-contractors leads to less cost-effective outcome, while that on extension staffs can economize the initial cost as expected earlier. The benefit-cost ratios discounted by 5% show the steady growth of management in the cases of Boer goat rearing and irrigation with treadle pumps. Although the gain so far achieved is far from expectation, the villagers involved in IGAs feel satisfaction with their activities as recorded in their self-evaluation results as mentioned below.

Table 4-13 Economic Viability of Major IGAs Employed in the Study Area

	Total four IGAs	Goat rearing	Treadle pumps	Bee keeping	Guinea fowl
annual benefit	701,000	220,000	429,000	37,000	15,000
initial cost	2,439,300	680,000	480,000	530,000	749,300
cost recovery year	4th year	4th year	2nd year	14th year	-
short term B/C ratio	1.59 (5% disc.6th yr)	2.34 (5% discount)	3.08 (5% discount)	1.03(5%disc,9th yr)	-
internal rate of return	30% (6years)	34% (5years)	73% (5years)	6% (9years)	-

IGAs so far attained as of September 2004

Boer goat rearing has given successful results because of favorable cycle of reproduction has continued in it with few problems of theft damages and diseases curable by veterinary treatments, easy rearing and plenty of untapped grass resources in almost all villages. In 2002, only 4 villages began rearing with 11 Boer goats for each (in total 44 heads) but in 2003, 18 villages followed (of which 2 villages successively chose goat rearing) with 198 stocks. Number of heads increased by 30% half a year after the delivery, then by 70% after one year. The delivered 242 stocks have had offspring counting 193 increasing by 80% during 2 years. However, minor problems have arisen from loss of theft and diseases like skin-ulcer and fluke that were carried from the supplying origins. As of September 2004, the herd has expanded by 83%, and it will be doubled two years after delivery. Thus, 83 % of the target villages have so far reared improved goats, with a capacity of propagating resources 5 times as much as the herd currently reared.

Received herd of 11 goats have been kept in huts or tethered or pastured in the villages during daytime, but in most cases they are kept in the houses of each member of goat rearing to prevent theft damage. If the total number of heads exceeds that of participants, the member of rearing group, born kids are shared as individually owned livestock and one of the kids born from the reared female will be returned to the group as pooled herd for further proliferation to be supplied to the group members who are subscribed in the waiting list. 14% of the total heads has been shared as private property. The result of management shows that 65 heads of offspring are shared among 379 members, equivalent to K429 per year assuming that after one year of rearing goats weigh 61kg, with the value K2,500/ head. As far as cash income is concerned, however, development still remains in embryonic stage since the rearing groups cannot sell pooled stocks they keep until all the participants receive offspring.

4.3 The Results of Combined Activities of Forestry with IGAs

4.3.1 Significance of coupling forestry with IGAs

In developing Pilot activities envisaged in the Model, tight coupling of forestry / agro-forestry activities with IGAs constitutes essential part because the same villager should take part in both activities. As mentioned later, the envisaged combination has been realized in all target villages albeit some conflicts have taken place between village chiefs or committee members and nursery participants on account of habit of monopolizing or usurpation by the former side. These conflicts were reported to the group villages controlling the villages concerned and finally to T.A. concerned, who made equitable decision to solve or reconcile them. Thus, a lady chief of Kateya village was replaced due to dispossession of irrigated plots cultivated by participants. PIU staff also redistributed Boer goats supplied through input supply of Pilot activities in order to rectify biased possession of inputs in favor of chief's clan in three target villages. Such unequal allocation or treatment has been a routine in any traditional society, though local community undergoes a process of democratization through implementation of projects, renovations and other actions brought outside the villages.

PIU staff has emphasized rigid application of fair combination of these activities anticipating that forestry performance would adversely be affected by reluctant participation in nursery and out-planting works if the participants were mobilized into hard norms without remunerative return with IGA distribution. Majority of the target villagers have realized the mechanism of this coupling through repeated lectures by the staffs of PIU. The efforts of PIU staffs for equitable distribution of IGA inputs among maximum households likely to be involved in the Pilot activities have borne a fruitful result of satisfactory and sustainable participation in (free of wage) forestry activities for three years.

Because both forestry and IGA norm, as already mentioned, were suddenly imposed on the same participants who were in most cases in poor nutrition especially during rainy season with heavy cropping labor, the burden would threaten their health if no measures were taken. This is the reason why IGA components have been selected in a way that their labor peaks do not fall on rainy season, but are evenly distributed throughout a year. Actually, about half of the participants have got engaged in forestry and two different IGAs in 2003/ 04 and they manage to get along without suffering from overwork. For example, participants in half of the target villages are working for forestry, Boer goat rearing and dimba irrigation with treadle pumps. Vacant periods of these activities fall on April ~June, September ~November and January ~March, thus no labor peak comes overlapping in particular season.

From use of available resources point of view, the planned combination does not arise inner competition of resource use. For instance, water is used both for nursery and treadle pumps, but water use for the former concentrates on October ~December while that for latter mainly occurs from April to September. Grass is also used both for manure preparation for nurseries and for feeding goats The period for the former develops during March ~July but the latter takes place from August to October, thus no serious competition on use of resource would arise here. On the contrary, goat hut/yard dropping as well as vegetable litter from plots of treadle pumps can be used for the preparation of good quality manure for raising tree seedlings.

As shown in Fig. 4-9, a high correlation is perceived between nursery works and performance of IGAs, where numbers of nursery-raised, out-planted and survived seedlings tend to augment as managerial state of IGAs is improved. Likewise, a positive correlation is found between quantities of available resources (such as grass and water) within a village and the values created by IGAs. Though it is not illustrated in the figure, participants in forestry works and IGAs have completely been overlaid for two years, indicating that close linkage between

forestry and IGAs has been secured. From these analytical results, it is identified that the aimed combination of forestry with IGAs has been held with closer inter-linkage as initially expected.

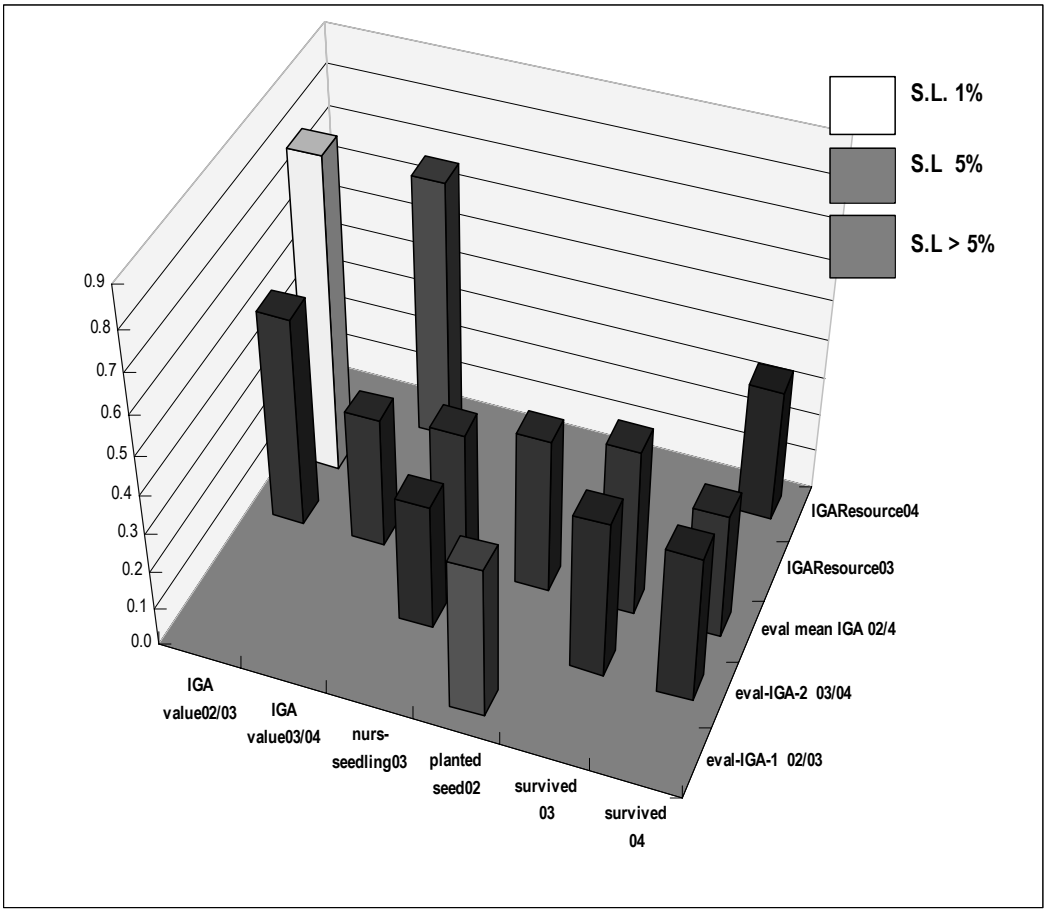


Figure 4-9 Analysis of Interaction between IGAs and Forestry

4.3.2 The Results of Villager's Self Evaluation

In July - August, Villager's Self Evaluation was made where 5 villagers per target village were asked to do their own evaluation by individual, and the results were summarized in Table 4-14 and Table 4-15: Many respondents appealed drought affected conditions and entailed food shortage (during October ~ February) and firewood scarcity. Villager's income sources were concentrated on piece-meal works followed by sale of crop and grocery commodities. Sale of wood and livestock occupied lower position as compared to the state surveyed in Baseline Survey, on account of dwindling resources.

Table 4-14 Summary of Replies to the Questionnaire on Villager's Self Evaluation

	Climatic Condition			All Villager's Health Condition			
	drought	ordinary	wetter		many villagers passed away	young villagers are well	all people are healthy
2002	63	45	11	2002	17	45	30
2003	69	46	5	2003	15	26	34
2004	66	5	1	2004	17	38	16
	Stream Water Flow			Tubewell Water		Firewood	

	scarce	ordinary	enough		scarce	ordinary	enough		scarce	ordinary
2002	31	58	30	2002	27	49	42	2002	97	23
2003	35	49	33	2003	31	37	50	2003	99	21
2004	67	33	24	2004	42	32	38	2004	98	20

Hunger and Food Security

	State of Hunger			famine months		Food Aid		
	serious	as usual	no hunger	started from	up to	nothing	some	to whom
2002	73	42	4	October	February	11	107	not all people
2003	43	69	2	October	February	73	44	not all people
2004	78	31	1	October	February	97	11	not all people

Income sources

	Income State, Major Source of income						Activeness of Village committee			
							Participation in village committees			
	piece meal labor	crop sale	wood sale	livestock	itinerant vending	selling beer	name of committees	yes	no	fee/month
fairly big	0	0	0	0	1	0	borehole	78	63	11
some	87	42	29	20	39	23	school	63	60	42
nothing	0	0	0	0	0	0	health	45	64	5
value(K)	7,940	3,830	2,650	1,800	3,560	2,100	Nursery/IGA	95	15	56

Participation to Nursery

	Regular Nursery Participants			Duration and work days/ week			Number of raised seedlings		
	women	men	children	from	to	days / week		yes	number
2002	56	47	0	July	Dec.	2	per week	9	753
2003	54	48	0	June	Dec.	2	per week	6	860
2004	41	56	0	June	Apr.	2	per week	3	63

Hardship and problems

Burden of forestry works				Problems and Constraints the participants face	reply	%
	Exhaustive	Ordinary	Not Hard	1. Nursery work overlapping to cropping period	12	50%
Nursery	0.20	0.13	1	2. No wage is paid to nursery works	13	54%
Planting	0.13	0.16	1	3. Nursery works coincide with hunger period.	15	63%
I G A s	0.08	0.17	1	4. Mobilization to nursery may affect health.	2	8%

Participation to Out-planting

	Out-planting Participants			Duration and work days/ week			Survival of raised seedlings		
	women	men	children	from	to	frequency		yes	no
2002	31	23	0	Dec.	Mar.	2	per week	9	0
2003	26	19	0	Dec.	Mar.	2	per week	6	0
2004	3	2	0	Dec.		2	per week	3	0

Practice of Out-Planting How many seedlings are distributed and where were they planted?

	Seedling distribution			Place / site of Seedling Planting					No. of seedlings planted		
	No	Yes	number	homestead	along paths	crop field	woodlot	river bank			village
2002	0%	100%	25	1	0	1	1	0			3,524
2003	4%	96%	23	1	0	1	1	1			3,824
2004	0			0	0	0	0	0			313

Awareness of Environmental Conservation: Why is tree planting necessary?

The reasons that villagers came up with concerning conservation	reply	%
1. Because we cut more trees than those spontaneously grown from fallen seed.	57	46%
2. Because trees give us not only firewood and timber, but water and soil fertility.	119	100%
3. Because planted seedlings will grow to useful wood for charcoal in future.	60	56%
4. Because we'll have to walk longer time to fetch firewood if we don't plant them.	61	57%
5. Not needed because trees naturally grow.	0	0
6. Not needed be cause planting is heavy work.	0	0
7. Not necessary because we don't have enough land for planting in our village.	0	0
	4	4%

Understanding on Environmental Change: What do you expect towards campaign of tree planting?

	reply	%
1. Planting trees leads to secure more firewood, poles and fruits.	114	96%

2. Planting trees results in less soil erosion, hence keeps fertility.	106	89%
3. Planting trees eventually increases borehole water and stream flow.	78	66%
4. Planting trees enriches useful products such as honey, mashroom.	52	44%
5. Planting agro-forestry trees is equal to applying fertilizers to crops.	6	6%
6. other reply	2	2%

Many respondents felt drought conditions during the survey period as identified in meteorological data processing. Affected by the drought, villager's health trailed a downward trend, and surface and ground water was influenced by drought. Firewood availability was affected by constant scarcity during the period. Majority of the respondents admitted serious famine started from October lingering up to the first harvest falling in February. Villager's income sources were concentrated on piece-meal works followed by sale of crop and grocery commodities. Sale of wood and livestock occupied lower position because of dwindling resources. Total participants in nursery works did not change throughout the Study period.

Similar to the participants in the nurseries, more ladies are found in those in IGAs, the period ranges from March, after harvest to June-November, before rainy season as PIU initially expected. The participants worked 14-18 days /month during this period and rate of satisfaction with their involvement in IGA introduced in 2002/03 reached 90% with a duration longer than the first IGA. As to equity and quantity of benefit share among the participants, response showed mostly satisfaction, however, as to input supply, some felt dissatisfaction because of too many participants to use limited number of inputs (30% of the participants), or of too delayed supply of inputs, leading to failure of timely works during peak season (9% thereof).

As regards supply of the second IGA, participation of ladies has been comparable to that for the first IGA, but men's participation has become declining. Beginning month of IGA has got earlier, while ending month is similar to the case of the first IGA. Satisfaction rate of IGA involvement has increased to over 90%, and the days of work under the second IGA has fairly augmented as compared to the case of the first IGA. Benefit sharing performance has become better than the case of the first year IGA, in the meantime complaint of short supply and failure in timely supply have declined. More participants in 2003 /04 IGA have received actual benefit than in the first year IGA, and this result matches with the above estimation of benefit trends. These trends indicate that both the benefit carrier and the receiver have got accustomed to the management of IGAs that is gradually oriented to a stabilizing phase.

When it comes to the activities of IGA committee, membership shows a stabilizing trend and attendance to meetings has been improved. Frequency of meeting has increased, implying that committees become more active with many things to discuss. What has been decided in the committees in 2004 has become more reflected in IGA management than in 2003.

Regarding future prospect of the Pilot activities, many respondents had optimistic outlook and 92% of them (109 out of 119 respondents) favored for sustainability without donor's assistance. Respondents also appealed need for further extension services as a condition of making their works sustainable. They appreciated forestry activities with recognition of incentives given therefrom. This can be interpreted as future possibility of income source for firewood / charcoal vending, because many villagers still remember dependence to natural endowments for past decades. The respondents also claimed for too short period for Pilot activities to attain certain degree of their targets. As concern IGAs, similar result was obtained on the sustainability to the forestry activities. They gave similar evaluation pattern for IGAs to that given to the forestry activities, implying that they recognized forestry and IGAs are coupled and mutually dependent.

Finally, villager's concept has undergone a drastic change into higher recognition of needs for planting trees than the level prevailed in a few years back, accounting for benefits that trees will bring, most probably impressed by the repeated lectures by extension staff. Expectation in IGAs

was as strong as that in forestry activities, where they deemed IGA as a resource based tool for improving future livelihood. Some respondents have replied in a way that if their life is stabilized with the involvement in IGAs, they can afford to consider their environment and it may lead to an atmosphere where more tree planting follows through nursery raising.

Table 4-15 Summary on Participation to Income Generating Activities

Rough number of participants in IGA1(2002 / 03)

	Regular Nursery Participants			Duration and work days/ week			Satisfaction of participation		
	women	men	children	from	to	work-days	% of yes	yes	no
2002	49	38	0	Mar.	Jun.	14	86%	56	9
2003	74	55	1	Mar.	Nov.	18	90%	105	12
2004	53	41	0	Mar.	Aug.	17	93%	88	7

Rough number of participants in IGA2 Period of IGA-2

	Regular Nursery Participants			Duration and work days/ week			Satisfaction of participation		
	women	men	children	from	to	work-days	% of yes	yes	no
2002	4	2	0	Jan.	Jan.	16	96%	20	3
2003	67	46	2	May	Oct.	27	86%	107	7
2004	55	38	2	Feb.	Aug.	28	99%	99	2

Participant's impression on IGA-1 2002 / 03 IGA management

	Degree of benefit share			State of input supply to the participants			Actual benefit received	
	well	fairly	poorly	equitable use	short supply	not timely supply	yes	no
2002	42	9	5	34	10	9	32	14
2003	88	17	10	59	35	8	94	24
2004	78	8	1	49	29	2	82	4

Participant's impression on IGA-2 2003 / 04 IGA management

	Degree of benefit share			State of input supply to the participants			Actual benefit received	
	well	fairly	poorly	equitable use	short supply	not timely supply	yes	no
2002	13	1	1	10	6	1	11	1
2003	86	19	8	75	33	4	102	6
2004	87	9	0	68	24	1	92	1

Activity of Related Committee(s)

	committee member		attendance		frequency of meeting		decisions reflected in activities		
	women	men	Good	poor	per week	per month	% of yes	yes	no
2002	4.3	4.1	87	2	0.7	2.9	97%	89	3
2003	5.5	4.9	100	18	0.9	3.9	88%	101	14
2004	5.6	4.9	100	11	1.0	4.1	92%	108	10

Future prospect of Forestry Activities in village : Whether current nursery/ planting continues in future or not

Yes it's sustainable on condition that			No, it'll not be viable because of		
all by self effort without aid	if input supply continues	if extension is actively served	poverty and hunger	no more input supply	no extension support
110 (92%)	11 (9%)	43 (36%)	0	1 (1%)	0

Future prospect of IGAs in village : Whether current nursery/ planting continues in future or not

Yes it's sustainable on condition that			No, it'll not be viable because of		
all by self effort without aid	if input supply continues	if extension is actively served	poverty and hunger	no more input supply	no extension support
109 (91%)	9 (8%)	40 (35%)	0	0	1(1%)

Influence of Forestry Activities to Villager's attitude: What effect was brought on villager's life

Given alternatives to reply as to the inquiry on villager's impression	reply	%
1. Some incentives are given to the villagers.	59	55%
2. No significant / visible effect has been given.	9	9%
3. It's still too early to make evaluations / judgment	9	9%
4. 3 year's term is too short to give positive Influence of IGA Activities to Villager's attitude	51	48%
5. Any other opinion on this question.	5	5%

Future prospect of IGA Activities in your village: Whether current IGAs continue in future or not

Yes it's sustainable on condition that	No, it'll not be viable because of

all by self effort without aid	if input supply continues	if extension is actively served	poverty and hunger	no more input supply	no extension support
109 (92%)	9 (8%)	40 (33%)	0	0	1 (1%)

Influence of Income Generating Activities to Villager's attitude

Given alternatives to reply as to the inquiry on villager's impression	reply	%
1. Some incentives are given to the villagers.	62	52%
2. No significant / visible effect has been given.	8	8%
3. It's still too early to make evaluations / judgment	13	11%
4. 3 year's term is too short to give positive Influence of IGA Activities to Villager's attitude	33	28%
5. Any other opinion on this question.	5	5%

Changes in villager's understanding brought about by the Nursery/Planting Activities?

1. We recognized need of planting trees to secure firewood for us in future, without planting trees always decrease.	109	93%
2. We learned that our resources such as honey, livestock, foodcrops and water are sustained by planting trees.	66	56%
3. We will be able to enjoy benefit from planting trees as firewood, poles and other harvests, though it takes long period.	90	77%
4. We have been motivated through intensive training by extension staff and technically and practically empowered.	56	48%
5. No particular changes have so far been substantially brought from forestry activities because of slow growth of trees.	4	4%
6. Basically villagers behaviors or way of thinking cannot be radically changed in short time of extension activities.	0	-
7. Villagers have to procure foods /income rather than engaged in forestry activities that give only slow return to our inputs.	1	1%
8. Forestry works are too heavy and exhaustive to continue while benefit is relatively small as compared with other works.	0	-

Changes observed in villager's livelihood possibly brought about by the Income Generating Activities?

1. We recognized positive effects of IGAs to stabilize future livelihood, otherwise people can't be well mobilized.	111	95%
2. We learned that our village resources can be efficiently converted into earning incomes through IGA practices.	67	57%
3. We can enjoy future benefits arising from our participation in IGA activities matching with our land conditions.	61	52%
4. We have been motivated through intensive training by extension staff and technically and practically empowered.	56	48%
5. No particular changes have so far been substantially brought from IGA activities because of retarded development.	2	2%
6. Basically villagers' behaviors or way of thinking cannot be ly changed in short time of newly introduced activities.	2	2%
7. Villagers have to rely on traditional income than engaged in new IGA activities that do not give stable return to us.	1	1%
8. IGA activities are too risky / exhaustive to continue and benefit is less than expected as compared to other works.	1	1%

4.4 Monitoring / Evaluation of Pilot activities and its Feedback

4.4.1 Monitoring and Evaluation of the Activities

The system of Project Cycle Management has been applied to the monitoring and evaluation of Pilot activities, and PIU provided the matrices as of March every year covering 2003 and 2004. Apart from PCM, PIU staffs have monitored and evaluated by their own observation records and their basic knowledge, experiences, and the results are summarized as follows.

As mentioned earlier, land scarcity remains as a bottleneck giving a negative effect to afforestation activities. Most land area in the target villages has been allotted with very limited area remaining for village woodlots. Previously only 9 village forests remained, but more than two sites per village, or 61sites in total have been planted as village forest during Pilot activities, as shown in Table 4-16. 22 sites per village have so far been planted as private woodlots with

nursery raised seedlings though average area of the lot is as small as 200 m^2 or so. This is a considerable achievement compared with the previous density; 4 private lots per village. These village wood-lots are often located at rocky hill sides, accounting for 0.3 ha per lot. Besides, all the participants in village nursery works and some other villagers received seedlings raised therein and planted on private land including homestead and crop field. The total number of private wood-lots is equivalent to that of out-planting participants, namely, a participant created a small wood lot. However small size they might be, the planted sites were dispersed all over the villages, thus served as barrier of soil erosion while they promised individual procurement of firewood in future in so far as the planted trees stood on private land.

As to AF practices, seed procurement has been ensured through creation of village seed banks. Many participants have been motivated through study tours, PIU demonstrations and delivery of seed and establishment of seed banks, because they cannot afford to purchase chemical fertilizers that brings better harvest. It was not until the third year that actual practice was diffused among the participants, who created 34 AF practiced plots per village versus none before the Pilot Study. Smooth development of AF has been brought about by improved material and seed supply to individual participants as such constraints as seed shortage, insufficient practical knowledge/ skill have been removed off. For example, village headman of Ndemanje village planted 0.12ha of his maize field with *G. sepium* and made success in improving maize yield. Other farmer in the same village directly sowed *T. vogelii* on his sweet-potato field though the effect was not clear. Observed participants followed their practice after they received seed or seedlings from the village nursery. Eventually, AF practice has covered 4% of the total arable land the participants cultivate, as against 50% as their long-term target.

Table 4-16 Major Results of 2002 / 03

Village	Forestry / Agroforestry				Income Generating Activities				Stakeholders of Pilot Activities		
	individual woodlots	village forestry	AF *** practiced	improved stove *%	compo-nent	inputs	outputs *m^2	actual income**	male	fem-ale	% ****
Makonokaya	6→30	0→2	SB only	0→4(7%)	Boergoat	11 goats	→13 (7st)	0	8	27	63
Siyamudima	7→20	1→2	SB only	0→5(3%)	Guineafowl	20 fowls	3 killed	0	20	22	25
Kaumbata	1→22	1→3	SB only	0→4(3%)	Treadlepump	3 pumps	0→200*	0	7	10	15
Mdala	15→65	1→2	SB only	0→4(1%)	Beekeeping	4 hives	0	0	40	75	38
Nanjiwa	8→30	1→3	SB only	0→4(3%)	Beekeeping	4 hives	0	0	7	15	18
Chikoja	5→150	0→1	SB only	0→22(13%)	Treadlepump	3 pumps	0→480*	0	7	20	16
Manjelo	10→25	0→1	SB only	0→12(18%)	Treadlepump	3 pumps	0→200*	0	11	22	49
Teula	4→20	0→1	SB only	0→6(4%)	Treadlepump	3 pumps	0	0	20	25	32
Chakana	0→14	0→2	SB only	0→4(8%)	Beekeeping	4 hives	0	0	8	7	30
Lemu	9→31	1→4	31 plots	0→12(2%)	Treadlepump	3 pumps	0→0.2ha	0	12	17	6
M. Ngondo	0→21	0→4	SB only	0→6(8%)	Guineafowl	20 fowls	4killed	0	7	10	21
Kam'mata	7→27	1→3	SB only	0→10(4%)	Boergoat	11 goats	→13 (0st)	0	6	21	11
Kumanda	0→19	0→1	SB only	0→1(2%)	Treadlepump	3 pumps	0	0	8	11	41
T. Kenji	3→13	0→1	SB only	0→4(7%)	Beekeeping	4 hives	0	0	10	17	48
Chilangali	2→18	1→3	SB only	0→5(13%)	Treadlepump	3 pumps	0	0	6	10	40
D. Mbeza	0→16	0→1	SB only	0→1(2%)	Guineafowl	20 fowls	10 killed	0	7	9	39
Kamwendo	0→61	1→2	SB only	0→35(59%)	Beekeeping	4 hives	0	0	31	30	100
Peter Bilila	1→16	0→1	SB only	0→12(17%)	Beekeeping	4 hives	0	0	31	53	100
Ndemanje	3→20	1→2	3 plots	0→11(29%)	Beekeeping	4 hives	0	0	17	18	92
S.Mpombe	2→10	0→1	SB only	0→14(22%)	Boergoat	11 goats	→11 (0st)	0	14	27	63
Kateya	0→13	0→1	SB only	0→14(61%)	Treadlepump	3 pumps	0	0	21	18	100
Maluwa	0→20	0→1	SB only	0→8(15%)	Boergoat	11 goats	→11 (2st)	0	5	15	32
Kumponda	0→18	0→1	SB only	0→16(6%)	Treadlepump	3 pumps	0	0	19	55	28
Chigumula	0→11	0→1	SB only	0→40(25%)	Treadlepump	3 pumps	0	0	45	75	75
Total/mean	83→679	9→44	34plot	0→254(9%)		-	-	0	367	609	32

Note: SB; seed bank establishment, *% and ****; to village household, ** in MK, *** AF; agro-forestry, st; stolen

The innovation as mentioned above was not confined to AF, but in IGAs including apiary and irrigation with treadle pumps horizontal expansion of techniques progressed in 2003/04, enabling participants who got accustomed to practices to earn cash income. Total annual value created by two major components of IGAs is estimated at MK 1,312 / participant / year (not real cash income). Both the progress of AF activities and IGAs lagged behind the initial schedule due to scanty seed supply and difficult procurement of inputs in the markets. In particular, buying up of treadle pumps by a donor project depleted stock in every supplier's store that led to oligopsonistic supply with skyrocketed price hike and finally retarded delivery to target villages. Thus, main season for employed IGAs had passed before the completion of input delivery, yet participants in nursery works performed raising and out-planting of seedlings amidst starveling hunger in an expectation of means of income generation.

A typical character in both forestry and IGA activities is found in prominent participation of housewives rather than men. This is partly imputed to traditional division in matriarchal society but partly to physical capacity or posture with challenging nature. Particularly, village headwomen toil for subsistence, often taking laborious attitude towards seedling raising and vegetable growing, possibly because they have much concern on fetching firewood desiring easier wood collection. Under lady chiefs more women tend to participate in nursery works though men also perform out-planting. In the above Table 4-21, women account for more than 60% of the total participants in the Pilot activities where ladies attended nursery works at the rate of over 70% under village head women. Women headed villages created more improved stoves than male-headed ones because of willingness of improving household chores.

Table 4-17 Major Results of Pilot Activities in 2003 / 04

Village	Forestry / Agroforestry				Income Generating Activities						Participants of Pilot Activities		
	individual woodlots	village forestry	AF *** practiced	improved stove	IGAs 02 / 03	outputs IGA-1	inputs IGA-2	outputs IGA-2	income IGA-1	income IGA-2	total IGA1	total IGA2	income /person
Makonokava	30→30	2→2	0.5	4→20	BG-TP	13→14	0→200		0	1.000	48	10	21
Siyamudima	20→85	2→3	0.3	5→25	GF-BG	17→17		11→16	0	0	14	75	0
Kaumbata	22→73	3→3	0.1	4→18	TP-BG	200-450	11	11→11	4,500	0	10	30	150
Mdala	65→65	2→3	0.4	4→20	AP-TP	1colon.	3		0	1,200	18	42	29
Nanjiwa	30→95	3→4	0.4	4→10	AP-BG	0colon.	11	11→19	800	0	50	10	16
Chikoja	150→150	1→2	0.5	22→60	TP-BG	480-270	11	11→14	5,500	0	83	10	66
Manjelo	25→45	1→2	0.6	12→18	TP-BG	200-500	11	11→16	3,000	0	45	45	67
Teula	20→38	1→1	0.1	6→14	TP-BG	0→650	11	11→19	3,500	0	38	38	92
Chakana	14→25	2→3	0.0	4→4	AP-BG	0colon.	11	11→17	800	0	11	10	73
Lemu	31→40	4→4	0.1	12→45	TP-BG	400- 400	11	11→16	3,000	0	40	10	75
M. Ngondo	21→36	4→4	0.3	6→20	GF-TP	17→13	3	17→	0	5,200	20	10	260
Kam'mata	27→90	3→5	3.5	10→15	BG-TP	13→25	3	0→360	0	1,500	16	31	48
Kumanda	19→33	1→2	1.2	1→10	TP-GF	0→300	20	20→	2,500	0	10	42	60
T. Kenji	13→40	2→3	0.6	4→17	AP-TP	4colon.	3	0→400	1,800	2,000	40	10	95
Chilangali	18→40	3→4	0.2	5→15	TP-BG	0→720	11	11→24	4,500	0	23	10	196
D. Mbeza	16→35	1→1	0.3	1→2	GF-BG	10→3	11	11→20	800	0	20	10	40
Kamwendo	61→92	3→4	1.1	5→44	AP-BG	2colon.	11	11→16	0	0	10	10	0
Peter Bilila	16→72	1→1	0.1	12→36	AP-BG	2colon.	11	11→14	940	0	10	10	94
Ndemanje	20→79	2→2	1.4	11→21	AP-BG	1colon.	11	11→19	4,800	0	10	10	480
S.Mpombe	10→65	1→2	1.2	14→22	BG-BG	-	11	22→47	0	0	17	17	0
Kateya	13→30	1→2	0.1	14→18	TP-BG	0→480	11	11→16	1,000	0	22	10	45
Maluwa	20→65	1→1	0.3	8→10	BG-BG	-	11	22→36	0	0	10	10	0
Kumponda	18→43	1→2	0.1	16→25	TP-BG	0→800	11	11→25	1,050	0	38	10	28
Chigumula	11→65	1→1	1.6	40→46	TP-BG	0→750	11	11→22	1,500	0	16	10	58
Total/mean	679→1,354	44→61	15.0	367→504	-	-	-	-	2,059	454	26	20	98

Note: BG; Boer goat, TP; treadle pump, GF; Guinea fowl, AP; bee-keeping.. unit of figures: heads, irrigable area m^2 , income at MK otherwise specified).

Concerning performance of IGAs shown in Table 4-17, initial delay lingered in the performance in subsequent years except Boer goat rearing that recorded favorable development owing to less constraints and ample availability of feeding material in most villages. Estimated income from IGAs in 2003/ 04 amounted to only MK 98 although it didn't include value of self-consumption and pooled stock.

However, in 2004 situation around IGAs has been ameliorated to yield higher income owing to various advantages, above all; participants have got accustomed to deal with IGA practices, conditions have turned into favorable state as observed in higher colonization of beehives, forestry participants have been remunerated with acquiring participation in IGAs. As a result, level of annual income has been augmented to more than a digit superior to that of the preceding year. Such satisfactory turnover in IGAs was also reflected in the result of villager's self-evaluation where majority of the respondents expressed satisfaction with their involvement in IGAs. Most of this contribution stems from Boer goat rearing and irrigation with treadle pumps, and these activities are considered sustainable on account of ample resource availability though some concern arises from adverse influence of global warming effect. In the following table, only gross incomes are tabulated and no cost expense is included.

Then, net income per participant comes to around MK 1,000, equivalent to the amount of subsistence expenditure for one month per household in terms of meeting BHN, in addition to crop harvest (Table 4-18).

Table 4-18 Major Results of IGAs in 2004

Village	Income Generating Activities (unit of figures: heads, irrigable area m^2 otherwise specified)						Participants of Pilot Activities		
	IGAs 02 / 03	outputs IGA-1	inputs IGA-2	outputs IGA-2	income IGA-1 (MK)	income IGA-2 (MK)	total IGA1	total IGA2	income /participant
Makonokava	BG-TP	13→14	0→250		7.500	1.000	48	10	147
Siyamudima	GF-BG	17→17		11→16	0	12,500	14	75	140
Kaumbata	TP-BG	200→450	11	11→11	4,500	0	10	30	113
Mdala	AP-TP	3colonies	3		2,100	1,200	18	42	55
Nanjiwa	AP-BG	2colonies	11	11→19	800	20,000	50	10	347
Chikoja	TP-BG	480→270	11	11→14	5,500	7,500	83	10	140
Manjelo	TP-BG	200→500	11	11→16	3,000	12,500	45	45	172
Teula	TP-BG	0→650	11	11→19	3,500	20,000	38	38	309
Chakana	AP-BG	2colonies	11	11→17	800	15,000	11	10	752
Lemu	TP-BG	400→ 400	11	11→16	3,000	12,500	40	10	310
M. Ngondo	GF-TP	17→13	3	0→500	0	5,200	20	10	173
Kam'mata	BG-TP	13→25	3	360→200	0	1,500	16	31	32
Kumanda	TP-GF	0→300	20	20→20	2,500	0	10	42	48
T. Kenji	AP-TP	4colonies	3	400→320	1,800	2,000	40	10	76
Chilangali	TP-BG	0→720	11	11→24	4,500	32,500	23	10	1,121
D. Mbeza	GF-BG	10→3	11	11→20	800	22,500	20	10	777
Kamwendo	AP-BG	4colonies	11	11→16	800	12,500	10	10	665
Peter Bilila	AP-BG	3colonies	11	11→14	940	7,500	10	10	422
Ndemanje	AP-BG	4colonies	11	11→19	4,800	20,000	10	10	1,240
S.Mpombe	BG-BG	-	11	22→47	0	62,500	17	17	1,838
Kateya	TP-BG	480→667	11	11→16	1,000	37,500	22	10	1,203
Maluwa	BG-BG	-	11	22→36	0	35,000	10	10	1,750
Kumponda	TP-BG	0→1,500	11	11→25	1,0500	35,000	38	10	948
Chigumula	TP-BG	0→970	11	11→22	1,500	27,500	16	10	1,115
mean 24 villages	-	-	-	-	2,493	16,808	26	20	1,312

Note: BG; Boer goat, TP; treadle pump, GF; Guinea fowl, AP; bee-keeping

Remarkable diffusion of improved fireplaces has been fostered by only voluntary labor with material at hand and easy skill for its installation. Over 25 fireplaces per village were installed

during two and a half years and most of them were offered to daily use, yet there had been none before the Pilot Study in the area. With regard to installation of improved fireplaces, unexpected but amazing result has been obtained because initial demonstration has made many households dispose of installing new type of fireplace. As a result of trials, it has been found that 16% of the total firewood, and cooking time can be saved though wood consumption per unit time is higher. Especially, when more than two different dishes are cooked at the same time, it can be done by the same fireplace, thus heat efficiency of cooking can be improved. Also, standing posture during cooking is more agreeable than use of traditional fireplace. One of the reasons of quick diffusion may lie in the cheap cost for the installation, requiring only pieces of bricks, mud, water and labor. About half of participants' households have installed them and two thirds of the installed fireplace is still used now, though annual repairing is necessary. At least firewood equivalent of 134 ton, or collection from 35 ha has been dispensed using 350 stoves for these two years after installation.

During the whole process of the Pilot activities, significant improvement has been made both in village vitalization and reforestation of the Study Area, as illustrated in Table 4-19, Table 4-20 and Figure 4-10 and Figure 4-11.

Table 4-19 Village Vitalization before/during the Pilot Activities

	Goat head per villagers		Intensive vegetable raising by treadle pumps		Number of IGAs run by villagers		Number of IGA participants in the village		Rate (%) of IGA participants to the economically viable population	
Village	B.L.	2004	B.L.	2004	B.L.	2004	B.L.	2004	B.L.	2004
Makonokaya	0.1	0.16	0	2,400	0	2	0	0	0%	28%
Siyamudima	0.1	0.16	0	0	0	2	0	0	0%	41%
Kaumbata	0.02	0.05	180	2,580	1	3	5	68	1%	9%
Mdala	0.05	0.05	0	600	1	3	0	1	0%	7%
Nanjiwa	0.05	0.09	0	0	1	3	0	1	0%	8%
Chikoja	0.03	0.06	750	1,250	1	3	7	117	1%	23%
Manjelo	0.05	0.15	0	400	0	2	0	0	0%	49%
Teula	0.05	0.08	0	200	0	2	0	0	0%	10%
Chakana	0.03	0.09	0	0	0	2	0	0	0%	16%
Lemu	0.05	0.07	250	2,750	1	3	5	75	1%	8%
M. Ngondo	0	0	0	5,000	1	3	0	1	0%	16%
Kam'mata	0.01	0.04	0	300	0	2	0	0	0%	5%
Kumanda	0.03	0.03	0	200	0	2	0	0	0%	16%
T. Kenji	0	0	0	200	0	2	0	0	0%	32%
Chilangali	0.05	0.11	900	1,300	0	2	7	53	2%	14%
D. Mbeza	0.1	0.27	0	0	0	2	0	0	0%	63%
Kamwendo	0.05	0.08	350	350	0	2	3	63	0%	10%
Peter Bilila	0.05	0.08	550	550	1	3	4	24	1%	6%
Ndemanje	0.03	0.11	3,200	3,200	2	4	24	129	10%	55%
S. Mpombe	0.02	0.22	450	450	1	3	4	80	1%	29%
Kateya	0.02	0.39	0	667	0	2	0	0	0%	91%
Maluwa	0	0.28	0	0	0	2	0	0	0%	97%
Kumponda	0.02	0.12	450	1,950	1	3	4	53	2%	21%
K. Chigumula	0.03	0.05	0	976	1	3	0	1	0%	6%
mean	0.04	0.11	295	1,055	0.5	2.5	3	28	1%	27%

Figure 4-10 Illustrative Changes Recorded during Pilot Study in the Category of Village Vitalization

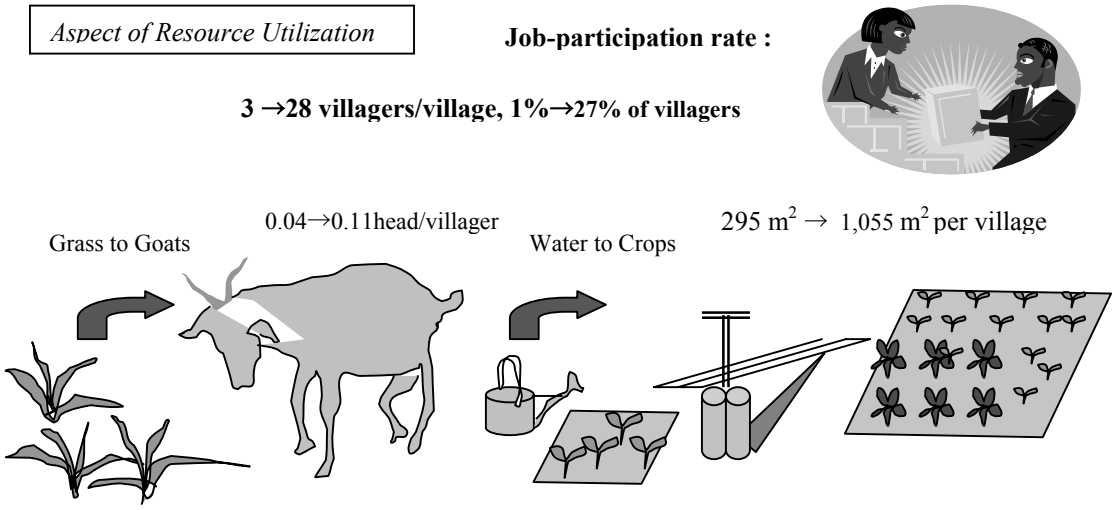
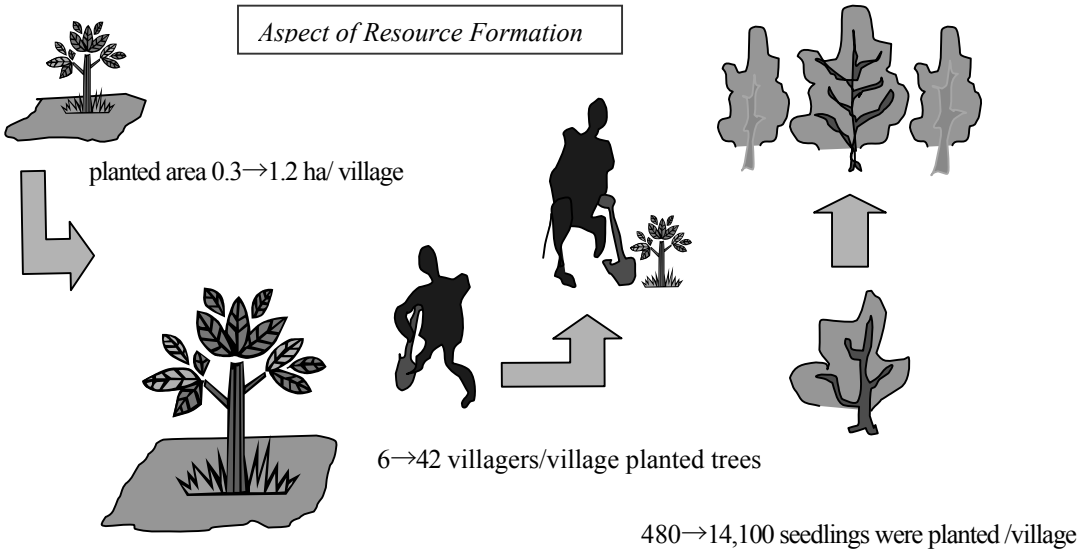


Table 4-20 Reforestation before/during the Pilot Activities

	Area of recent outp-lanting (ha/year)		Numbers of villagers who planted trees per year		Numbers of seed-lings survived in planted lots(includ-ing AF species)		Firewood consumption by villagers per annum (m^3)	
Village	B.L.	2004	B.L.	2004	B.L.	2004	B.L.	2004
Makonokaya	0.1	1.3	0	30.5	0	14,807	18.0	15.8
Siyamudima	0.06	1.1	0	69.0	0	15,185	16.0	13.0
Kaumbata	0.3	0.5	8	47.0	550	10,113	99.0	95.8
Mdala	0.06	0.7	0	42.5	0	12,350	72.0	69.2
Nanjiwa	1.1	1.6	22	27.5	1,400	7,458	76.5	74.9
Chikoja	0.5	2.1	15	66.0	880	20,470	31.5	23.5
Manjelo	0.4	1.4	0	66.0	0	20,470	13.5	10.3
Teula	0.2	1.1	0	26.5	0	10,849	18.0	16.0
Chakana	0	0.5	0	21.0	0	9,726	9.0	8.4
Lemu	0.3	1.4	27	27.5	2,750	12,350	103.5	97.9
M. Ngondo	0.1	0.5	0	27.5	0	8,756	13.5	11.3
Kam'mata	0.56	2.9	24	65.0	2,000	40,286	13.5	11.7
Kumanda	0.2	0.9	0	25.0	0	16,669	11.7	10.3
T. Kenji	0.5	1.5	36	36.5	2,950	21,673	11.5	7.5
Chilangali	0.3	2.0	0	30.5	0	16,617	13.5	11.5
D. Mbeza	0.2	1.0	0	39.0	0	12,167	13.5	13.1
Kamwendo	0.36	1.1	5	89.0	330	15,149	31.5	26.9
Peter Bilila	0.5	1.0	4	48.0	600	7,170	13.4	9.4
Ndemanje	0.36	0.4	10	34.5	0	8,337	13.5	10.1
S. Mpombe	0.24	0.9	0	52.5	0	16,363	18.0	15.6
Kateya	0.44	1.1	0	41.5	0	14,204	9.5	7.9
Maluwa	0	0.2	0	28.5	0	8,663	9.5	8.1
Kumponda	0.3	1.5	0	33.5	0	8,053	17.9	14.3
K. Chigumula	0.1	1.2	0	29.5	50	12,298	9.5	4.5
mean	0.3	1.2	6.3	41.8	480	14,174	27.4	24.5

Figure 4-11 Illustrative Changes Recorded during Pilot Study in the category of Reforestation



As for the forestry results mentioned in 4.1, PIU has given the following evaluation from their own expertise point of view.

(1) Selection of tree species: As liberal selection based on environmental rehabilitation was impossible due to difficulty in procuring seed and material, freedom of selection was limited within the availability thereof. However, PIU exploited other sources than hitherto relied government or international institutes and NGOs, such as local providers and self-provision using seed banks and mother trees inside the target villages. Limited use of exotic species including Eucalyptus and AF species can positively be evaluated from the standpoint of ecological balance since fast-growing ones absorb too much soil water from the planted sites. Indigenous ones, on the contrary contribute to preventing eco-system from rapid drying, help villagers serve herbalist medicines, plant oil, edible fruit and also as nectar sources for apiary. Some others serve as fodder trees.

(2) Procurement of planting space: PIU recommended wider use of nursery seedlings in the light of limited availability of planting space within the target villages. This enables the participants to receive seedlings they raised as their own property that can be planted at their disposal to homestead, fallow field and idle land, giving other incentive than IGAs.

(3) Survival rates of out-planted seedlings: PIU was astonished that villagers managed to realize survival rates of as high as 75% amidst serious drought in 2003~04 as compared with that achieved outside the target villages ranging only 30 ~ 40% (if monthly rainfall remains as low as 100mm then only 40% of the out-planted seedlings can survive though the rate differs from specie to specie). PIU considers the reasons of the success attributable to improved planting dibbles with enough depth and water-harvesting basin (Kenyan style) provided around the planted seedlings and relevant selection of species.

(4) Villagers' efforts for promoting tree planting: PIU evaluates particular leader's effort of expanding planting activities. Two of these villages established new nurseries within their villages in order to give chance to those who can hardly participate in the nursery works due to long distance to commute to existing nurseries. There are many reports of firewood theft by villagers living within the same village. In order to minimize such undesirable incident, it is necessary to expand planting activities to wider area so that

villagers can rely on the trees they themselves have planted. Also, village cadres who are eagerly promoting tree planting realize merit of tree planting not merely for firewood but also for soil and environment conservation. They recognize recent trends of rainfall pattern with less frequency but more intense hourly concentration giving heavier soil erosion leading to trench rill formation on farm roads. They planted seedlings they nurtured along farm paths to protect their plots from such degradation.

(5) Desirable IGAs to be coupled with forestry: PIU concerns feeble bargaining strength of villagers on sale of IGA products. Rather, it feels like advising them to fortify food security with a view to providing for future desertification. Recent trends of dwindling rainfall really threaten the base of staple food, white maize, where substitute crops will have to develop. Sweet potato is a promising alternative as PIU has brought in the target villages as a sort of IGA and they've identified successful results after introducing four new varieties. Cassava, sorghum and finger millet will serve as effective alternatives as sweet potato. Current components, especially goat rearing has been successful and desirable in providing manure using its dropping. However, treadle pump irrigation has been confronted to radical problem of water shortage. If stream water completely dries up in future, nursery watering will have to rely on groundwater. Then, nurseries can be utilized as a base of diffusing drought resistant alternative crops as mentioned above.

4.4.2 Feedback of the Obtained Results into next Plans and Schedules

PIU has played a role of feeding the results of the Pilot activities back into establishment and revision of plan or schedule, employment of new tactics or countermeasures and other actions. PIU staffs arranged performance of the Pilot activities through PDM learned in the process of technical transfer lest already established goals should be ignored, and periodically delivered results and information collected and compiled in the villages concerned to the participants so that participation can be sustained pursuing the goals. PIU meetings held weekly or bimonthly have provided a forum of exchanging wide spectrum of information on Pilot activities including progress, performance, plan, feed-back and response/ reaction of stakeholders. In particular, PIU staff has been keen on the issues and problems taking place on the process of development and eager to try to find solutions. General process of treating such issues and problems takes the following steps:

1) to fill the obtained data, figures and information in the PDM recording charts and other formats to make comparison with the pre-determined targets,
2) to point out particular cases where outstanding delay, failure or other problems have occurred,
3) to inquire chiefs, chair persons and village cadres on the issues, constraints, causes and reasons of particular problems, situations and possible development,
4) to explore causes and related background states that have brought failure, delay, under-fulfillment and other issues through the review of processed data and information,
5) to discuss, try to find effective measures to rectify group behavior, reluctance or inertness of the participants,
6) to design promotion measures to stimulate, attract and activate potential participants,
7) to contact with people concerned to encourage them, to take provided countermeasures,
8) to monitor, identify the development or progress after taking proposed measures.

PIU also distributed village recording notebooks to the committees of each village, where chair-persons, accountants and other committee members fill and record important matters on Pilot activities for later reporting. For example, distributions or storage of inputs, material, products,

cash income, collected fees, nursery performances, out-planting records, observations on planting sites, survival, tree growth and pest or drought damages, records of study tours, inter-location tours, training attendants and field work records have been kept in the notebooks. PIU often makes use of these records for identification, references and evaluation. Making full use of this recorded information, they tried to continue capacity building for the participants in Pilot activities so that they themselves can establish plans ahead, implementing schedules and self evaluating what they have practiced. In 2002, the following (Table 4-21) was major topics of feeding back to 2003 planning / implementation.

Table 4-21 Major Feedback of 2002 Pending Issues into 2003 Plans

Village	Forestry / Agroforestry	Income Generating Activities	Admnistrative / organizational matters
Makonokava	Need for seed bank fortification		
Siyamudima	Need for seed bank fortification	delay in cage-hut construction	
Kaumbata	Need for seed bank fortification		delay in input storage hut
Mdala	recovery from nursery damages		
Nanjiwa	need for seed bank fortification	delay in beehive intallation	
Chikoja	restoration of burnt nursery		
Manjelo			
Teula			delay in input storage hut
Chakana	recovery from poor planting	delay in beehive intallation	
Lemu			
M. Ngondo		delay in cage-hut construction	
Kam'mata			
Kumanda	improving nursery water supply		delay in input storage hut
T. Kenji			
Chilangali			delay in input storage hut
D. Mbeza		delay in cage-hut construction	
Kamwendo	need for seed bank fortification		
Peter Bilila	shifting site of nursery		
Ndemanje	need for seed bank fortification	delay in beehive intallation	
S.Mpombe	need for seed bank fortification		
Kateya	shifting site for irrigation		pending dispossession
Maluwa	delay in out-planting works		delay in input storage hut
Kumponda		need of pond for treadle pumps	
Chigumula	measures for poor planting		

Employed pattern of feed-back consists of two dimensions. Firstly, results of comparison are fed into next plans aiming at eliminating currently prevailing constraints, misunderstanding or improving shortcomings or bottlenecks of existing systems. Secondly, better strategies, means or trials found in some villages were applied to other ones monitoring response therefrom. Most of simple technical or practical issues can be ameliorated with such feedback practices.

However, improvement of deep-rooted problems, such as poor forestry performance attributable to administrative failure or social drawbacks cannot easily be solved by simple feedback methods. In particular, problems involving land use, resource or input allocation are often difficult to treat with because they have bearing to interest of chiefs, dominant clans and particular people. Even if the third persons could manage to handle them, it may take a long time until solution is brought about by feedback principles. Social problems in which outsiders of the Pilot activities are intervened generally have difficulty in solving within direct stakeholders. Typical cases arise from theft damage of inputs such as goats, harvestable crop on the irrigated field and farm implements. In most cases, thieves or burglars invade into a village on the sly from outside, and no effective means other than alert vigilance throughout nights can avoid the damages. Many target villages frequently have such bitter experiences, but they can hardly be utilized as means of feedback for preventive purposes.

Table 4-22 Major Feed-Back of 2003 Results into 2004 Plans

Village	Forestry / Agroforestry	Income Generating Activities	Admnistrative / organizational matters
Makonokaya			need for rebuilding solidarity
Siyamudima		reproduction of Guineafowl	
Kaumbata		control of goat skin disease	
Mdala	measures for high survival	relocation of beehives	
Nanjiwa		relocation of beehives	need for theft control measures
Chikoja	expansion of village nursery	need of weir for irrigation	
Manjelo	shift of nursery site		
Teula	recovery from poor planting	repairing fishing net	reorganization of committee
Chakana	recovery from poor planting	relocation of beehives	need for rebuilding solidarity
Lemu	recovery from poor planting		
M. Ngondo		avoiding fowl damages by dogs	
Kam'mata		procuring water for pumps	
Kumanda	Water supply to nursery	procuring water for pumps	
T. Kenji			
Chilangali			need for rebuilding solidarity
D. Mbeza		avoiding fowl damages by dogs	
Kamwendo	expansion of village nursery	relocation of beehives	
Peter Bilila		relocation of beehives	
Ndemanje		relocation of beehives	
S.Mpombe			
Kateya	recovery from poor planting	relocation of irrigation plots	
Maluwa	recovery from poor planting		strengthening of committee
Kumponda			
Chigumula		relocation of irrigation plots	

PIU periodically evaluated the progress of Pilot activities, and necessary procedures of feed back were cleared with PDM formats though it failed to set up step-wise, detailed quantitative targets, because it did not have any means of annual forecast on forestry or IGA development. Therefore, inquiries in workshops, transect walk and supervising records have been employed as means of verification. PDM has been performed every end of the rainy season by village, by component. Results of PDM are tabulated in the above three tables.

4.5 Statistical Analysis of the Results for Elucidation of Intra-factor Relations

4.5.1 Aims and the key point of Analysis:

In this Study, analysis has been tried to find relationships among forestry techniques and survival or growth of employed tree species, in order to establish practical manual to show villagers how to maximize effects of their forestry activities under semi-arid conditions (that has not so far been provided by extension authority). As cited later in 4.6, PIU staffs and the Study Team observed time sequential differentiation into the village group with better forestry performances and that with poorer forestry performances. A number of different causative factors intervene that are attributable to differentiation of forestry performances. These are classified into social, technical and environmental ones, affecting differently village-wise performances where the same conditions on input supply and extension services have been applied. Since the Model under examination during the period 2002-2004 aims at afforestation, the following interactions among the related indicators should be analyzed:

Determinant Indicators relating to Factor Analysis

In Figure 4-12, a host of indicators are related to the performances of what the Model aims at. All these indicators do not necessarily give values at the stabilized phase/stage, because it takes no less than a few years until income to be brought from employed IGAs can reach matured stage to help forestry participants gain substantial benefit, but actual IGA activities started from the end of 2002. In other words, participants have satisfied with equitable distribution of inputs and aftermath of IGAs rather than actually benefiting from these. Taking this into account, the indicators in Table 4-23 have been selected to analyze the obtained results to see the functional mechanism of the Model.

Figure 4-12 Indicators Used in the Analysis

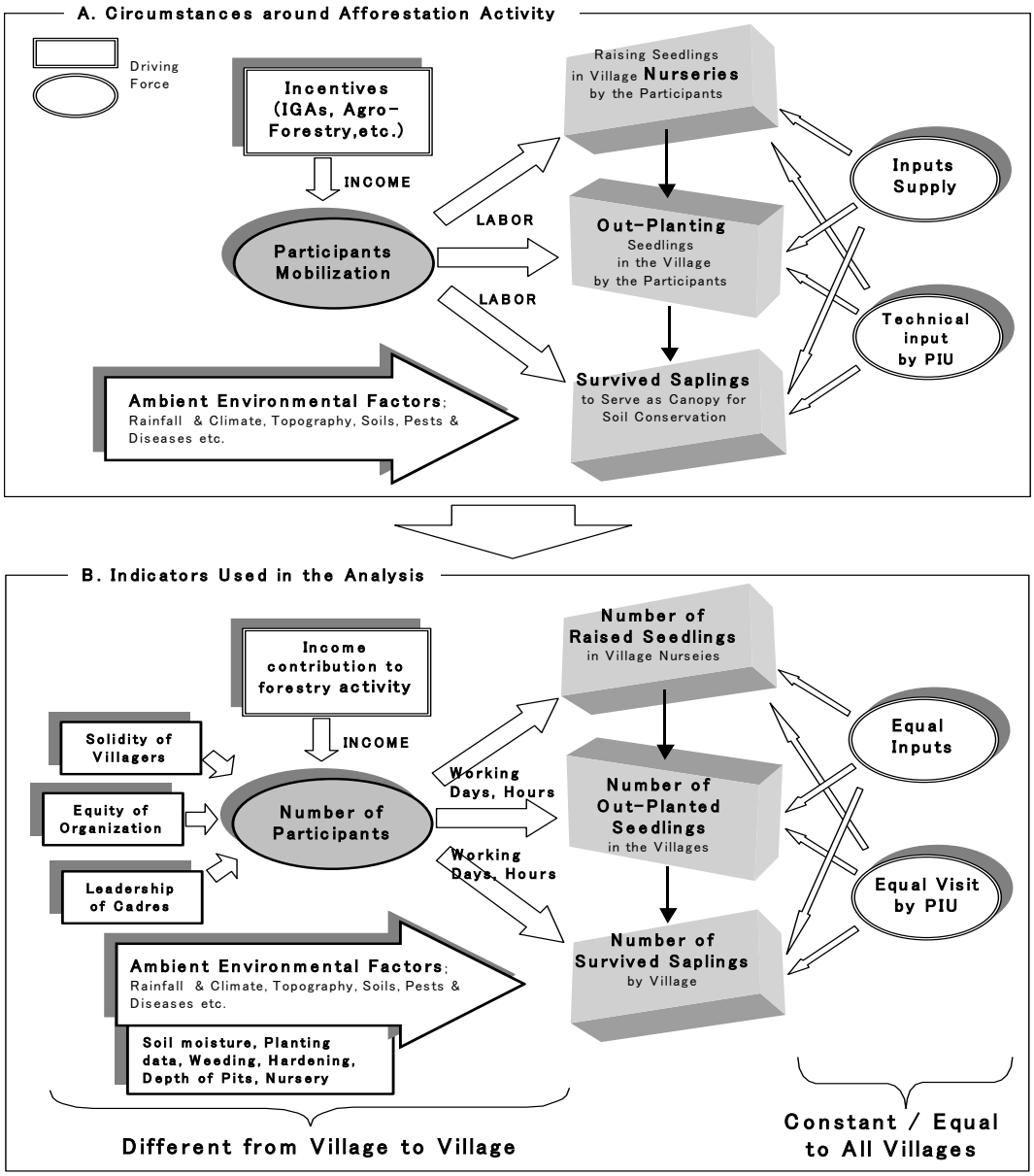


Table 4-23 Indicators and conditions employed for the analysis of the Model rationale

Indicator	1	2	3
Forestry / Agro-forestry	A1- nursery seedlings	A2-planted seedlings	A3-survived seedlings
IGAs	B1- pooled assets	B2- management status	B3- local resources
Participatory dimensions	C1- village nursery	C2- out-planting	C3- IGA components
Governance dimensions	D1- administrative equity	D2- cadre's leadership	D3- villager's solidarity
Organizational dimensions	E1- organization viability	E2- labor intensiveness	E3- PIU's intervention
Technical indicators	F1- technical skills	F2- practical expertise	F3- scientific awareness
Environmental indicators	G1- topographic effects	G2- quality of resources	G3- climatic effects
Condition			
Input distribution	Equal inputs for IGA-1	Equal inputs for IGA-2	Equal input distribution
Extension services	Equal village orientation	Equal technical transfer	Timely advice/monitoring
Treatment principles	No award, no penalty	No pay for participation	No Differential treatment

The following definitions have been applied to the analysis;

Cadre's Leadership: This is defined as an administrative attitude of the village chiefs / cadres that guides their villagers to voluntarily participation in the proposed activities and that helps to create solidarity among them that facilitates implementation/ achievement of the activities. Status of leadership is shown as the followings:

i. Capability of making up solidarity to do democratic activities,
ii. Capacity to plan and formulate a series of work in proper order, and
iii. Capacity to communicate, disseminate timely information among villagers.

Administrative Equity: This is defined as an administrative state or social environment in which all the villagers can equally be dealt with for burden or benefit sharing, and equitable treatment has been applied to all of them for the decisions on social order. It is shown in governance of equitability, capability of administration order and transparency.

As to designed function of the Model, whether nursery - out-planting participants can benefit from IGAs or not should be identified. Regarding the determinant indicator of participation on forestry activities, the key factor is calculated as the product of participants, number of mobilized days and working hours per day. Number of participants in forestry works, administrative equity, cadre's leadership, villager's solidarity and organizational indicators are adopted as the indicators to find interrelation, where the ranking has been decided based on reported data and the discussed conclusion of all PIU staff in order to avoid biased decision. PIU staff has objectively evaluated these from villager's attitude in participation, punctuality of participation, record holding in village registry notes and the contents of records.

Since constant and homogenous inputs and extension services have been supplied to all the target villages and natural conditions are not much different among them, conditions of forestry and IGA activities have been deemed equal for all target villages, while participation, organizations and their function, governance and administrative situations are different that affect the results of the Pilot activities in the Model. Under the given ambient conditions of the Model, statistical treatments are considered applicable to the independent indicators that have been measured and recorded during the Study period to seek for the interrelation among them.

In so far as the Model aims at sustainable forestry practices through a participatory approach, a relevant motivation of participants can give enough impetus to make them drive into forestry practices. The Baseline Survey had revealed that villagers have long been suffering from chronic hunger, exacerbating firewood deficit and lack of income sources. The Model consisting of forestry activities coupled with IGAs and agro-forestry provides them with full incentives including mitigation of food and firewood shortages with income generating chances, agro-forestry and reforestation activities. In order for the Model to efficiently function, the

participants must be involved in both forestry/ agro-forestry activities and IGAs so that they can receive benefits from both activities, in turn they have to share burden of exhaustive forestry practices. Generally, IGAs provide fastest gain, followed by agro-forestry and forestry activities bring only sluggish benefit for participants. As concern benefit distribution within traditional administrational regime, only fair governance enables villagers to receive equitable benefits from what they are involved in, and this motivates them long-lasting efforts to promote practices for environmental conservation.

Another motivation stems from scientific understanding / recognition of environmental crisis villagers have been facing. Starting from introductory workshops for launching the Pilot Model, PIU staff has kept close contact with target villagers guiding, teaching, advising, training and demonstrating causes of environmental degradation, countermeasures to control or to alleviate it, skills and techniques to practice it including resource conservation. Three year's relevant and timely sensitization, capacity building, enlightenment and education by PIU members have increasingly eradicated ignorant or indifferent villagers, rectifying them into trainees who really understand envisaged goal of Pilot activities.

Frequent visits of PIU staff to target villages have allowed them to objectively evaluate equity and leadership (elsewhere defined in detail) of village chiefs and committee cadres, finally succeeded in controlling them to behave fair. These cannot be assessed quantitatively, however, villager's solidarity can be judged from percentages of installation of improved stoves because a solid team system is prerequisite to install and diffuse them. As concern number of out-planted and survived seedlings, environmental and technical indicators by far directly affect the results rather than social factors. With regard to the treatment of the target villages, equal input and extension service were adopted according to the decision through PIU meetings in spite of initial proposal from the Study Team to make differential treatment for applying a carrot and stick policy.

4.5.2 Methods and Results of Analysis

A. Methods of Analysis

In this Study, analysis has been tried to find relationships among forestry techniques and survival or growth of employed tree species, in order to establish practical manual to show villagers how to maximize effects of their forestry activities under semi-arid conditions (that has not so far been provided by extension authority). As cited later in 4.6, PIU staffs and the Study Team observed time sequential differentiation into the village group with better forestry performances and that with poorer forestry performances. A number of different causative factors intervene that are attributable to differentiation of forestry performances. These are classified into social, technical and environmental ones, affecting differently village-wise performances where the same conditions on input supply and extension services have been applied.

(1)Social Factors: Participatory activities can be organized and sustained through village organizations concerned. Sustainability of participatory activities depends heavily on their functions, and policies/ nature because participation is motivated and promoted by benefits from participating activities that in turn can be hedged by the host organizations. Participants form solidarity, evaluating equitable treatment, reasonable sharing of benefits and burden with due considerateness. Therefore, these social indicators have been employed to analyze actual differentiation of the performances.

(2)Environment Factors: Although forestry performances are dependent of social state of the target villages, they are also influenced by ambient environment factors such as climatic factors, distribution of natural resources and demographic changes. Especially, sites availability for out-planting seedlings affects villager's approach to tree planting exercises. This is the reason why such factors should be analyzed along with social bearings.

(3)Technical Factors: During three year's study, it has been confirmed that technical level of villagers greatly influences their forestry performances. Amidst adverse conditions for floral establishment observed in the Study Area, techniques practiced by the participants have given substantial effects on their forestry performances, in particular survival rates of out-planted tree seedlings. Without assessing these factors, clue of success in forestry activities can hardly be grasped. Under semi-arid conditions, importance should be attached to hardening, selection of out-planting date, digging of planting pits (dibbles) and tending of out-planted seedlings. Experiences of forestry practices also constitute a major factor influencing success of forestry activities.

Table 4-24 Criteria to Evaluate Forestry Activities by Ranking

Administrative / Social Factor

Grade	Village Cadre's Leadership	Administra-tive Equality	Participa-tion in the works	Committee meeting Frequency	Working days/hrs. of nursery work	Villager's Solidarity	Firewood Scarcity
1	only village cadres	oligopoly trend	<15person/ village	rarely held on	1~2days/m, <1hr/d	stove in <10% hh.	< 50 wa./p
2	5% mobilizable	absent-mindedness	>15 person/ village	once bimonth	5 days/m, >2hrs/d.	stove in >10% hh.	50~99 wa./p
3	>10% mobilizable	equality on claim	>30 person/ village	once a month	10 days/m, >3hrs/d	stove in >20% hh.	100~149 wa./p
4	>20% mobilizable	democratic equality	>45 person/ village	twice a month	15 days/m, >4hrs/d	stove in >40% hh.	150~250 wa./p
5	>30% mobilizable	moral transparency	> 60 person/ village	every week	20 days/m, >5 hrs/d	stove in > 60% hh.	> 250 wa./p
Unit:	5 grades, since it can't be counted	5 grades, since it can't be counted	countable	countable	countable, d : day hrs: hours. m: month	hh.: households with improved stove	wa./p.: wood area (m^2) per villagers

Environment / Technical Factor

Grade	Soil Dryness	Tending	Dibble Depth	Hardening	Termite attack	Nursery Water	Experience
1	granite debris	no practice	5~8cm	not practiced	>50%	>200m carrying	no experience
2	coarse sand	some weeded	8~10cm	screen removed	35 ~ 45%	>100m carrying	scattered planting
3	clayey sand	goat damage	11~15cm	water controlled	20 ~ 30%	>50m carrying	<0.5% of area
4	sandy loam	clean weeded	16~19cm	water & screen	5 ~ 15%	at times depleting	<1% of area
5	marshy loam	basin applied	>20cm	even after pruning	no damage	nearest available	<2% of area

Note: The ranking of the social factors was made by the states of PIU who did measurements, partly cross-checked by the Study Team.

Whether different treatments were applied to different species or not?
Mixed planting was practiced for the most part of out-planting to disperse the risk of scorching and termite attack. Only Eucalyptus species were in some cases on relatively large lots planted separately from other species. Likewise, different species were coincidentally raised with the same treatment for hardening, pruning, out-planting. Mixed-planted seedlings have been treated, tended in the same way for post-planting tending over the same soils.

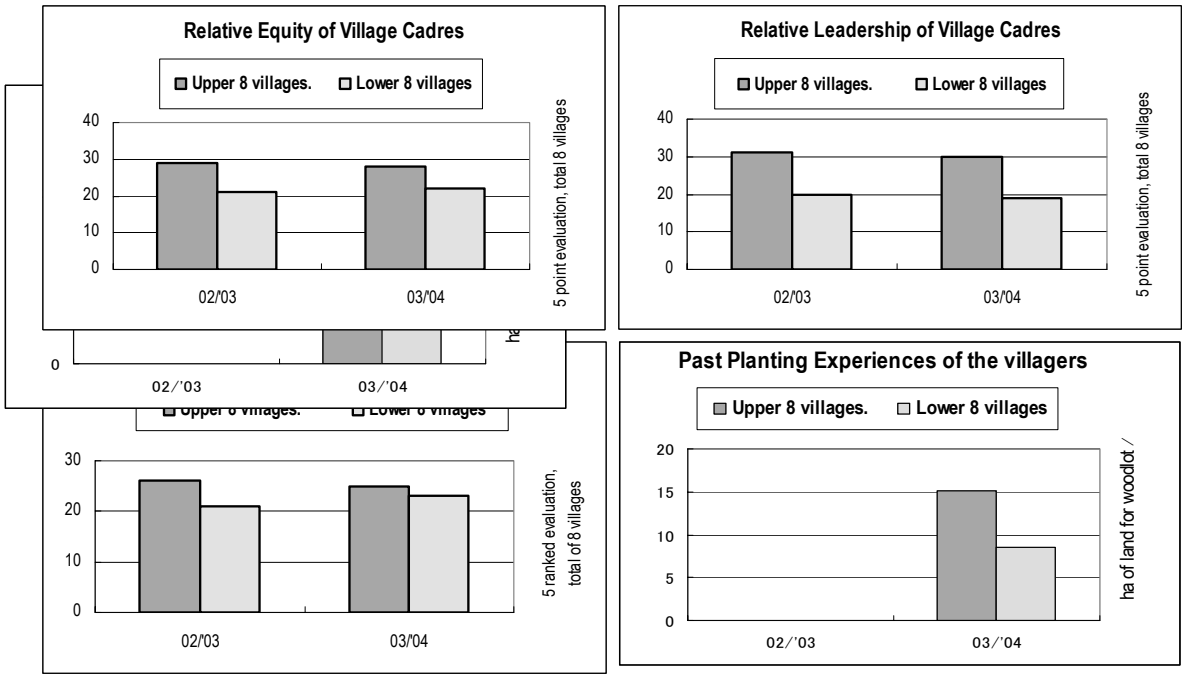


Fig. 4-13 Illustrated Results of Qualitative Analysis

B. Results of Analysis

(1) Qualitative Analysis

Following differentiation is observed in the performances of tree planting at the target villages in 2004, as shown between highest-ranked 8 and lowest ranked 8 villages with regard to number of raised seedlings in their nurseries. The former planted much more seedlings than the latter, and achieved higher survival rate than that of the latter. The former mobilized more participants in nursery works and out-planting activities. The participants in the former villages worked longer hours and more frequent than those in the latter. The former village group had more committee members than the latter. The cadres in the former village group behaved in more equitable way than those in the latter group, for example, in the even distribution of such benefits as seedlings, and goat kids as well of even sharing of burden such as water fetching for nurseries. Likewise, the cadres in the former group showed stronger leadership than those in the latter in such occasion as arrangement of training, punctual mobilization of villagers to demonstration by PIU staffs. Both cadres leadership and villager solidarity made them faithfully follow what PIU staffs advised, thus selecting better date of tree planting for achieving higher survival of what they planted. They could follow what were instructed by PIU staffs partly because more ample experience the villagers in the former group had in the past. The former group has narrower woodlots in their villages to fetch firewood that might have induced ardent attitude to promote tree planting

(2) Quantitative Analysis

Analyzed relationships between survival of planted trees and related techno-environmental factors by major tree species are summarized as follows:

Concerning influential indicators on the survival of out-planted seedlings, planting date as measured by deviation from mid-January affected the survival of *F. albida, G. sepium, E. grandis, S.sianes* and *A. quanzensis*. Soil water retention gave impact thereon in case of *F. albida, G.sepium, E. camaldulensis,, A. quanzensis* and *S. siamea*. Post-planting tending contributed to the survival of *F. albida, G. sepium, E. grandis,* and *A. quanzensis*. Depth of planting dibbles gave impact on the survival of all major species in this year. Also, hardening influenced survival of most major ones except *M. azadirach*.

As to contribution of related factors on the growth out-planted tree species, soil water retention exerted as an influential limiting factor on all the major species except *M. azadirach* and *S. spectabilis*. Deep pitting for out-planting positively contributed to the growth of all major species. Likewise, hardening fostered favorable growth of all major ones except *M. azadirach*.

F. albida

Survival of the out-planted seedlings was influenced by planted dates (deviation from mid-January) and water retentive character of soils on planted woodlots. It was affected but lesser extent by depth of planting dibbles (pits), hardening before out-planting and tending of out-planted seedlings. Their growth has been dependent on the state of soil water, affected particularly by depth of dibbles and pre-planting hardening especially in drought year. In drought year, growth rate had bearing to survival rate of seedlings.

G.sepium

Survival after the out-planting was heavily affected by soil water retention and hardening in nurseries, practices including depth of planting pits and tending in out-planted woodlots. Planting date in the ordinary year also affected the survival. Growth of this specie was vigorous as compared to other species but influenced by soil water , hardening degree and tending on the planted lots.

E.grandis* and *E. camaldulensis

In the case of *E.grandis*, out-planted seedlings planted in January survived best, and water availability in the nurseries, depth of planting pits affected their survival. State of soil water and hardening practice also gave influence on the survival. Its growth was influenced by degree of tending and soil water in drought year. In case of *E. camaldulensis*, tending planted seedlings and soil moisture retention greatly influenced its survival in the drought year, followed by water availability in the nurseries and size of planting pits. Its growth was affected by the planted date and water retention capacity of soils, and to lesser extent by degree of tending and water availability in the nurseries.

A. quanzensis

Planting dates and depth of planting dibbles affected its survival in two years, but state of soil water influenced only in the drought year. As regards growth, soil moisture retention related to its growth along with hardening and tending in the ordinary year. Negative correlation was observed on planting dates and water availability in nurseries in the drought year, implying that seedlings raised sparing nursery water and planted later than January had more surviving capacity and then caught shower during the period of February~March 2004.

S. siamea

Both planting date and hardening before out-planting gave positive effects on better survival of this specie. Soil water retention and depth of planting dibbles also served as relating factors on the survival. Whereas, growth after out-planting was affected by depth of planting pits, water availability in nurseries and partly by soil water retention.

M. azadirach

In the ordinary year, depth of planting dibbles, hardening and planting dates almost equally influenced its survival. But in the drought year, depth of planting pits seemed to give by far decisive effect on its survival. As for growth, soil water, water availability in nurseries and tending practice after out-planting affected height of planted seedlings in the ordinary year, though these were negatively correlated with growth in the drought year most probably due to erratic rainfall distribution.

S. spectabilis

This specie is highly resistant to drought, but survival has been influenced by such practices as tending after out-planting, deep digging of planting pits and hardening just before out-planting in two consecutive years. Growth of out-planted seedlings was dependent on tending, depth of planting pits, hardening. In both years, survival rate have been highly correlated with post-planting growth of seedlings.

4.5.3 Interrelationship among adopted indicators

A number of facts have been found during a short period of Pilot activities as the fruit of PIU and concerned villagers' interactions. However, climatic vagaries have by far dominant influence over the results of human activities just because forestry and agriculture (including livestock husbandry) are highly dependent thereon, and actually serious drought threatened the Study Area during 2002/03 and 2003/04 consecutive cropping seasons, that have masked many other phenomena arising from climate-related indicators as observed above. Another nerve-racking constraint is availability of tree seed in rural villages. In 2003/ 04, nursery seedling production was halved as compared to the previous year's result mainly because of lack of viable seed, and villagers had to suffer from acute water shortage for nursery watering, to use old seed distributed in the previous year that affected the germination rate, leading to marked decrease of raised and planted seedlings. Similarly, growth and survival of seedlings were affected by water shortage in nursery water sources during 2003 raising season.

The above-tabulated relationships explain a series of requirements for achieving goal of the Model set at increased canopy cover that allows villagers to retrieve self-sufficiency of firewood. First of all, technical transfer from extension staff to the villagers is prerequisite for the application thereof. PIU staff has performed their missionary for three years and now villagers concerned can manage to raise seedlings in their nurseries, as observed recently in their nursery works. Enough quantities of inputs needed for participatory works have been distributed to the target villages to continue current activities for the time being. Performances expected in 2004 and later depend on the villagers' efforts from now onward, where the mechanism of function expected in the Model can be forecast from these relationships.

Table 4-25 Analyzed Performances of Pilot Activities Applicable to Future Development

Item	Independent	Dependent	Relationship among indicators on past development that can be used for looking future prospect
1	Influence of rainfall	for survival	Only a quarter of planted seedlings can survive in an extreme drought
2	Advised practice 1	for survival	Hardening in nurseries is essential factor to make the outplanted survive
3	Advised practice 2	for survival	Post-planting tending (weeding, catering) is also important for survival*
4	Planting condition 1	for survival	Planting in early ~ mid January will give best survival of the outplanted
5	Planting condition 2	for survival	In severe drought supply of nursery water affects growth of seedlings**
6	Site situation of nurseries	tree production	It is the best policy to establish nurseries as near to villages as possible
7	IGA management	tree production	Desirable management of IGAs gives real incentive to nursery workers
8	Villager's experience	for survival	Past experiences of outplanting will result in better survival of seedlings
9	Firewood scarcity	participation	Current firewood scarcity drives villagers into participation in nurseries
10	IGA management	IGA income	Quality of management for IGAs reflects in disposable income thereof
11	Participation in nursery	tree production	Scale of participation is one of the determinants in tree production 2002
12	Participation in nursery	tree production	Scale of participation is one of the determinants in tree production 2003
13	Participation in nursery	tree production	Scale of participation is one of the determinants in tree production 2004
14	Total labor in nurseries	tree production	Cumulative labor (villagers efforts) determines tree production in 2002
15	Total labor in nurseries	tree production	Cumulative labor (villagers efforts) determines tree production in 2003
16	administrative equity	participation	Administrative equity could procure sustainable participation in 2002
17	administrative equity	participation	Administrative equity could procure sustainable participation in 2003
18	Villager's solidarity	participation	Villager's solidarity can sustain constant participation in planting in 2003
19	cadre's leadership	tree production	Desirable leadership gives positive effect on seedling production in 2004
20	cadre's leadership	participation	Desirable leadership gives positive effect on nursery participation in 2004
21	IGA participants	participation	77% of participants in forestry shared all IGA inputs for the first year
22	IGA participants	participation	All the participants in forestry can be engaged in 1.5 IGA components

Note: *In the second year, participants mostly mastered hardening practice, then weeding or termite control was attached importance.
** In the second year, amidst serious drought, many water sources depleted and this affected viability of seedlings for survival.

In conclusion, three dimensions of the verified Model were found satisfactory as:

1) coupling of forestry activities with IGAs has completely been achieved,
2) participation in forestry activities has been kept through incentives from IGAs, and
3) actual tree planting has been performed according to the efforts of the participants.

In detailed analysis, of which results of statistical treatments are given in Annex B-11. the following has been found from the analysis by means of SPSS. [1]

In the first year, there were three promising villages (Chikoja, Manjelo and Kammata) in a good contrast with other three discouraging ones (Mdala, Chakana and Maluwa). These were related to various social factors. Number of seedling raised in nursery has significant correlation with administrative equity, number of committee members, number of participants and planted days. This is because equitably behaving chiefs provide with reasonable way of mobilizing their villagers who willingly participate in the works given by chiefs. Willing of participation is also reflected in number of committee members responsible for participatory arrangement. The more a village has raised nursery seedlings, the more planting days are required to plant them. This relation is expressed in high coefficient between number of seedlings and that of planted days. Number of seedling planted in the villages has high correlation with number of planted days.

[1] [1]A computer soft named "SPSS" is used for statistical analysis of the results obtained from a planned treatment, Here, multiple regressions have been calculated among the independent variables and the dependent variable. Test for the attribution of independency among the selected independent variables are also carried out using SPSS prior to delivering the multiple regression equations in Table 4-29. As for independency of independent variables in multi-regression equations, Wilcoxon-Whitney's tests proved their independency at the level of 0.01(tests of both sides).

As stated above, significant correlation is found between Cadres' equity and the number of seedlings raised and planted. Significant correlation is found between Cadres' leadership and the number of seedling raised and planted. The number of participants also has significant correlation to afforestation performance. In drought year, significant correlation is found between the Water availability and the number of seedlings raised.Significant correlation is found between Afforestation experiences, which was estimated by the number of trees planted in villages before, and the number of seedlings raised.

Data by tree specie give the following statistical results. As regards the influencing degrees of the indicators on the survival of out-planted seedlings, deviation of planting date from mid January showed high correlation in the case of *F.albida, E.grandis* and *A quanzensis*. Soil water retentive capacity served as an influential limiting factor towards *F. albida, G.sepium, E. camaldulensis, A. quanzensis* and *S. siamea*. Tending after out-planting had impact to *E. camaldulensis, S. siamea, G.sepium* and *F. albida*. Depth of pitting for out-planting influenced the survival of *F. albida, E. grandis, S. siamea, M. azadirach* and *S.spectabilis*. Degree of hardening contributed to the survival of *F. albida, E. camaldulensis, S. siamea* and *S.spectabilis.*

Planting date has less relation with planting factors just because seedlings was mainly out-planted during January with concentrated rain spell despite that heavy drought hit them in 2003 /04. It is difficult to understand that experience of tree planting has inversely correlated with out-planting performances. Possible reason may be found in low participation of those who have experience in planting works just because they already have matured woodlots planted by themselves.

Analysis of the Forestry Data 2004/05

Simple analysis has been made as follows to assess the above-cited results. The above-listed results are numerically converted into 5 ranked order by village and correlation among factors is assessed by ordinary and Kendoll's rank coefficients. Technical factors are not employed because planting has not been done in off-season. Pots filled and those sown are highest correlated because toilsome villagers do faster works than lazy ones. Participation in nursery works is also highly correlated with filling/ sowing works just because group work brings about faster fulfillment of norm. Powerful leadership of village cadres (chiefs, committee chairmen etc) can facilitate mobilization of villagers to participatory activities in their nurseries, leading to higher rate of participation in nursery works and coupled IGAs. Correlation coefficient between nursery water and pot filling shows how severely water availability in nursery affects nursery works. Income levels of IGAs show correlation with social indicators, implying that desirable leadership helps villagers to get higher income, participation in nursery works means solidarity that allows participants to attain higher income. Number of filled pots and sown ones have also bearing to IGA income because nursery participants are all involved in IGAs and hard working can result in more seedlings and also enable higher IGA income. Wise village chiefs can locate their nurseries in convenient sites in order to minimize walking distance thereto, serving as positive factor for higher participation in nursery works. Water availability in nurseries has also correlation with income from IGA because irrigation with treadle pumps and goat rearing also rely on

Analysis of IGA data

The extent of the actual achievement as to the targets of tree planting and IGAs, the following is the summary of 2002 - 2004. Details of analysis are also tabulated in Annex B11.

In the analysis of IGAs with tree planting performances, the basic assumption has been placed on the fact that those who take part in IGAs are at the same time those who are engaged in tree nursery and out-planting works. Since the same committee have managed both activities though part of nursery / planting workers in a village belong to the group of IGA-1 and the rest to that

of IGA-2, with some exception that the same person takes advantage of two different IGAs. In 2003 /04, the benefits arising from IGA-1 had been negligible even though some treadle pump groups already had some disposable benefits from their vegetable sale, on account of a large delay in starting IGAs in 2002 /03. It was not until the beginning of the third year that substantial benefits were observed from three major IGA components including apiary. Minor components, home bakery and inland fishery have become viable though they were neglected from this analysis. Even if the performances of IGA are tried for assessment by component, population or sample number becomes too few to do statistical treatment. It follows that different IGAs should be analyzed in the same manner not separating them into components.

As to the relations among the first IGA, or the second IGA and social factors, planting components, correlation has been found between IGAs and social factors. For example, planting in 2003/ 04 has correlation with performances of IGA. It is noteworthy that participation has little negative relations with all adopted indicators, implying that only participation can hardly achieve envisaged targets. There found close relations between performances of IGAs and their resources, suggesting that ample availability of a resource gives base of success in IGAs. As regards evaluation on IGA performances both goat rearing and treadle pumps are stabilizing, and apiary is tracing favorable development from 2003 to 2004.

Table 4-26 Criteria to Evaluate IGA Performances into 5 Ranks

Rank	Basis of Judgment
1	economic benefit from IGAs can now improve villager's livelihood and sustain forestry
2	though benefits have not been materialized, promising trend is observed ahead
3	villagers make efforts to improve livelihood with introduced IGAs, with positive prospect
4	expected result have not been realized, but villagers do not give up
5	no substantial result has been brought and villagers are disappointed

	goat rearing	treadle pump	bee keeping	Guinea fowl	Other IGA
Average achievement 2002/3	2.3	2.5	3.6	4.0	-
Average achievement 2003/4	2.9	3.2	3.0	3.5	3.0

Among the factors adversely influencing IGAs in 2002/03, the clue lies in delay of input supply due to lack of availability of treadle pumps in the markets that has made one dry season completely idle, as compared with Boer goats that have been delivered on time before rainy season. Then, water scarcity has given inconvenience in some villages that are not located along major streams. Apiary has confronted with technical insufficiency to observe and deal with colonized swarm, leading to too late harvest and low honey quality, though in the third year villagers have got accustomed to operate proper harvesting works of honey and more colonizing has taken place. Villagers who rear Guinea fowl have faced to two serious damages, one incurred by savage dog attack and the other sudden prevalence of New Castle Disease in the Study Area, that has made hatching of fertilized eggs by chicken almost impossible.

In 2003 /04, planted number of seedlings and degree of success in 2003 /04 IGAs are highly correlated; implying that good management of IGA prevails in the villages where IGA activities prosper. Degree of equitable administration and mean success in both IGA activities are also correlated, suggesting that the latter tends to go on well if equity prevails in the villages. Number of planted trees throughout two years and mean success of IGAs have correlation, in other words benefits from IGAs may foster favorable tree planting that requires hard labor.

Success in the IGAs have correlation with equity in the village, leading to a tendency that equitable social environment may bring more favorable activities in IGAs than under a regime of monopoly chief. Higher correlation between resources available in the villages and success in IGA components implies that success in IGA may be brought about by resource availability in

the villages. Lastly, administrative equity and leadership of village cadres are almost accorded in a sense of management giving comparable influence on forestry performances.

With regard to the check on whether actual participants in forestry works received IGAs for their sustenance, it was found that good accordance between two activities attained in almost all villages. Some villages failed to realize this accordance, but later PIU rectified it by calling all the participants and made debate with village cadres until desirable solution for redistribution of IGAs realized. In a case, a TA dismissed a village chief by an appeal of a group village headman under his jurisdiction in order to satisfy this accordance.

Number of the participants in out-planting of seedlings raised in village nurseries accounts for 35% of the total households in the Study Area. In other words, there still remain 65% of villagers who should join in raising and out-planting seedlings to cover the whole village areas. Number of survived seedlings of forestry trees for 2002/03 and 2003/04 seasons amounts to about 240,000, equivalent to 54 ha (assuming the planting interval of 1.5m x 1.5m, to be thinned later), or 112 seedlings per year per participants. On the other hand, that of agro-forestry species reaches 74,000, equivalent to around 15 ha assuming planting density of 1m x 2m or every other hill at 1m interval, or 37 seedlings per annum per participant. These results mean clearance of the tentative target of 100 seedlings to be established per year per participant in case of forestry trees is not difficult. However, due to shortage of seed, progress of agro-forestry is still behind the plan. Since the goal of afforestation has been set at 211 ha (limited by land available to plant trees), it will take over five years to achieve it. Currently available wood area for fetching firewood is estimated at 138 ha only, which has still been disappearing at the rate of 0.2% of the total area, or 8 ha/ year in the Study Area.

In the light of this falling trend, out-planted area of 54 ha may be duly evaluated with the fact that out-planting by 6 small villages surpassed existing wood area within these. Without this Pilot activities it was estimated that 0.6 % (or 24ha) of existing forest vanished, but actually 30 ha was increased by the activities. As higher demand for seedlings arises in the practice of agro-forestry rather than forestry among participants, accompanied with maturity of village seed banks, faster progress can be made in agro-forestry development from now on.

4.6 Causative Tracing of Intra-Area Differentiation

Table 4-27 shows trends of nursery activities by village. Evidently, marked differentiation has occurred among target villages. Higher ranked villages mostly have aggressive or toilsome chiefs and functioning committees. Such creative atmosphere allows more participants to voluntarily join in nursery activities. Most of these villages already had community forest created by villagers under foreign sponsored projects or through voluntary reforestation before the Pilot Study had been initiated. Participants in nursery works have concern on chronicle shortage of firewood, have willingness of pole wood production as they remember abundant firewood or timber supply a few decades ago. They are also willing to make charcoal, make brick, make processed foods for income generation they have been engaged in the past, rather than given IGAs from Pilot activities since they feel physical limitation of developing goat rearing, treadle pump irrigation and apiary under limited resource availability. There are still four villages where charcoal is produced in mud kilns as of August 2004 (Nanjiwa, Makonokaya, Chilangali and Chikoja) and earnings amount to one digit higher than other IGAs. Other villages have large brick kilns, bakery oven or furniture processing atelier (S.Mpombe, Kamwendo, Manjelo and Ndemanje). Without such substantial incentives they would never enthusiastically join in nursery activities even if inputs and IGAs were provided from outside.

On the other hand, lower ranked villages do not have particular goal for forestry works since the villagers still manage to fetch firewood within their villages, and they do not currently have forest-based means of earning. Rather, villagers in these villages have long been engaged in marketing of vegetables as suppliers to Lunzu retail market (Lemu, K.Chigumula, Kateya, Teula, M. Ngondo, Kumponda and P. Bilila), also in local beer brewing (Maluwa, Mdala and Chakana). These piecemeal works are considered as a reason that inhibits villagers to concentrate on nursery works. Villagers of such villages used to buy firewood from their neighboring villages, implying acute firewood shortage but they seem to already give up firewood supply by their own efforts in their village land.

In predicting future sustainability of the verified Model, the most reliable factors lie in participant's judgment on the necessity of continuing nursery and out-planting works, and decisions of village chiefs/ committees on their continuation. As long as key persons in the villages consider the activities worth continuing, sustainability of forestry activities will remain as it is because the participants strive for their goal. This will most probably take place in the villages ranked in higher level where 30% of the available area was already out-planted and they envisaged to have firewood and pole wood harvest as they did in the past. Villagers in these villages have kept momentum of tree planting from which they benefited in the past, still more they have acquired techniques and inputs to raise seedlings by themselves. In addition to villager's will of planting trees, these villages have favorable governance atmosphere with ample solidarity, administrative equity and firm leadership that can sustain current rising tide.

As concern the middle ranked villages, villagers have their own targets for forestry products, and some of these villages have enough background experiences in establishing woodlots of fast growing species (mostly Eucalyptus species). Sustainability of tree planting in these villages depends heavily on solidarity of current participants. Even though current companionship broke up, nursery activities would continue on individual basis to meet their own need of immediate supply of home-consuming firewood, material of salable charcoal etc. There is possibility of shifting site(s) of nurseries and of participants within a village into virgin area if the chief or committee chair person keeps his/her attitude to diffuse tree planting, because many villagers still wait chance to participate in the activities. Extension staffs also expect and welcome such inner-village expansion for developing canopy coverage into wider space.

Table 4-27 Village Differentiation in Nursery Seedling Production

	Rank of nursery seedling raising					Raised nursery seedling (1,000)				state of propelling force	
Village / Year	02/03	03/04	04/05	mean	trend	02/03	03/04	04/05	.trend	state	aiming at
Kam'mata	1	1	3	1.7	constant	28.2	12.0	10.9	constant	solidarity	wood
Chikoja	10	2	1	4.3	ascend	9.7	10.8	11.9	ascend	2 nurseries	wood
Tamvekenji	2	11	6	6.3	recover	15.1	6.6	8.8	recover	willingness	wood
Kumanda	5	13	4	7.3	recover	11.5	6.2	9.5	recover	willingness	A.F.
Makonokaya	3	7	12	7.3	descend	13.4	7.0	6.1	descend	willingness	wood
Siyamdima	11	6	7	8.0	constant	9.2	7.5	8.2	constant	willingness	firewood
Chilangali	8	12	5	8.3	recover	10.1	6.4	8.8	recover	willingness	wood
Kamwendo	15	9	2	8.7	ascend	8.5	6.7	11.1	ascend	2 nurseries	firewood
Manjero	13	5	11	9.7	constant	9.1	7.9	7.0	constant	willingness	firewood
S. Mpombe	6	2	22	10.0	big fall	10.4	9.2	2.1	big fall	exhausted	wood
Nanjiwa	7	17	10	11.3	recover	10.3	5.0	7.2	recover	willingness	wood
Ndemanje	24	8	8	13.3	ascend	1.3	7.0	7.7	ascend	willingness	A.F.
Kaumbata	9	19	13	13.7	recover	9.9	4.1	6.1	recover	exhausted	unknown
D. Mbedza	17	10	14	13.7	constant	7.6	6.6	6.0	constant	unstable	unknown
Lemu	12	14	17	14.3	constant	9.2	5.5	4.1	slump	inert	A.F.
K.Chigumula	24	4	16	14.7	big fall	4.0	8.3	4.6	slump	unstable	unknown
Kateya	4	23	19	15.3	recover	12.0	2.2	3.3	falling	unstable	unknown
Teula	14	24	9	15.7	recover	8.7	2.1	7.3	slump	inert	unknown
Kumponda	22	15	15	17.3	constant	6.4	5.5	5.1	slump	inert	unknown
M. Ngondo	16	18	21	18.3	constant	8.5	5.4	2.5	falling	exhausted	unknown
Peter Bilila	20	18	18	18.7	constant	7.1	4.4	3.6	falling	inert	no target
Mdala	20	21	20	20.3	constant	7.3	3.1	3.2	falling	unstable	no target
Maluwa	18	22	23	21.0	constant	7.5	2.5	1.7	falling	laziness	no target
Chakana	21	20	24	21.7	constant	6.6	3.1	1.3	falling	laziness	no target

Note: AF: agro-forestry, fw: firewood, unstable governance is derived from death/ change of chiefs etc.

village group	forest-based earnings	other income earnings	nursery * participants	working hours in nursery **	working days in nursery ***	equity / leadership	% of villagers mobilizable*4
Upper ranked 8 villages	5	3	42	69	4.0	3.5 / 3.8	31.7
Middle ranked 8 villages	3	5	33	62	4.6	3.1 / 3.1	22.1
Lower ranked 8 villages	0	8	28	53	3.6	2.4 / 2.1	27.9

Note: * 3years average / village, ** annual average / village,*** in-season weekdays for nursery labor, *4: % of stove installed

village group	Survived seedlings#	Created woodlot (ha)	Plantable area (ha)#2	Remaining woodlot(ha)	Agroforestry practice (ha)	% of A.F. crop field	
Upper ranked 8 villages	6,699	2.6 /village	8.4 /village	3.9 /village	1.0 /village	6.1%	
Middle ranked 8 villages	4,474	1.3 /village	9.1 /village	9.5 /village	0.7 /village	4.6%	
Lower ranked 8 villages	2,473	0.7 /village	6.5 /village	3.9 /village	0.2 /village	1.1%	

Note: #: out-planted per village in 2002/03 ~ 2003/04, #2: both communal and individual area for creating woodlots,

Table 4-28 shows current firewood availability in three village groups separated in Table 4-27 that shows village differentiation and remaining wood area. It can be extracted from this table that villages with smaller woodlot per population tend to be ranked higher, where housewives have already recognized acute shortage of firewood in their villages.

As self-evident from the comparison in the Table 4-34, village activities led by experienced cadres show better performances in the Pilot activities. After all, the villagers themselves should lead the established Pilot activities after the Study phases out. Experienced villagers are identified to be able to serve as key persons for sustaining on-going activities as well for expanding the established ones into their neighbors, since they have ample knowledge, practicing ability and influencing power on the villagers and participants.

In the Study Area, a third of village chiefs are head-women. There observed significant difference between the lady headed and men headed villages in both forestry works and IGAs, where those headed by women gave better performances than those recorded in the villages headed by men, as seen in Table 4-31. Since routine fetching of firewood has long been one of women's chores as fixed housekeeping division, they really worry about scarce firewood as studied in the Baseline Survey.

Table 4-28 Village firewood availability and differentiation in 2002/04

unit: woodlot/person: square meter

Villages with favorable performance				Those with ordinary performance				Those with discouraging performance			
Village name	area ha	wood-lot	w/person	Village name	area ha	wood-lot	w/person	Village name	area ha	wood-lot	w/person
Kammata	171	1.8%	2.1	Manjelo	69	4.3%	16.2	Kateya	69	6.7%	23.3
Chikoja	233	3.0%	13.6	S. Mpombe	54	7.4%	14.5	Teula	54	3.1%	31.3
Tamve kenji *	36	5.6%	7.9	Nanjiwa	234	7.3%	34.8	Kumpond	234	1.1%	8.0
Kumanda	127	1.6%	7.2	Ndemanje	144	1.4%	8.5	M.	144	3.7%	10.8
Makonokaya	164	2.4%	17.4	Kaumbata	316	7.0%	30.5	Peter	316	1.6%	4.6
Siyamudima	119	2.5%	12.0	Daniel Mbeza	70	4.3%	26.8	Mdala	70	2.0%	21.9
Chilangali	51	5.9%	7.9	Lemu	347	6.6%	23.0	Maluwa	347	2.2%	7.8
Kamwendo	315	2.2%	11.1	K.Chigumula	102	1.0%	1.1	Chakana	102	4.1%	7.8
Mean area	152	3.1%	9.9		167	4.9%	19.4		183	3.1%	14.4

Note: area; village area in ha, wood-lot%; usable woodlot % to total area in the village, w/person: woodlot area per population

Table 4-29 Past Major Tree Plantings in the Target Villages of the Study Area

Village	year	planter	tree specie	seedling supply	area / scale
Kaumbata	1997~2001	village chief	*Eucalyptus spp.*	self supplied from nursery	0.2 ha, 550 stands
Nanjiwa	1998 ~ 2001	comm.chairman	*E. camaldulensis*	supplied from own nursery	0.6 ha, 1,400 stands
Chikoja	1995 ~	comm. member	*Eucalyptus saligna*	bought from MASAF nursery	0.4 ha, 880 stands
Lemu	1998	comm. member	Indigenous spp.	supplied by an NGO	0.8ha, >2,500 stands
Tamve Kenji	1990 ~	chief's clan	*E. camaldulensis*	bought from MASAF nursery	1.2 ha, 3,000 stands
Kammata	1992 ~	village cadres	*E. camaldulensis*	distributed by a Project*	0.7 ha, 2,000 stands
Peter Bilila	1997 ~	comm.chairman	Fruit trees	bought from Research I.**	0.1 ha, 300 stands
Ndemanje	1999~2001	comm. member	*E. camaldulensis*	bought from MASAF nursery	0.2 ha, 600 stands
Kamendo	1999~2001	comm. member	*Eucalyptus spp.*	bought from MASAF nursery	0.1 ha, 330 stands
9 villages	1990~2001	Pilot members	mostly Eucalyptus	mostly bought seedlings	4.3 ha, 11,560 stands

Table 4-30 Comparison between Above-Listed 9 Villages and Others on Average Forest Status and Performances of the Pilot Activities

	Nursery seedlings	Outplanted seedlings	Survived seedlings	current forest area	firewood deficiency	N nursery participant	Nursery working days and hours / day
9 villages	8,966	7,945	5,557	9.7 ha	2.9 (48%)	41.7	66.6 days, 5.1hrs
15 villages	7,176	6,457	3,943	3.4 ha	3.1 (52%)	32.5	58.3 days, 3.4. hrs
24 average	7,847	7,015	4,549	5.8 ha	3.0 (50%)	35.9	61.4 days, 4.1 hrs

Note: S: Seedlings / year, D. deficiency (%deficient), N: nursery works

Such daily arising, immediate need no doubt drives them to plant firewood trees around them so that they can fetch it without exhaustive walking for several hours to destination shrubs. Also, women don't want to pay for firewood though sometimes they are obliged to pay for it as they often do in southern part of the Study Area. Thus, differentiation as cited above has been brought about by the actions of multiple factors including past experiences of tree planting and current firewood situations.

Table 4-31 Difference in Forestry Performance between Headmen and Head-6 Women Villages

	nursery seedlings		outplanted seedlings		survived seedlings		nursery participants		planting participants	
year	'2002/03	'2003/04	'2002/03	'2003/04	'2002/03	'2003/04	'2002/03	'2003/04	'2002/03	'2003/04
lady chiefs	10,166	7,414	9,981	5,951	5,732	4,664	46	30	47	45
headmen	9,391	5,361	8,983	4,095	5,118	3,330	38	32	48	32
	committee members		mobilized days /year		nursery work hours		equal govenance		cadre's leadership	
year	'2002/03	'2003/04	'2002/03	'2003/04	'2002/03	'2003/04	'2002/03	'2003/04	'2002/03	'2003/04
lady chiefs	10.1	11.1	84.0	48.0	5.1	3.4	3.4	3.1	0.7	0.9
headmen	8.9	10.8	72.0	46.5	1.9	2.8	2.8	2.9	1.5	1.0

4.7 Villager's Consciousness of Environmental Conservation

Though villagers lived in harsh environment degraded by an aftermath of their own exploitation, majority had been ignorant or indifferent to their ecosystem before the Pilot activities. A host of causes i.e., lack of environment education, prevalent illiteracy, limited chance of observing outside their villages to make comparison had brought about their ignorance. Many villagers believed that round pieces of stone spontaneously had grown taller as time elapsed, because they had almost been buried in the ground in their childhood but now they can observe them over the ground. Such belief prevailed just because they didn't know the mechanism of soil erosion. The Pilot Study brought basic knowledge on environment into the target villages through extension activities by PIU along with that on forestry and IGAs.

As identified in the results of villager's self evaluation, nowadays most villagers are aware of causes and process of environmental degradation, preventive countermeasures to mitigate it and conservatory conducts they should follow through lectures and training in village workshops by PIU staffs. School education still does not cover much about such environmental protection, so people cannot help resorting to adult education to diffuse concept of environmental and resource conservation. However, mere transfer of knowledge does not much serve for effective practice.

PIU staff taught villagers how to provide box hills and marker ridges in their field in addition to planting firewood or agro-forestry trees. Villagers have acquired both knowledge and practical skill, coming up with instructor's level. They created thousands of marker ridges, box hills and check weirs in the streams to store water and sediment (dredging it into vegetable gardens as manure) and finally began planting stream bank lots to prevent direct soil erosion into streams. Instruction by PIU was really timely, for there was growing concern among villagers on dwindling surface water in their streams. They learned how to conserve water within watershed as need arises to retain as much rainwater as possible in the watershed amidst accelerated process of desertification. They have also been instructed from PIU staffs how to avert their crop from drought damages by applying organic manure. Through such practical experiences they could absorb really useful conservation techniques against the process of desertification.

Table 4-32 illustrates environmental issues villagers are facing with and related measures they have taken as an initial approach to tackle them.

Table 4-32 Environmental Issues, Causes and Measures in the Study Area

village	issues / problems	causes of degradation	measures taken by villagers
Peter Bilila	soil erosion on field	decreasing canopy cover, gullies formed	marker ridges with vetiver grass
Kamwendo	do.	exposed to wind erosion on bare surface	planting wind breaks, marker ridges
Kaumbata	do.	over-felling of indigenous trees	planting wind breaks along farmroad
Mdala	do.	decreasing canopy cover, gullies formed	marker ridges with vetiver grass
Chikoja	surface water depletion	lack of canopy in upstream watershed	reforestation, use of improved stove
Kumanda	do.	over-thriving of weed inside marsh	weeding, planting indigenous species
Tamve Kenji	do.	lack of canopy in upstream watershed	reforestation, use of improved stove
DanielMbeza	do.	lack of canopy in upstream watershed	weeding, planting indigenous species
Kammata	do.	over-thriving of weed inside marsh	reforestation, use of improved stove
Kumponda	groundwater scarcity	lowered water retention in aquifers	promoting recharge with water-harvesting
Lemu	do.	declined rainfall recharge in aquifers	promoting recharge with water-harvesting
K.Chigumula	do.	abusing of water and less recharge	controlling water use around wells

As explained in preceding section, the results of villager's self-evaluation indicate the extent of understanding among the respondents (more than half of 120 respondents were women). All the

respondents understood that tree planting could rehabilitate degraded environment, and 93% of them recognized concern for current and future scarcity of ligneous resources in their villages. Also, all of them replied contributing effect of tree planting to soil and water conservation besides firewood procurement. 57% replied that they encounter future difficulty in fetching firewood unless they plant trees, while 56% expected that they would benefit from forestry products if they planted trees. 46% of them recognized that spontaneous regeneration of tree stands no more took place if wood-fetching consumers failed to plant trees. As concern environmental change, 96% of the respondents replied that tree planting was necessary for securing firewood, pole wood and other forestry resources, while 89% of them knew that reforestation was effective to prevent soil erosion. Also, 66% of them gave a positive answer to water retentive function of reforestation in recharging groundwater and sustaining surface running water in the perennial streams. 6% of them considered positive function of planted agro-forestry species to sustain soil fertility. As to negative response, only 4% of the respondent gave negative outlook due to narrow space for planting trees within their villages.

Table 4-33 compares villager's understanding towards environment before and after the Pilot Study. Remarkable changes could be identified during two years of the Study in which villagers had closer contact with PIU staffs who gave them profound impact on their concept, although contents of inquiries and methods of survey were not exactly the same between two occasions. When the initial Baseline Survey and subsequent workshops were held, villager's expectation to the content of the Study was too high as many of them counted on some wage or meal from participatory works, while few of them recognized importance of reforestation. Nowadays, their perception to environment conservation has been greatly renovated through the influence of PIU staffs from reluctant attitude toward getting involved to works into aggressive participation even if no wage were paid to their contribution, as they felt necessity of coping with water crisis.

Table 4-33 Changes in Villager's Concept during the Pilot Study

Time Sequence	2002 workshop		2004 self-evaluation	
	opinion	composition	reply	composition
Whether afforestation is really necessary or not				
1. People cut more trees than natural regeneration	0	0%	57	46%
2. Afforestation helps trees / forest grow to produce wood	0	0%	119	100%
3. Afforestation will give us trees for charcoal	0	0%	60	56%
4. Afforestation enables us to save walking distance to fetch firewood	30	13%	61	57%
5. Afforestation ia not needed because trees naturally grow.	78	33%	0	0
6. Not welcomed as planting accompanies people's burden	64	27%	0	0
7. Not acceptable because of lack of sites for planting	42	18%	0	0
8. If no wage is paid or no food supplied for work, it's better take rest at home	25	10%	4	4%
The reasons why some villagers consider necessity of planting	opinion	composition	reply	composition
1. Afforestation secures enough firewood, poles and fruits.	18	60%	114	96%
2. Afforestation reduces soil erosion, increases soil fertility.	0	0%	106	89%
3. Afforestation contributes to recharge borehole water and stream flow.	0	0%	78	66%
4. Afforestation helps enrich honey, mashroom and useful products	12	40%	52	44%
5. Planting agro-forestry trees is equal to applying fertilizers to crops.	0	0%	6	6%
6. Other reply	0	0%	2	2%

Thus, concentrated instruction by PIU staffs radically changed basic concept and way of thinking among the participants. This deserves attention as one of the harvests obtained from Pilot activities that are essential to make tree planting sustainable among stakeholders. Short life expectancy of rural inhabitants has been reported on TV programs, estimating less than 40. So, very few old people remain in the villages. However, these old villagers well remember past landscape of their land densely covered with indigenous canopy. They also have observed process of environmental degradation occurred around their villages including charcoal, leaf tobacco or brick production that consumed lots of ligneous resources. These were important

means of income generation to subsist their families. They've never felt guilty conscience of their environmental destruction but have an anxiety of crisis on acute shortage of food and fuel.

According to the aged generation, land denudation has sharply been accelerated in these two decades, especially during 1990s. Be it a fact, the lost canopy may still be restorable under loosened population pressure in these years. Such a degrading trend may not be confined to Malawi but common in many east African countries coincidentally happening after a period of demographic explosion. In these countries, forest products still constitute major source of fuel supply to urbanized, metropolitan areas since substitutable fuel like briquette is not yet developed. Radius of fuel supply areas from city center grows distant year after year, but rural inhabitants believe that forest products are salable as long as cities are existing. Nursery participants in Pilot activities are not an exception and they also expect income generation through urban markets. Real problem may lie in a tendency that younger generation does not necessarily worry about firewood shortage and give up tree planting. They want to behave like urban citizens rather than rural people. Thus, participatory tree planting would be last resort to maintain nation-wide planting campaign that Malawi pledged in SADC council a decade ago.

4.8 Conditions for Sustainability of Social Forestry Activities and Related Factors

4.8.1 General Conditions for Forestry Development

One should recall the results of analysis mentioned in 4.5 to debate sustainability of social forestry activities as verified in Pilot activities in the target villages. Above all, preconditions should be set at global desertification process as seen in actual trends of declining rainfall. This premise has already been adopted in the strategy development to cope with recent food crisis in MOA. (refer to "review of the implementation of the national action programme for Malawi for the Unite Nations Convention to combat desertification (UNCCD) for the period 2001 -2004.") This has bearing to basic matters such as creation of village nurseries, surviving of tree seedlings and participant's health etc. The concept of social forestry, forming basis of the verified Model, evolves from positioning forestry activities as means of subsistence otherwise the participants can neglect or skip them, by the reason that forestry products are essential for daily life. The behavior that villagers cannot eat raw foodstuff constitutes important assumption here and this is obvious from the fact that even amidst severe famine they have to boil pumpkin leaves before eating them. It follows that villagers must continue or resume tree planting regardless of whether they like or dislike it, once they have learnt the whole practical procedure of tree planting and material of planting is available around them. The model has provided coupled forestry activities with IGAs assuming the same beneficiary participants in both activities, in order to allow slow-acting forestry activities to serve as means of subsistence.

Here, condition to make tree planting sustainable among villagers is complete technical transfer of tree planting from extension staffs to the villager-planters. In other words, involvement of extension staffs for initial few years until villagers can master it plays essential role to introduce and sustain tree planting, though sustainable tree planting cannot be verified from the designed Pilot process since it takes long time. Similarly, sustainability of forestry activities without coupling IGAs could not be identified from Pilot activities. However, there have been ample examples of such trials where no past trial has been successful without any involvement of technical supporters like official extension staffs or NGO supporters, nor any project with forestry component alone continuing long after phasing out.

Then, nursery is necessary for seedling supply, but site requirement should be met to maintain function of nursery. In the analysis of the results, it has been concluded that monthly rainfall gives influence on tree survival and water for nursery also affects survival of seedlings. In future, it is anticipated that annual precipitation becomes as scanty as 500mm or less in and around the

Study Area. Under such circumstance all the villages cannot procure water to supply to their nurseries. For example, provided that a village relies on a stream with a catchment area of 4 square kilometer, equivalent to 10% of the total surface area of the Study Area, it can expect only half a liter per second of surface water at the end of dry season, judging from leakage water from Milala Dam located at the center of the Study Area. This is a risky level to establish a nursery raising over ten thousand seedlings. Then, taking a safer side it can be concluded that nurseries can safely be established along large streams with the catchment of ten square kilometer, i.e., Lunzu River and Nkokozi River in the Study Area, or major tributaries of Shire River. This may lead to an estimation that nurseries can be maintained at only half of the target villages facing to these major tributaries, and other half have higher risk to establish and maintain them.

Then, participation in forestry activities serves as key factor to sustain participatory works of the Model, as identified in the analysis. How to keep the participation sustainable depends wholly on the management of village organizations through administrative equity, cadre's leadership and villager's solidarity. These indicators are not directly controlled or determined by artificial intervention but indirectly oriented through leadership training and instruction through input distribution. After all, sustainable participation is derived from long-lasting impetus to the villagers in the form of giving chances, incentives and benefits to the participants. Here, complete concordance between the participants in forestry activities and those in IGAs constitutes the most important condition to realize and to keep impetus for a long time.

Although the difference between the coupled forestry activities with IGAs and those without coupling has not been verified in this Study, it is possible to make a comparison with another example of participatory verification study carried out in Swaziland (2001 to 2003). This example contained also participatory activities on afforestation and soil-erosion control with IGAs involving more than 30 villages, however, these could not be coupled in the same villages mainly on account of topographical constraints. As a result, separate beneficiaries took place between environmental care and IGAs (gravitational vegetable irrigation and rotation block of cattle herds), thereby causing large difference in number and frequency of participation in the former and that in the latter activities (much less participated in forestry but much more in IGAs). Another possible cause of differential participation may be attributed to the level of living standard of villagers who can afford to buy fuel even if firewood scarcity has already arisen in some parts.

In any social development activities, it is imperative to target as many inhabitants as possible for homogenous development. If very limited people are involved in a project and they happen to make success, they will become sooner or later a target of thief's (like Robin Hood) attack and lose what they have created. Actually, such happening took place in some villages where the chiefs monopolized inputs among his/her clan families, and they had to rectify their own character of governance later. In this connection, inter-location tours can often function as an effective monitoring opportunity because neighboring villagers can act as vigilant observers on any misfeasance of chiefs of other villages. Group of extension staffs can intervene to rectify poor management of inputs by village chiefs/ cadres.

It is well known that forestry takes too long embryonic period to yield benefit in comparison with other activities. As compensatory means it is advisable to combine it with agro-forestry practices or with agronomy components (such as fruit trees) so that nurseries can be multi-purposely utilized, since agro-forestry trees enable to give earlier return than forestry species.

Analytical results also revealed that close relationships were found between distance from villages to nurseries, enough space for planting trees and villagers' past experiences of planting trees. From these facts, it can be concluded that village nurseries should be placed at convenient sites from village center for better management, and participants can raise more seedlings if

they have ample space to plant them, while it is the best policy to involve experienced people for tree planting in forestry works. As regards rational use of resources, both space to plant and quality of land, especially soil moisture retention give heavy influence on survival of planted seedlings. Hence, relevant land use plan will lead to success of forestry activities, along with proper utilization thereof including land, manpower and other domestically available resources.

As to whether the verified Model can be sustained under the given conditions or not, fairly promising outlook can be presented from the observed changes during the time span from Baseline Survey to the end of Pilot Study. It's needless to say that actual practice in the future depends heavily on the efforts of villagers because they already know that the outcome will give direct effects on their own livelihood and environment.

In the debate of whether reforestation under the examined Model is sustainable among the villages under the verified conditions or not, it might be necessary to review historical event that brought radical change of staple crop. It was not many centuries ago that maize, originated from South America replaced millet and sorghum in almost all African countries. Such a drastic change took place because there was exigent need of increasing food supply as population expanded. Similarly, exotic tree species such as Gmelina, Eucalyptus and Australian acacia replaced indigenous flora, because villagers had planted them. Here, it should be noted that spontaneous multiplication by dropped seed could hardly replenish loss of tree resources through local consumption under semi-arid climatic conditions now prevailing in the Study Area. Everybody observes housewife's participation in nursery works just because they confront with acute firewood shortage and it is their role to fetch firewood according to gender division. Thus, Malawians never doubt that local population can naturally be involved in tree planting in order to meet BHN, provided that they know how to raise tree seedlings. There is no other choice for their survival than planting trees so long as they cannot get along without firewood, since they can eat only cooked food but they cannot eat raw meat, raw maize powder and even raw vegetables. Some foreigners discuss on substitute fuel like briquettes, or rural electrification, but it is too dear and not realistic for local population to use such value added substitutes for naturally grown trees, as discussed in 4.10.

Table 4-34 Conditions for Sustainable Tree Planting in the Target Villages

Why don't people plant trees?	What drives them to plant trees?	What makes tree planting sustainable?
They don't know how to raise tree seedlings, how to collect seed.	They need firewood to cook food but it gets less available within village.	Disappearing tree stands in their villages has made up their mind to plant trees.
They suffer from hunger that makes them reluctant to get involved in tree planting works during famine time.	Incentives, especially IGAs, can motivate them to get involved in tree planting since it can give hope/energy.	Employment of fast growing species can foster them to participate in planting works anticipating quick benefit from harvest.
Local people have so far been ignorant of planting trees since school education never attach importance to tree planting / environment.	Extension service has provided them with awareness and capacity building, sensitization and enlightenment during workshops, demonstration/ training.	Those who are fully aware of merits of planting trees can keep planting but they should teach ignorant neighbors how to do, otherwise they become only thieves.
Conclusion drawn from Baseline S.	The Model provided IGAs/Extension.	The model employed fast growing ones.

Table 4-35 Criteria of Judgment on Customized Tree-Planting

Source of Assertion	Evidences / Proofs of Sustainability of Planting Trees
Baseline Survey	Villagers relied on sale of firewood, charcoal and bricks before Pilot activities started. Their need and belief cannot radically undergo change for few year's time span. Housewives concern for dwindling availability of firewood, sometimes paying cash for buying firewood for cooking.
Past Performances	There had been a tree nursery in Kaumbata village that lasted 5 years just before the Pilot Study began, supplying seedlings to 5 villages supported by a forest guard-man. Villagers including two committee chairmen created a number of forests in 9 villages in the Study Area (Table below).
Villager's Daily Life before Pilot Study	Some people consider that villagers are only engaged in IGAs while they abandon forestry, but actually, especially housewives acutely need everyday firewood, otherwise they have to eat raw maize or raw meat in spite of their eating habit of boiling / roasting everything before eating.
Effect of Pilot Activities	Many villagers have been sensitized and now are aware that trees never spontaneously grow

by PIU	without planting. They learned that tree resource declined year after year. This response has been identified in the result of Villager's Self Evaluation (presented above) carried out in August 2004.
Outlook of Actions in Post-Pilot Period	Now villagers have acquired the skill of raising seedlings, out-planting and tending them for future firewood, pole-wood and environment. Anyone who believes Malawian's sincerity and intelligence has no doubt on their further engagement in sustainable forestry/ agro-forestry works.

4.8.2 Targets and Strategies for Forestry Development

Reasonable targets of villagers' voluntary efforts should be set for rehabilitating their resources and environment. Villagers know their limit of physical works on their crop field, nursery and woodlots. The numbers of seedlings they have grown in their nurseries and those left in the nurseries without planting imply possible and reasonable rate of producing and planting. Average figures of achieved performance during 2002-2004 give 114 trees planting per participants. This figure can be used as a reasonable target of sustainable planting per year per participant. It can be estimated from this figure that a participant can annually create 80 survived stands from planted seedlings and continuous planting for 5 years 400 stands can cover 900 square meter, and a decade later he can expect to harvest 0.45 cubic meter of wood from what he/ she has planted. From the equilibrium of forest cover in the Study area, the area is estimated losing 20ha every year and 70,000 seedlings, taking survival into account, will be necessary just to compensate the loss. 560 participants, or 24 participants per village can raise and provide these seedlings. Currently, firewood consumption is less than hitherto used quantity because of food scarcity. In future, if villagers have more food, more demand for fuel would arise from current basis. So, it is desirable that more than 24 villagers in a village continue to plant 125 seedlings per year, for 5 years in order to sustain rehabilitation of forest. As for villagers' voluntary activities, some village chiefs expanded, increased their village nurseries as suggested from PIU, and this movement must be deserved. Lastly, it should be noted that people in Malawi can hardly eat even raw lettuce and other vegetables, in other words every foodstuff should be cooked before eating. In other words, villagers know firewood is indispensable for livelihood and trees never spontaneously regenerate. It follows that no one can pursue only IGAs without worrying firewood shortage, unless it enables him/her to earn as much money as he can afford to buy firewood. This is a reason why many participants are still involved in unpaid nursery works but with IGAs, in spite of on-going paid public work in the Study Area.

Possibility of diffusing forestry development coupled with IGAs

PIU has made village seminars on proper management of IGAs for the sustenance of already introduced activities into 24 target villages. Three to five committee members per village, including secretaries and treasurers, attended and took part in the lectures and discussions. Both nursery/out-planting works and IGAs are covered under the same (village development or VNRM) committee, and the benefits from these activities have been pooled for further accounting management. Therefore, if this system continues as it is, there will be no need of transferring gain from IGAs to forestry activities, since every participant know both forestry and IGA are equally important as debated above, and all participants will consume all as their food that enables them to plant trees. Most committee members have experienced Eucalyptus planting a decade ago and some of them also experienced charcoal baking in kiln, implying that they also need to obtain material for pole and charcoal. This implies that committees can sustain forestry activities just because members know the benefits of forestry, and actually only the labor inputs are required to sustain it if seed and manure can be supplied within the villages.

Effect of extension on sensitization and empowerment of villagers

As revealed in the Baseline Survey, in the past extension workers seldom visited target villages and villagers benefited few from extension services. Pilot study allowed them to have frequent chances to learn not only forestry and AF but also basic techniques on farming and IGAs.

Extension staffs can give farmers training on tree planting and farming through input supply, otherwise the trainees can hardly be trained without any tools or implement. In the villager's side, Pilot study brought them chance of observing outside of their villages including model project sites, performances in their neighbor villages through inter-location tours, of receiving trainings and seminars. Also, chances have been given to express opinions in workshops held by PIU staffs. Along with input supply, this activated committees where participants' or members' opinions are more reflected in the management of activities than before, as the reply in villager's self-evaluation shows (88-97% considered so). The fact that some village chiefs have made autonomous decision to expand nursery activities without any proposal by PIU staffs tells us improvement in consciousness of importance attached to forestry activities.

Sustainability of participatory forestry and agroforestry activities.

This is a core point to be extracted from the study results. As far as the number of participants in nursery activities is concerned, no change has been seen in both PIU reports and villager's self-evaluation. As to those in out-planting, some decline was recorded in 2003~04 in the result of self-evaluation due to water scarcity in nurseries and subsequent decrease in planted number of seedlings. However, sustainability of participatory activities depends heavily on dimension of capacity building activities and support. In so far as participants satisfy with the activities, the participatory project can be sustained. The results of self-evaluation give overwhelming support for the sustainability, claiming no additional input needed for continuing (92% for forestry, 91% for IGAs), continuous input supply needed (9% and 8%, respectively), continuous extension support needed (43% and 35%, respectively). There was only 1% of denying answer to the sustainability of Pilot system. The situation will be different on diffusing a model to neighbor areas, because however successful a model project is going on, people in the neighbor would not try to follow the model, unless a promoter or a sponsor takes some action to support them to follow collaborating with related government agencies. This has been observed in some phased-out projects and such inert attitude may evolve from oppressive outcome of vicious circle.

Method of extending forestry/AF techniques through establishing core farmers has the following outcome:

a. ICRAF has transferred AF techniques to some excellent farmers, who applied advanced techniques received from the Institute to their own farming successfully, but extension workers found that the transferred techniques were not disseminated from these core farmers to their neighbor, possibly because a group of villagers was not involved as participants in a participatory activity (villagers of the Study area visited and observed a core farmer), and those chosen as core have more favorable farming conditions. Thus, developing techniques from a point to a dimension through a core media seems difficult.
b. AF practices have been introduced to Michongwe village where USAID assisted the villagers to extend them, however, the techniques have not been diffused into neighbor villages（the village was excluded from the Pilot area at the stage of M/P）. Although some core farmers in this village have still continue acquired practices, they have never deemed as common asset to be extended over all of their neighbors, where the poor diffusion may be attributed to the lack of generosity, according to the extension worker who was in charge of the project but now working as a member of PIU.
c. In Nanjiwa Village, the chairman of nursery committee has personally been engaged in out-planting tree saplings for a decade, though none of his villagers follow his efforts up till 2002, the beginning of the Pilot activities. One reason may lie in the fact that wide out-planting requires physical ability that has not always been bestowed to all the villagers. Another reason may be found in that awareness of necessity in planting trees among villagers has remained in a low level in this village where relatively ample indigenous stands still remain. However, during the Pilot Study more than 20 villagers

have planted seedlings they raised in the village nursery where the chairman played a role of supervising leader.

Other than these examples, some others including nursery/out-planting scheme sponsored by a tobacco manufacturing company, and waged out-planting of common woodlots under the sponsorship of MASAF have failed to expand the introduced techniques into their neighboring villages, whereas, successful case of further diffusion from core farmers to their next-door (except participatory way of project) has not so far found in and around the Study Area.

In this context, excellent expertise villagers are difficult to serve as a target to be followed by average ones because of too big gap of capacity between these core villagers and ordinary multitudes. In Malawi, the best extension policy always seeks for nurturing groups or persons of average capacity, not very much different from ordinary people, because villagers at large are liable to get exhausted in catching up with extraordinary standard of excellent people who can run as fast as top marathon runners. Many projects have made glorious success in bringing up advanced farmers, but these farmers have very often failed to trigger ambition of the multitude to come up and overtake their forerunners. However, it is quite a different story that competition among villages can be heated up just because village cadres don't want to run behind other villages out of jealousy. From this point of view, the verified Model may have had a right choice to treat all target villages equal and make them compete one another.

4.8.3 Potential of Sustenance, Future Stabilization and Expansion of the Pilot activities

(1) Future Prospect of Forestry and Agro-forestry Activities

(a) Forestry Activities

In near future, women will take more part in forestry activities as observed in 2004 (ladies account for two thirds of nursery participants). As social division, women are responsible for fetching firewood at least twice a week and they began to worry about depletion of resources in and around their villages. At any rate, they cannot dispense firewood for their daily food preparation and they have already learned from PIU staffs that without planting firewood it never fails to disappear in a few years. They have already recognized that only less than 6 ha of wood lots is available within each village where only 10 households can fetch 1,000 head-loads (=15kg) throughout a year (twice a week). Since more than 120 households form a village of average size, 110 of them fail to fetch firewood and they are obliged to burn dried grass and crop residue. This is the basic reason why villagers cannot get rid of forestry works. Some villages still keep naturally available fuel-wood, but they have already suffered from incessant theft damage of tree stands by invaders who sly into their villages from outside.

The above-mentioned serious situation has been identified through the result of villager's self-evaluation on the Pilot activities. No wage has been paid to nursery and out-planting works despite the fact that wage based public road works has in parallel been going on, yet villagers (especially ladies) have fully been engaged in the nursery and out-planting works for three consecutive years. Majority of the respondents to a questionnaire who were the participants of nursery works replied that they would continue tree planting. Evidently, they have prospect of harvesting firewood from their own woodlots or village lots where they have planted seedlings they raised in village nurseries.

Table 4-56 gives a rough estimation of woodlots acreage and envisaged annual harvest of firewood from what they have planted through 3 years of Pilot activities. 9 out of 24 villages show more than 0.4 cubic meter, or the minimum firewood requirement per household without resorting to existing/ remaining forest area. Of course, desirable quantity of annual firewood accounts for 1.1 cubic meter or more, but the rest amount, 0.6~0.7 cubic meter can be supplied from dried grass, crop residue (mapesi) etc. What is expected in the target villages from now on

includes new participants join the seedling production in the established nurseries so that they can also plant their own seedlings prepared for future firewood consumption by themselves.

If four batches of villagers groups can sustain the nursery and out-planting activities verified in the Pilot Study for three year's term respectively, in total 12 years from 2002-2013, then almost all households will experience real forestry practices, creating about 300 ha of public as well as private wood-lots and around 80 ha of crop field with AF practices. This is equal to say that 380 ha of vegetative cover can be created in addition to remaining forest area (approximately 1-2% or 60ha in 2013). When this goal is fulfilled, self-sufficiency of firewood will also be attained and at the same time satisfactory canopy coverage will be created to minimize soil erosion. Chiefs and committee chair-persons still keep farm implements for nursery and IGA activities as common properties. Villagers know that use of these implements can be shared among them for public works. Along with multi-purpose use of their nursery as a base for distributing fruit tree seedlings and sweet-potato vines, villagers will not give up their right of utilizing these farm implements so long as village nurseries function as they produce seedlings of not only firewood trees but many others including crop seedlings.

Table 4-36 Future Prospect of Firewood Harvesting by Village

unit: hectare, firewood harvest / participant in 2007: cubic meter

Village	Seedling production 2004	Seedlings survived In 2002~04	Envisaged seedlings 2004~05	Total surviving 2002~05	woodlot area created 2002 ~ 05	agroforestry area created 2002 ~ 05	Total wood lots hect-are/village*	Nursery partici-pants	Harvest/ participants in 2007 (m^3)
Makonokaya	6,100	7,634	4,362	11,996	3.5	0.69	7	31	0.3
Siyamudima	8,200	6,335	5,863	12,198	3.9	0.54	6	48	0.2
Kaumbata	6,050	5,380	4,326	9,706	2.9	0.30	24	21	0.4
Mdala	3,150	5,460	2,252	7,712	1.9	0.53	17	23	0.3
Nanjiwa	7,220	4,882	5,162	10,044	2.2	0.62	19	38	0.2
Chikoja	11,857	14,738	8,478	23,216	5.1	0.76	12	40	0.4
Manjelo	6,986	14,173	4,995	19,168	3.8	0.85	6	49	0.2
Teula	7,343	7,227	5,250	12,477	3.3	0.28	7	29	0.3
Chakana	1,300	2,005	930	2,935	2.1	0.09	4	17	0.4
Lemu	4,060	7,901	2,903	10,804	3.0	0.27	26	23	0.4
M. Ngondo	2,450	4,112	1,752	5,864	1.9	0.38	4	17	0.3
Kammata	10,852	32,758	7,759	40,517	6.5	3.80	9	40	0.5
Kumanda	9,523	12,937	6,809	19,746	3.5	1.50	5	18	0.6
T. Kenji	8,835	12,000	6,317	18,317	5.1	0.81	7	35	0.4
Chilangali	8,840	11,674	6,321	17,995	4.6	0.48	7	21	0.7
D. Mbeza	6,005	7,603	4,294	11,897	2.9	0.53	5	38	0.2
Kamwendo	11,136	9,106	7,962	17,068	3.5	1.37	10	69	0.2
Peter Bilila	3,600	5,437	2,574	8,011	2.0	0.24	4	35	0.2
Ndemanje	7,741	7,828	5,535	13,363	1.4	1.64	4	31	0.1
S. Mpombe	2,051	12,739	1,466	14,205	2.4	1.26	6	26	0.3
Kateya	3,250	4,794	2,324	7,118	3.5	0.17	4	30	0.3
Maluwa	1,682	4,936	1,203	6,139	1.7	0.42	2	12	0.4
Kumponda	5,100	5,590	3,647	9,237	2.3	0.32	4	29	0.2
K.Chigumura	4,624	11,082	3,306	14,388	1.6	1.76	2	22	0.2
T o t a l	147,955	220,337	105,788	324,119	74.6	19.6	201	742	-
Average	6,165	7,634	4,408	4,408	3.1	0.82	8.4	31	0.3

Note: * without grave yard.

(b) Agro-forestry Activities

One of the characteristics of the verified Model is a combination with AF in social forestry activities. Villager's interest in AF practices has increasingly been enhanced in response to study

tours, stimulus by a neighbor AF project (in Michongwe village where two-year term project had been carried out about 5 year's back sponsored by USAID. Still now, half of village population has been practicing AF.) and ardent recommendation by PIU. All villages have created seed-banks of *Gliricidia sepium* and *Tephrosia vogelii*, where more than 700 stands of these varieties began bearing pods and 120 kg of seed, worth MK 102,000 is expected to ripen as self-supplied seed to their nurseries. In 2004, PIU trained villagers to use cuttings from seed-bank trees for direct propagation and direct sowing of *Tephrosia* seed to crop field. These practices will save labor and facilitate the diffusion of AF techniques deeply into rain-fed farming. As long as fever for AF practice continues, villagers won't abandon their village nurseries to raise seedlings of Gliricidia, Sesbania and Leucaena that are also useful for fodder fed to Boer-goats during season of feed scarcity.

(2) Future Prospect of IGA

(a) Goat Rearing

Potential of expanding Boer goat rearing in targeted 20 villages is estimated through grass resources found therein. The estimation is made on the basis of current land use and present production of crop residues and crude grass growing on marshy area (dimba) and grass-land on which goat herds can be pastured or tethered. It gives the maximum number of heads of adult Boer goat (mean of he- and she-goats) assuming live weight of 40kg per head.

Table 4-37 Estimation on Potential Expansion of Boer Goat Rearing

Village	Introduced year	current Head	crop field(ha)	grass land(ha)	crop resi-due (t)	grass feed-ing (t)	total TDN	Capacity max. head	Room for expansion	income/year /participant
Makonokaya	2002	14	54.1	27.9	69.0	209.3	29.4	134	120	2,692
Siyamudima	2003	16	60.6	21.4	77.3	160.5	31.1	141	125	1,838
Kaumbata	2003	19	126.4	37.9	161.2	284.3	63.5	289	270	8,592
Nanjiwa	2003	21	93.6	16.4	119.3	123.0	44.8	204	183	3,353
Chikoja	2003	14	135.4	23.5	172.6	176.3	64.8	295	281	4,604
Manjelo	2003	19	46.5	5.2	59.3	39.0	21.7	99	80	1,260
Teula	2003	19	50.8	25.4	64.8	190.5	27.4	125	106	4,584
Chakana	2003	16	26.6	10.5	33.9	78.8	13.8	63	47	1,709
Lemu	2003	16	244.3	28.0	311.5	210.0	114.3	519	503	19,096
Kammata	2002	43	26.1	16.6	33.3	124.5	14.8	67	24	1,048
Chilangali	2003	24	24.5	4.7	31.2	35.3	11.8	54	30	1,598
D. Mbeza	2003	19	18.0	33.7	23.0	252.8	14.4	65	46	1,073
Kamwendo	2003	16	204.8	59.8	261.1	448.5	102.6	466	450	4,224
Peter Bilila	2003	14	18.0	13.6	23.0	102.0	10.6	48	34	859
Ndemanje	2003	19	47.5	18.7	60.6	140.3	24.7	112	93	2,264
S. Mpombe	2002/03	55	31.0	3.8	39.5	28.5	14.5	66	11	1,589
Kateya	2003	16	1.4	11.6	1.8	87.0	2.8	13	-3	265
Maluwa	2002/03	36	10.4	13.5	13.3	101.3	7.2	33	-3	1,698
Kumponda	2003	25	25.5	5.1	32.5	38.3	12.3	56	31	1,208
K.Chigumura	2003	22	18.0	6.8	23.0	51.0	9.3	42	20	1,202
Total 20 villages		443	1,263.5	384.1	1,611.0	2,880.8	635.9	2,890	2,447	3,238

Note: TDN: total digestable nutrient in ton.. income in Kwacha as of Sept. 2004

Table 4-37 gives the result of estimation analysis, based on the data obtained in the Baseline Survey. The maximum heads of Boer goat herd in 20 villages are estimated over 6 times as much as current herd size, though the heads in some small villages have already reached the maximum capacity of feeding. The maximum income envisaged per nursery participants (as of September 2004) amounts to K 3,238/ year/ participants, equivalent to the local currency value, worth of 50kg of maize flour. However, villagers in 12 out of 20 villages can expect only MK

1,000 – MK 2,000 from goat rearing, implying that they would fail to meet the estimated calorie consumption for currently practiced participatory forestry works.

(b) Marshy land (dimba) irrigation with Treadle Pumps

Currently encountered bottleneck will limit future potential of expansion in irrigable area within 15 beneficiary villages. The major constraint lies in water retention in watershed due mainly to poor vegetative cover. Current out-planting practice will improve retention capacity but a decade ahead, not effective in the nearest future. Three treadle pumps have so far been supplied to a group in a planned village with the maximum lifting capacity of 1.2 liter/ sec. and maximum plot coverage at 1,500 square meter per pump. Potential irrigable acreages are quite limited after individual allocation, and duration (months) of pumping practice is also limited due to scarcity of surface water. Estimated annual net income reaches at most K2,869, somewhat lower than the maximum amount from goat rearing. It follows that treadle pump irrigation alone can barely meet the food requirement of sustainable forestry activities. However, if a village can employ both Boer goat rearing and treadle pump irrigation, the villagers can viably get along with both IGAs and forestry activities.

Table 4-38 Estimation on Potential Expansion of Treadle Pump Irrigation

Village & year	CIA In m^2	Potential IA in m^2	Catchment area in ha	Available Stream	Minimum Flow (l/sec)	Irrigable duration	need of dibble	Max.IA/ participa nt	Max Income /participant*	Total par-ticipants*
Makonokaya 03	2,400	2,100	5,000	Nkokodzi	9.51	365	no	145	3,919	31
Kaumbata 02	2,400	2,100	4,800	Nkokodzi	9.13	365	no	161	4,339	28
Mdala 03	600	1,950	4,800	Nkokodzi	9.13	365	no	196	5,296	13
Chikoja 02	500	1,332	210	Namingomba	0.40	100	yes	37	1,009	49
Manjelo 03	400	1,365	130	Milala	0.25	80	yes	40	1,083	44
Teula 02	100	2,200	180	Milala	0.34	90	yes	105	2,823	22
Lemu 02	2,500	2,000	180	Milala	0.34	90	yes	196	5,283	23
M. Ngondo 03	5,000	-	110	Namingomba	0.21	70	yes	208	5,625	24
Kammata 03	300	1,050	60	Milala	0.11	60	yes	64	1,736	21
Kumanda 02	100	1,100	25	Milala	0.05	40	yes	32	853	38
T. Kenji 03	100	1,100	35	Ntenjela	0.07	50	yes	34	926	35
Chilangali 02	400	1,025	65	Ntenjela	0.12	60	yes	68	1,832	21
Kateya 02	667	1,917	250	Ntenjela	0.48	120	yes	86	2,325	30
Kumponda 02	1,500	999	190	Nasonje	0.36	90	yes	109	2,934	23
K.Chigumula 02	976	1,173	75	Ntenjela	0.14	60	yes	113	3,055	19
Average	748	1,529	-	-	2.04	134	80% yes	106	2,869	18

Note: CIA: currently irrigated area, IA: irrigated area, Max.: maximum, participant(s) those in the groups of treadle pump irrigation.

4.9 The Results of Implemented Technical Transfer

Techniques have been transferred from the Study Team to PIU staffs, then from the staffs to the villager-participants in the target villages. Transfer has been made step-wise especially to the villagers since some of them are illiterate without any basic knowledge on forestry, AF and IGAs. The strategies adopted for technical transfer was already mentioned in Chapter 3. The largest merit of concentrated and systematic technical transfer can be found in villager's capacity building. They have been trained with scientific practices over 2 years by PIU staffs. During this period of technical contact, villagers have learned both manual operations and theory or basal information behind the practical operations. Thus, widened spectrum of their basic knowledge greatly helps them understand systematic intelligence such as crop rotation and rational land use for efficient use of available resources. Of course, supply of inputs to the target groups has allowed them to absorb knowledge and skills through input utilization.

At the same time, PIU staffs foresaw future prospect of austerity livelihood in these villages, and introduced relevant skills so that villagers don't have to cling to outer material supply, but exploit means of self-help such as pursuit of domestic procurement of seed without resorting to purchase from outside. Only if trained villagers remember and actually practice what they have learnt, they will be able to develop their own villages without relying help from outside. This does not mean that no additional help is any more necessary for them to get along with, but implies that they can manage at least already established system of tree planting, AF practices and IGAs. Table 4-39 summarizes overall evaluation of technical transfer from PIU to target villagers, including year-wise contents of technical capacity building and transfer.

Table 4-39 Evaluation of Technical Transfer from Villager's Capacity Building

expertise	workshop	training course	study/ inter-location tours	demonstrations in the nurseries/sites	site/ field works
Forestry	villagers can manage site operations of participants with sustainable attendance	villagers can make use of supplied inputs efficiently for the purpose of reforestation and homestead planting, stream-side planting self supply of seed	villagers experience various ways of resource utilization and techniques of raising seedlings and tending them, woodlot creation, thinning, coppicing	seed treatment, land preparation, pot filling and soil/ manure preparation, sowing, weeding, shading, watering, pruning, hardening, pest/disease control	selecting planting sites, clearing, dibble digging, dry-season planting, provision of basin, termite measures, weeding, fire breaker, inter-planting, seed bank
Agro-forestry	concept of AF, series of practices	theory and soil nutrient balances, use of AF species, direct field sowing	actual practices and benefits/ effects of practices, coppicing and green-manuring	seed treatments and sowing, transplant-ing, use of cuttings, field out-planting	management of seed banks, cutting multiplication, regeneration
IGA (apiary)	estimation of nectar sources	use of bee-suits and smoke-blower,	suspension of bee-hives, monitoring	filtering of collected honey	control of predators
IGA (Boergoat)	estimating base of feeding, ration	mating, tethering, fluke, parasite control	kid weaning, post delivery feeding,	construction of huts, detoxification	pasturing, tick control
IGA (treadle pump)	estimation of water requirement, soil conservation	preparation of Changu manure, repairing of pumps	excavation of water channels, water distribution	vegetable rotation, pest/disease control, nematode control	maintenance of pumps, soil improve-ment, marketing
IGA (others)	design of improved stove, significance	installment of improved stoves	production and propa-gation of sweet potato	cooking comparison with traditional ones	collection of install-ation material

PIU staffs were mostly responsible for technical transfer to the villagers, but some other lecturers and technical experts also joined to strengthen practical capacity in the field of goat rearing, apiary and sweet potato production/storage. A comprehensive technical transfer manual with pictures, provided by PIU staffs, was used for explanation to the villagers.

As described in the Baseline survey, villagers had not benefited from current extension system but Pilot activities enabled them to get ample benefits from extension services, including input supply of high-yielding and drought resistant varieties of trees and sweet potatoes. Technical transfer accelerated diffusion of improved fireplaces, new sweet potato varieties, propagation of Boer goats, practice of marker ridges and box hills and manure preparation. Although effect of technical transfer is not tangible, it could motivate at least over 1,000 nursery participants to be involved in effective capacity building. If these capacity-built participants can serve as core promoters of Pilot activities, the introduced activities can vertically be expanded deeper into the rest parts of the target villages until most villagers are involved in the existing activities.

4.10 Financial Justification of the Study

There are many alternatives on where to disburse the budget of assistance. In this context, the reasonability of disbursing it to participatory activities by target villagers through the assistance of extension staffs can be judged by the comparison among conceivable alternatives. Here, the

following three alternatives can be evaluated for the justification of disbursement to inputs including those for establishing nurseries, out-planting, AF practices and IGAs (in the form of allowances paid to PIU staffs, cost of transporting the staffs, cost of purchasing inputs to be distributed among the village participants). In this connection, the total cost of the Study should not be dealt with since measures for environmental conservation can hardly be evaluated with cost-benefit analysis on account including intangible benefit from global aspects.

The following alternative analyses are carried out here for comparison:

1) Methods and results of evaluating aftermath of without-Study

Supposing that no countermeasures would be taken for escalating deterioration of forests in the Study Area, then energy for daily living would completely be depleted within two decades to come. It follows that substitute energy should inevitably be brought in for the inhabitants to sustain their life. Two alternatives are conceivable to procure energy, i.e., rural electrification and use of paraffin for cooking and heating living space. In both cases, electrification or substitution of lost firewood by paraffin is planned in a phased way, offsetting dwindling forests with substituted energy. Rural electrification has virtually been made in a long time span to cover a wide area because it takes many years to extend grid networks. The calculation showed that the hypothetically incurred (shadow) cost for introducing and applying substitutable energy outweighed the examined cost of the Study. So, the part of the Study cost directly spent for input procurement has been justified by the estimation of shadow cost for energy replacement. In this context, substitution briquettes may be the cheapest way, but not realistic since their material, living waste is not much available in either Blantyre-Limbe or the Study area. The above-mentioned substitution was already discussed with Mr. L Bauleni, representative of ESCOM who was a member of the Steering Committee of the M/P in 2001.

2) Financial evaluation of the obtained benefits and envisaged plan in this Study

Internal rate of return and cost benefit ratio were estimated on the basis of the routine financial analysis and the Study was evaluated with positive outcome though it showed low return as expected in common cases of activities for forestry and land rehabilitation.

3) Finally, what village participants had achieved in their activities was compared with a hypothetical alternative, in which purchase of inputs and material were supposedly contracted to contractors, planting was also entrusted to contractors and training of villagers was again sub-contracted to local NGOs. The result of comparison showed little cost advantage for the actual activities as compared to the cost of the hypothetical alternative. However, the difference may arise from intangible aspect of the activities. Villager participants in the Pilot Study learned importance of environmental rehabilitation through their toilsome activities, whereas willingness of villagers or their positive, challenging attitude towards environmental rehabilitation would never be born out from an atmosphere where everything was carried out through contractors, only receiving ready-made objects and built-in systems from donors. The above-mentioned results are summarized in Table 4-40.

Table 4-40 Results of Financial Analysis Including Hypothetical Alternatives

1) Methods and results of evaluating aftermath of without-Study

(Unit: ,000 US$)

Case	Electrification	Paraffin
Period	20 years	20 years
Situation assumed in the flow	Rural electrification were implemented, if no pilot activities of the Study	Paraffin were used, if no pilot activities of the Study
Total Cost without-Study Situation = Collateral Benefit	1,084	5,649
Cost with-Study Situation*	484	484
B/C (at 5%**)	1.5	7.3
FIRR	10%	29%

Note * = Cost spent 2002-04 = 436
Assumed cost to be spent by the government 2005-30 = 48
Hence, total cost with-Study situation in 20 years = 484
** = at 5% : Discount rate

2) Financial Evaluation of the Study itself and 3) a Hypothetical Alternative

(Unit: ,000 US$)

Case	The Study	Hypothetical Alternative*
Period	20 years	20 years
Situation assumed in the flow	Pilot activities by a participatory approach using wood as energy source	Instead of mobilizing PIU and participants, all works are constracted to suppliers and NGOs
Whole Cost** of the Study /Alternative	1,523	1,550
Cost with-Study Situation	484	-
Benefit accrued from with-Study situation	714 (tangible benefit only)	-
B/C (at 2%**)	1.2	-
FIRR	4%	-

Note * = In case all the activites in the Study was implemented by contractors.
** = Cost for with-Study situation consists of pilot project costs and assumed expediture by the government at post-pilot project, while whole cost of the Study included all the costs including Japanese consultants renumeration etc.

Chapter 5 Revised Village Natural Resources Management Plan (VNRMP) in and around the Study Area

5.1 Constraints and Impetus of Forestry and Agro-Forestry Development

There are a number of constraints that inhibit development of social forestry and AF activities in rural media. They are classified into endogenous and exogenous ones, by the origin of causes as shown in Table 5-1. Besides, there exists some impetus that can foster activities of social forestry, and here these two influencing factors are dealt together.

Table 5-1 Classification of Constraints and Impetus on Social Forestry

division	endogenous constraints		exogenous constraints	
Social dimension	ignorance	inertia	social distrust	usurpation/ monopoly, misgovernance
			co-existence of paid works, food for work	prevalence of contagious diseases
Environmental dimension	lack / scarcity of resources	topographic, pedologic conditions	climatic conditions	
Technical dimension	lack of forestry techniques		low availability of extension services	
	endogenous impetus		exogenous impetus	
Socio-economic dimension		need for self-supplying natural drugs	offering forestry projects by NGO etc.	strong demand for urban fuel material
Environmental dimension	dwindling sources of village fuelwood			

In the above-tabulated constraints, such endogenous nature as villager's laziness and inertia can more easily be handled than exogenous one because only villager's willingness or effort is required to rectify them. However, inertia doesn't only originate from villager's laziness, but also is partly attributable to malnutrition. Hunger constitutes the most influential inhibitor. Recently, MOA attached importance to food security because rural population has ever more been threatened by famine. Stakeholders of forestry activities cannot be indifferent of such grave recent trend of rapidly developing food shortage, for it is hunger-stricken villagers who should raise and out-plant seedlings. Then, how much additional calorie does an out-planter consume for planting 100 seedlings per year? A participant who participates in nursery management and out-planting may annually consume energy as shown in Table 5-2. As exogenously originated ones inclusive of contagious diseases and climatic vagaries are beyond villager's control, measures to cope therewith need threshold chances by the help of assisting entities.

In many cases, there exist many vulnerable strata in a village like ethnic minorities and lately joined households who often fail to join any projects when they are launched. Such out-caste people also have to consume firewood everyday, or to get inevitably involved in environmental destruction and theft cases. This is the reason why environmental activity should involve all strata of the villagers, including such vulnerable ones to avoid discrimination of participation. In order to maintain the participation of the villagers in these activities in a sustainable way, it would be indispensable to support the groups that can realize equitable share of benefit and labor burden as mentioned above. Since small villages often suffer from lack of water sources to singly maintain village nurseries, joint management of village nursery by several villages should be considered to make the participation and management more sustainable.

Among the activities developed in the Pilot Study, forestry works require high physical energy (2,500 kilocalorie per person / day) equivalent to 24kg of cereal or MK 1,700 per annum,

accounting for 20% of annual per capita consumption in a drought year, which has been met in hitherto implemented assistance project. It means that IGA allocated to this participant should annually transfer 24kg of maize flour, equivalent to MK 1,700. Judging from food availability during famine period, a villager should maintain his/her body with only 1,500 kcal or less (137 kg of maize). If the total 298 hours of forestry work is converted into working days, it comes to 37 days, during which the participant needs 2,500 kcal/ day. Then, the participant should spend a day with only 1,387 kcal for the rest 328 days if no additional food is available to him/her. In the Pilot Study, this requirement has been covered by IGAs. Through this trial, any compensatory measures have proved to serve as an incentive towards the participants in forestry and environmental conservatory activities. AF has also similar effect of giving incentive, but it takes fairly long period until effect is manifested.

Such substantial impact of additional forestry labor to villager's daily life is the main reason why this report adheres to nutritional bearing. For this reason, MASAF and other supporting agencies has provided them with food for work or paid public work even the result of participatory work would be imputed to the communities the participants belong to. In the verified Model, coupled IGAs are expected to play a role of food supply or wage payment. As cited above, forestry works do include heavy labor of nursery preparation, land clearance, dibble digging and watering during pre-rainy and rainy season or most hungry season. Therefore, if only one or few families challenge forestry works, they sooner or later become burdensome in doing too many practices by limited participants. However, if many households send participants who share divided series of works, they can manage to cover all the necessary works to fulfill the targets and this yields an advantage of growing solidarity. In order to arrange such participatory procedures or commitments, villagers must be sensitized, motivated, enlightened and organized. There should intervene organizing assistants, workshop facilitators to persuade village cadres and villagers for their voluntary participation in forestry activities.

Table 5-2 Estimated Annual Ration Rate of a Participant for Forestry Works

kind of works	nursery works	land clearing works	dibble digging and out-planting works	Total requirement of calories/ foods
Calculation based on working hours				
cumulative hours	171	43	84	298
equivalent days	21.4	5.4	10.5	37.3
calorie consumed	53,400	13,400	26,300	93,100
equivalent maize	13.4	3.4	6.6	23.3
equivalent value MK				1,630
Calculation based on earth/ water carriage				
quantity of work	17.1	4.5	14.1	35.7
equiv. to ton-meter	227.4	59.9	141.3	428.6
conversion into KJ	54.3	14.3	33.8	102.4
conversion into KC	13.3	3.5	8.2	25.0
equivalent value MK				1,748

In this context of participatory planning, constraints may arise from difficulty in finding original threshold and means on how to make the target population disposed of starting forestry activities. In rural media, there is no doubt that every household is always seeking for job opportunities around it, because a family can hardly get along with its own crop harvest that cannot meet annual food consumption within it. If some chances of getting involved in public paid works or food for work are brought to a village, villagers will rush into the offered public works without regarding their vocation, responsibility and division of works. However, such windfall chances, mostly consisting of donor-sponsored road construction, well drilling and reforestation over government owned land, seldom occur their villages and if any, lasting only a

few months. The purpose of organizing a participatory activity is placed on an aggressive exploitation by self-help instead of only relying on such donor-driven luck of chances.

Many villages have once accepted invitation to such unpaid participatory schemes from NGOs and other assistance agencies/ organizations, but many participants have also bitter experiences since benefits from participatory activities had not equitably been distributed and finally only one or few of them could enjoy substantial benefits from the proposed scheme. Thus, multitude of the participants only participated in the schemes without any remuneration, where disappointment, disbelief of village cadres and physical fatigue left behind. When similar scheme is again proposed to the village, very few villagers fall in temptation but majority is wary of the proposal because they remember past lessons. Though villagers can believe the visiting organizations but they can hardly trust other well-off villagers who may again betray their expectations. Thus, only mutual belief and subsequent rigid solidarity can facilitate and sustain participatory approaches by village.

Likewise, attitude of village chiefs and cadres toward governance of the community plays key role in launching and sustaining of participatory activities, as revealed in the analysis. If they fail equal treatment for all the participants, many dropouts will follow even though the initial participants are satisfactorily recruited. In some cases, biased favor to particular people like chief's clan will induce jealousy of other participants, often ending up in outbreak of dreadful theft damages. In particular, in the case of coupled Model of social forestry with IGAs, equal participation of the participants both in forestry works and IGAs constitutes prerequisite for leading it to a success. Here, participants require convincing way of allotting IGAs to individual participants, and so long as the equitable treatment continues, they can support the Model in a sustainable manner.

Just as land held by a household has been too much divided into small parcels, so splitting of an original village into a number of small villages has posed a common social issue. This trend of fractionation now coincides with prevalence of HIVS where many orphanage households have resulted. In some small sized villages difficulty arises from measures on how to procure and maintain enough participants in forestry activities. Small villages have very limited grass resources to weave grass mats for fencing and cover shade for their nursery, narrow land for providing nursery space, and quite often suffering from access to water sources. In such exceptional cases, joint management of village nursery by several villages will make the participation and management more sustainable because land available to tree planting is also limited in a village alone and all the demand can be raised within one or two years.

In the light of limited land area in some of the villages, it is not realistic to establish village forest in all the villages to supply firewood to all the households therein. Instead, it may be rational to distribute nursery-raised seedlings to individual participants, thereby expecting individual self-supply of firewood (from land use point of view, tree planting space is estimated at 0.2 ha per household on average in the Study Area, and if the whole space is planted with firewood trees, the envisaged firewood supply at maturity of wood will reach 70% of annual household firewood requirement, but with subsidiary fuel including such crop residue and dried grass as the villagers currently use, the envisaged amount will suffice their need).

AF provides part of the solution to self-sufficiency of firewood in these narrow spaced villages where procurement of space for creating village forestry is not realistic. Every 3~5 years farmers practicing AF would pull out manure trees for regeneration, where yield of debris per hectare is estimated at $2m^3$ or 1.2 m^3 per household (average holding size measures 0.6ha per household), or almost sufficient for meeting annual requirement by a household.

In most cases, very steep slope and rocky land have left unused. The reason why such land remains unplanted lies in hard work required for planting because of high stone content in the soils and difficulty in land clearing. However, such wasted land acutely requires soil

conservation because runoff is accelerated in proportion with steepness, washing out huge amount of soil. Therefore, villages have to establish plans to reforest wasted land with nursery-raised seedlings. Besides need for land husbandry, planting trees on steep or rocky land is also desirable from the standpoint of utilizing underused land resources and of expanding base of firewood supply, although it is too wearisome to plant trees over steep surface.

Escalated drying of climate has posed a serious issue affecting survival of out-planted seedlings particularly in the villages where soils with low water retention, derived from granite and gneiss are widely distributed. If drying trend of climate lingers for a long period, adverse effect will not be confined to survival, but growth of planted trees would seriously be affected. In fact, a forestry researcher has observed a transitional change in composition of tree species for the past decade in Soche forest reserve located at 7 km south of the Study Area, in the form of decline in humidity preferring indigenous species versus rising of drought tolerant ones. For example, the former including *Uapaca kirkiana, Parinari curatelifolia, Ficus sikamorus* and *Rauvolfia caffra* (all of these bear edible fruits) tend to decrease, meanwhile *Diospyros lycioides* and *Ziziphus mauritiana* (also edible fruit species) tend to increase. In the Study area, inhabitants recognized expansion of dryland species including *Steculia quinqueloba, Phoenix relinata, Combretum molle, C. imbebe, Lonchocarpus capassa, Pseudolachnostilis condylocarpon* and *Adansonia digitata* accompanied by rapid or fatal recession of stocking with *Colophospermum mopane, Pterocarpus angolensis, P. rotundifolia, Brachystegia boehmii, B. spiciformis* and *Vanguelia infausta*. To cope with drying trend, drought tolerant species, as identified in the analysis, have to be selected as planting material taking account of the conditions of the sites of out-planting.

As to lack of forestry techniques, deployment of extension staffs can easily solve this issue though means of transportation are indispensable to mobilize them frequently to the villages. Limited official budget to provide material of extension also constitutes a constraint since at times staffs must use utensils, equipment and other teaching material for their extension activities in the villages. Usually, an extension worker covers several hundreds of villages and he/she visits a village under his/her jurisdiction only once or twice a year. Many of them live in urban areas and seldom visit their service area due to lack of transportation. Under such circumstances, one can expect very little for efficient performance of extension services unless extension staff lives near the villages in their service areas. As villagers have been engaged in traditional sedentary farming for a long time, they don't have to expect much on extension activities and their services only evoke dull response that makes extension staffs discouraging frequent visits.

Thus, extension services tend to be concentrated on few farmers with enough land or excellent production performances, without contributing much to elevate overall level of farming skills among farmers at large. As adhesion of extension staffs with well-off farmers grows, poorer strata eventually fail to contact with extension media, remaining in primitive level of farming or left behind of any technical renovation. However, if extension staffs happens to be mobilized into particular campaign or scheme, there would be no room to indulge in such adhesion and chance of equitable extension services to all strata would result. A mysterious point in this connection arises from the behavior of majority of the villagers who observe the technical success of well-off, progressive farmers but never try to follow these successful examples.

This constitutes decisive difference between farmers in Blantyre District and those in other areas. Such difference stems from various conceivable causes, but the largest one may stay in easy resignation without any patience. On the other hand, out-migrated laborers originating from Malawi to Zimbabwe, Zambia and Republic of South Africa used to have been welcomed for their toilsome, patient nature. This contrast most probably originates from difference in nutritional conditions, because lingering hunger spoils not only physical strength but also gives damage to spiritual perseverance. During famine period, theft of goats rapidly increased in the Study Area, partly because lack of patience often gives rise to theft, the most energy-saving way

of getting rid of hunger. Such critical behavior was also identified in the Baseline Survey conducted in 2002. The strategy of establishing core-farmers to facilitate technical diffusion (in order to dispense concentrated mobilization of extension staffs) is thus skeptical in this respect.

In order to provide an effective strategy for promoting social forestry, dimension of impetus should be taken into account along with the measures against current constraints. Current deficit of firewood resources drives housewives who have to fetch firewood into possible measures to cope therewith. This is the main reason why more housewives participate in nursery activities, because husbands and men rarely have to carry head-load of firewood. Suppose a woman who has to walk half a day to and fro to fetch firewood is solicited to join a participatory activity for producing firewood near her house. She would easily be tempted in the participation to save her time and energy. It follows that if one wants to establish forestry activities in the village level, it'll be the best way to appeal to women in the target villages rather than contacting with male villagers. In this way, consideration on gender has close relation with division of work in Malawi. Especially, raising seedlings in nurseries constitutes simple, boring works but requiring patience, and women seem more suitable than men to undertake such type of works.

Another reason that implies suitability of women to nursery works resides in acute need of natural drug for curing diseases of children and ladies, because most of them cannot afford to go to hospital nor buy medicines and no doctor is available in their villages. They used to take such natural drugs of plant roots, barks, leaves and fruits of indigenous trees and insects, but nowadays such resources deplete to a critical extent. When babies and children suffer from diarrhea, malaria and influenza, parents need first-aid drug extracted from natural herbs and tree drugs. For this purpose, *Senna (Cassia) siamea, Azadirachta indica, Afzelia quanzensis, Bauhinia petersiana, Tamarindus indica, Sesbania grandiflora, Cinchona ledgeliana* etc. are used and seedlings have been raised in nurseries in most of target villages in 2002~2004.

Short-term, single projects for reforestation have been offered from NGOs, private enterprises and international institutes in and around the Study Area in the past decades though no record, nor report remains. In most cases, the offered villagers accepted them and took part in forestry works. The fruits of these projects can nowadays be observed as planted lots in the implemented villages, but practices once introduced have been terminated for various reasons: for example, the plan had limited period of implementation and no inputs supplied after phasing out, the participants did not feel necessity of sustaining the activity, or they were instructed only to maintain what had been created during the project period. Rarely, the former participants still continue the instructed practices long after phasing out of the projects. In this case, the chiefs are wise enough to recognize merit of sustaining the activities, and the former participants still keep on what they have learnt and acquired during the implementation period.

Finally, high demand kept in urban center for fuel-wood and charcoal provides deep-rooted impetus among the villagers because old villagers still remember marketing of these forestry products from their villages to highly demanding areas, though their resources for sale expired. Major supply sources of firewood and charcoal have been shifted to remote areas locating at 40 kilo-meter or farther from urban center, but some people in the Study Area still continue to produce charcoal for sale. This fact implies that villagers dream to sell forestry products for earning never fades away with time elapsed.

5.2 The Appropriate Implementation System for Realizing VNRMP

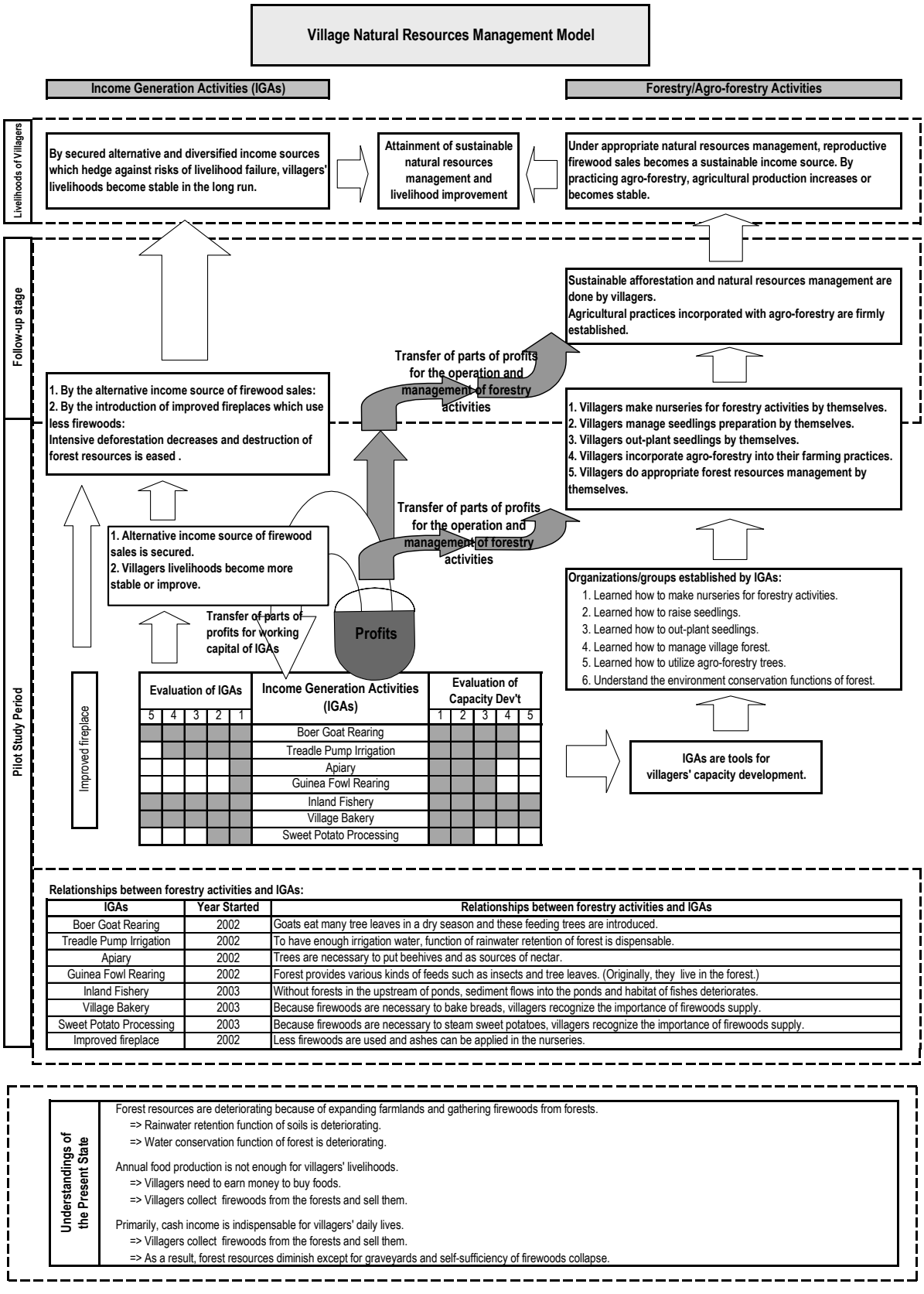
5.2.1 Concept of the Structure of VNRMP

As mentioned above, the envisaged objectives or goals of environmental conservation and desirable management of natural resources are attained through the coupled model of forestry and AF activities with IGAs. The concept of how to gear these two components constitutes an

important tool to implement VNRMP. A time sequential model is displayed in Fig.5-2 where intermittent transfer of the benefit is made from IGA sector to environment activities, though actually all the benefits are consumed as supplemental foods and improved physical strength can lead villagers to sustainable participation in forestry and AF activities.

Villages should take initiative of formulating and implementing VNRMP that includes major activities of conserving and rehabilitating natural resources through reforestation etc. With a view to performing these activities in a participatory approach amalgamation of reforestation and IGAs is required. These coupled activities can yield positive interactions to make reforestation sustainable. To smoothly realize the plan, supporting Government organizational framework, ranging from central ministries to local government agencies, plays key role in closer link with autonomous administrative entities. The supporting framework should assist them by making current status and desires of the target villages clear so that relevant technical transfer and effective input supply can be applied to meet the needs, thus disseminating the planned activities into the entire targeted areas.

Figure 5-1 Concept of VNRMP



Relationships between forestry activities and IGAs:

IGAs	Year Started	Relationships between forestry activities and IGAs
Boer Goat Rearing	2002	Goats eat many tree leaves in a dry season and these feeding trees are introduced.
Treadle Pump Irrigation	2002	To have enough irrigation water, function of rainwater retention of forest is dispensable.
Apiary	2002	Trees are necessary to put beehives and as sources of nectar.
Guinea Fowl Rearing	2002	Forest provides various kinds of feeds such as insects and tree leaves. (Originally, they live in the forest.)
Inland Fishery	2003	Without forests in the upstream of ponds, sediment flows into the ponds and habitat of fishes deteriorates.
Village Bakery	2003	Because firewoods are necessary to bake breads, villagers recognize the importance of firewoods supply.
Sweet Potato Processing	2003	Because firewoods are necessary to steam sweet potatoes, villagers recognize the importance of firewoods supply.
Improved fireplace	2002	Less firewoods are used and ashes can be applied in the nurseries.

Understandings of the Present State

Forest resources are deteriorating because of expanding farmlands and gathering firewoods from forests.
=> Rainwater retention function of soils is deteriorating.
=> Water conservation function of forest is deteriorating.

Annual food production is not enough for villagers' livelihoods.
=> Villagers need to earn money to buy foods.
=> Villagers collect firewoods from the forests and sell them.

Primarily, cash income is indispensable for villagers' daily lives.
=> Villagers collect firewoods from the forests and sell them.
=> As a result, forest resources diminish except for graveyards and self-sufficiency of firewoods collapse.

5.2.2 Extension Tactics

The Ministry of Mines, Natural Resources and Environment has promoted the villagers' efforts of proper management of natural resources in their villages for the sake of conserving and rehabilitating village environment. In promoting works planned in VNRMP in a voluntary participation a campaign is needed to facilitate villager's participation. Since systematized and well-organized villager's association has the key to success, it would be difficult to promote the planning and implementation of VNRMP unless supporting framework urges cadres of target villages to strengthen existing village organizations. It is also difficult to involve the whole village population in newly launched activities of VNRMP from the beginning, especially in larger villages, though thorough involvement of villagers in the plans is a final goal. Along with above cited support it is necessary for extension staffs and NGOs to have a catalytic function so that villagers are oriented to make voluntary efforts towards VNRMP. Most villages have existing committees but additional leverage is required to vitalize them as a carrier of VNRMP, while it is necessary for supporting framework to establish a group for extension campaign. It would be a strategic alternative to begin with an approach to demand-supply linkage, necessarily involving those who have been engaged in such illegal conduct as charcoal burning. Pilot activities have suffered from a number of theft damages leading to loss of village assets, thereby villager's willingness to participate in Pilot activities have been eroded. This suggests acute necessity of employing self-help security means as a component of VNRMP to be organized by male villagers as already observed in the villages around the Study Area. Through the alert and vigilance of this group, not only village resources but also assets of IGAs can be protected. If this is proposed in VNRMP, those who have bitter experiences of theft damages can be mobilized as participants in VNRMP.

However, the issue arises from the need of materializing such initiative into an organized action. At least, a catalytic assistance from outside the villages is essential to lead them to form a village-wise group to manage and enrich village resources. The undertakers of the assistance may be NGOs, consultative fora consisting of relevant government offices and local agencies of international organizations and donors. They should have concrete vision as to what must be done for the rehabilitation of natural resources / environment and how to mobilize villagers to take conservation measures, based on which they should contact with village chiefs and cadres to decide initiation procedures of assisting villagers to organize or vitalize a group for effective management activities of village natural resources / environment.

It is not always necessary to establish a new organization to initiate this management, because in most villages development committees have already been established and this can function as a promoter of VNRM activities. Prior to launching a verification model it had better to identify current activities and level of knowledge / ability of the committee members. In many cases, just adding sub-committee(s) to currently existing organization is enough to start the planned activities. In common, most village development committees are inert on account of lack of activity, resources and their own idea for development or management. Such misconduct as poaching, random felling and theft has been connived as routine deed in the villages in a struggle with sustaining life, while villagers' minds have been occupied by tomorrow's food rather than the destination of future natural resources. VNRMP is surely necessary for managing resources, but providing and applying the rule and making villagers observe what they have decided are practically not so easy, and in real life very few villagers know what VNRMP is. In reality, the villagers who are acquainted with VNRMP sometimes burn charcoal for sale in brick-kilns for sustaining livelihood, perhaps feeling the qualms of guilty conscience.

However, such contradiction does not at all spoil importance of VNRM concept, on the contrary many villagers began worrying about disappearance of shrubs in their villages after felling and selling out all tree stands. Such anxiety constitutes only passive part of resource management. If they find out aggressive part, i.e., efficient utilization of village resources for IGAs, many

villagers would be disposed of joining in resource management. In other words, VNRMP can not only take a step to mitigate drought damages, but also open a new step for developing IGAs.

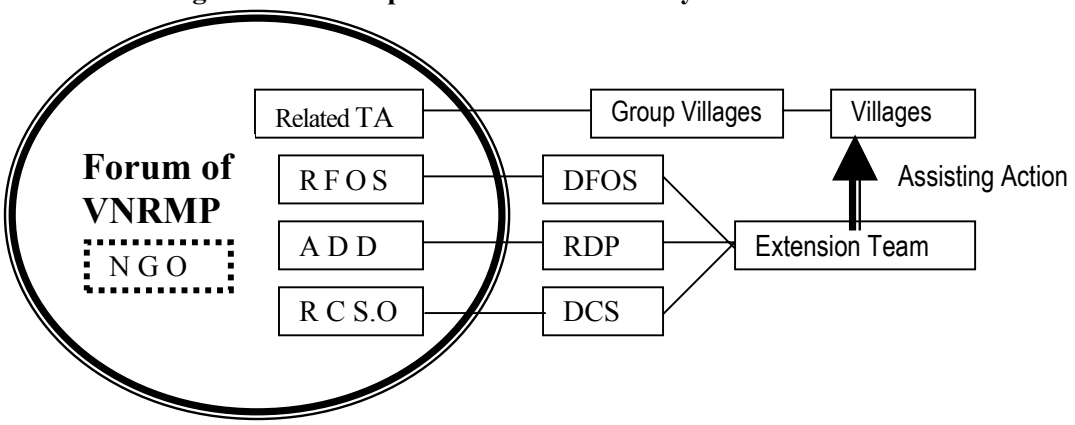
The verified Model including both forestry and AF activities so as to cover as wide area as possible for planting trees will serve as a useful example to solicit, foster and finally evoke target villager's interest and intention to tackle rehabilitation of their environment. Anyway, how to seize villager's mind would occupy focal point to bring VNRMP into target villages, but if the team directly recommends them to introduce pure forestry activities, it may end up in disappointing results because villagers with life expectancy of less than 30~40 years tend to keep at a distance towards the activities that takes a long time to accomplish. What allures them is not a healthy environment likely to come a decade ahead, but more realistic, currently available means of income and food. Villagers are more easily motivated through proposal of easy IGAs and fast-maturing AF mixed with original target of social forestry activities. Based upon the results of analysis mentioned in Chapter 4.5 and above discussion on constraints and impetus, the following system is extracted from the results and proposed. The focal point of the proposed system envisages one that allows rational and desirable restoration and management of natural resources available (but sometimes at the fringe of extinction) in the villages.

Firstly, any sustainable approach to environmental conservation needs an action of wide coverage. In the past, many small-scale trials of conservation were sporadically launched where reforested woodlots were created, but these scattered and sparse performances have been masked with overwhelming idle communities without any effort towards conservation. In some cases, created woodlots have been exposed to poaching or theft, committed by outsiders living in surrounding villages. With a view to preventing villagers from such tragic outcomes, it is imperative to launch schemes/measures for conservation simultaneously in a substantially large area, desirably covering the whole watershed of a tributary or some tributaries.

Secondly, hitherto Pilot activities suffered from a number of theft damages in goat rearing, irrigation with treadle pumps and nursery implements. This suggests acute necessity of self-help security means to be organized under influential leadership of village cadres. It is also desirable to involve TA within the beneficiary of schemes/measures for conservation so that TA himself/ herself contributes thereto, because TA is responsible for juridical decisions, security control and maintenance of equitable governance over the whole territory of the TA. On the other hand, many villagers connive in, as recorded in the Baseline Survey, that theft provides the poor with important means to survive, as the last resort to relieve hunger. If this is commonly prevalent idea among villagers, it may not be absolutely necessary to take rigid preventive means in any action proposal, though in this case generosity would put spurs to environmental aggravation as a result of rampant poaching of trees.

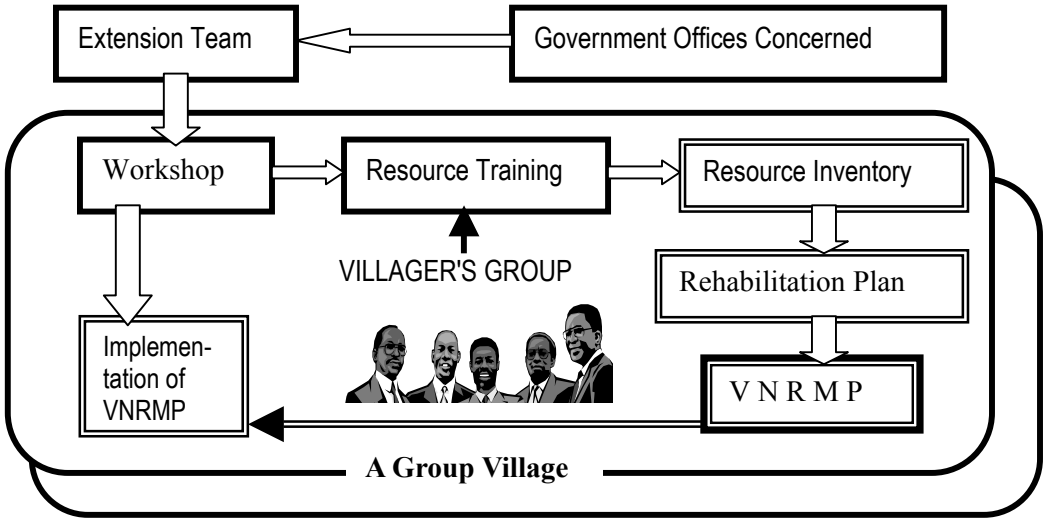
Thirdly, a sustainable system for implementing measures/ schemes of environment conservation requires a long-term technical supporting by extension services. It means that relevant regional or district offices have to arrange systematic or concentrated technical and input-supply services for the implementers most probably at the sacrifice of the rest beneficiaries of the services, since such assistance should be made within the capacity of already assigned extension staffs and budget for transport. In order to procure required extension services in a sustainable manner, a regular forum of communication among stakeholders should be organized where concrete plans and schedules of activities included in the scheme are formulated so that the participating offices can cooperate with the provisions of related services.

Figure 5-2 Conceptual Structure of the System of VNMRP



Taking account of these three key points mentioned above, the structure in the system of promoting Village Natural Resources Management Plan (hereinafter referred to as VNRMP) is illustrated as Fig. 5-2. The procedure to be followed in formulating VNRMP is displayed below in Fig 5-3. Government offices at the regional level consisting of natural resources sector (regional forestry office south), agricultural sector (Blantyre agricultural development division) and gender and community service sector (Blantyre regional community service office) organize an extension team comprising extension staffs at district and area level. The team visits group villages in a TA where workshops for sensitizing and enlightening village committee members of the villages under the visited group village are held and resource training is provided so that committee members can do resource inventory for each village to be used for formulating VNRMP of individual villages.

Figure 5-3 Conceptual Procedure of the Formulation of VNMRP



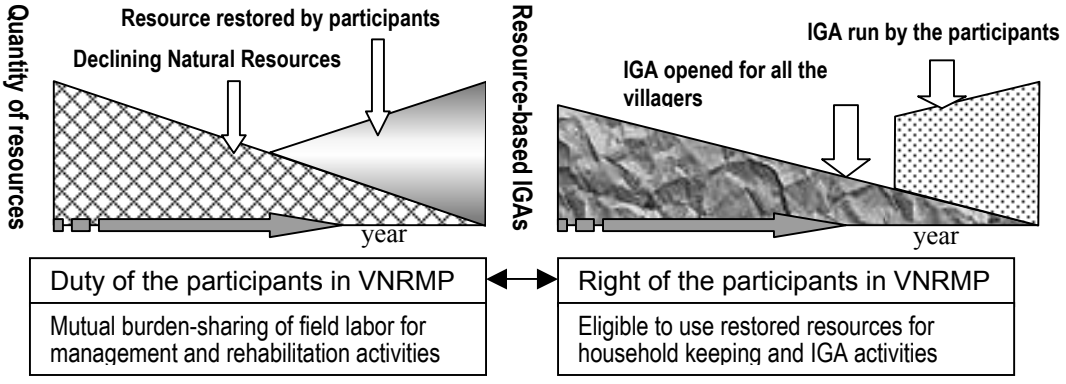
Based on the resource inventory, villager's group of each village under the visited group village establishes village resources rehabilitation plan and then VNRMP. The group convenes meetings in the village committee to elaborate an implementation schedule and the extension team gives pertinent advice on VNRMP and implementation schedule. Government offices

concerned will examine the established VNRMP and the schedule, thereby providing assistance for delivery of input material to the villages that have established VNRMPs.

Here, the villages can employ a participatory approach for the implementation of VNRMP, as already recommended by the Department of Forestry in 1999 in the "Guideline of VNRMP". The main reasons why participatory activities are suitable form of managing village natural resources are found in the fact that they constitute major part of common village property that should be offered equally to all the villagers. This property is too big and precious to be managed by single or a few individual villagers. Also, all the villagers should share the burden of proper management and rehabilitation of such public asset for him/herself and coming generations. Furthermore, the participants in their proper management are eligible for utilizing them in their IGA activities. Thus, reasonable burden sharing through participation will never fail to bring about equitable benefit sharing later on. A precondition of applying a participatory way of development to conserve public resources, it should always be kept in mind that participation is open to every villager without any discrimination. If all the villagers in a village desire to join in a proposed environmental conservation, the group of implementers should include all of voluntary village households and provide them with appropriate tasks in conformity with concept of division of works through relevant decision-making process such as debates and polls in village committees.

At the same time, equitable chance of involvement into provided IGAs should be given to all the participants through similar way of decision-making where their opinions and claims are put into consideration. In case of villages with vast surface area, the decision makers including development committees can establish a rational block-wise division, for example inhabitants living in the location far from nursery are to cooperate in the provision of fencing and shading material and clearing or out-planting works while those living in the area near village nursery are to be engaged in raising seedlings therein. Success in such type of inter-area cooperation requires a strong unity or wide-ranged solidarity among villagers, otherwise difficulty arises from making all the participants keep pace with what has initially been planned. Relationship between right and duty of the participants is illustrated in Figure 5-4.

Figure 5-4 Relationship between Right and Duty of the Participants in VNMRP



Regarding responsibility of the extension team, it should urge TA to consummate monitoring function by providing them with training courses so that TA staffs can cater for the group villages and their member villages in establishing and implementing VNRMPs. Also, the team has to timely disseminate information on the actual cases of the implementation into TA and implementing villages as it can serve as a useful tool or references to facilitate, rectify and review implementing performances of the Plans. Moreover, it is responsible for supplying inputs to the implementing villages as MOA has so far done including free of charge

distribution of crop and agro-forestry seed, starter packs etc. to promote participation and performances of the villagers concerned on resurrection and proper management of resources.

Existing input assistance systems including starter-pack distribution, on-going loan schemes for farmers to buy treadle-pumps, MASAF activities should be preferentially applied to the newly developing areas as a self-help action of GOM for further sustainable development of what has been verified in this Study, aiming at starting IGAs to be coupled with forestry/ AF practices.

5.3 Review on the Training of Extension Techniques and Improvement in Village Organizations:

During the Pilot Study, the Study Team and PIU staffs exchanged views, means and strategies concerning rehabilitation of deteriorated, devastated and critical environment, identifying a lot of gray-areas that need further review, analysis and findings to establish and recommend concrete methods to be applied to. Even Ministries, offices, research institutes and extension headquarters do not have enough basic information on how to cope with accelerated degradation of natural environment, accelerated adverse effect of climatic changes towards desertification. Fortunately, the Pilot activities could have brought some input contribution to such unknown areas, for example knowledge on survival data by species, by rainfall and by planting technique.

What are acutely required at present include feeding of contemporary techniques and findings to the extension staffs in charge of VNRMPs and environmental conservation works, compilation and exchange of related data among stakeholders, provision of regular courses for in-service training for extension staffs to brush-up their instruction capacities, and above all, creation of habit of measuring and analyzing results not in a descriptive manner, but in a quantitative way. PIU has rendered assistance to improve function of village organizations not only scientific aspect but also social one. To brush up their contribution, it is desirable to give extension staffs leadership training. It is also desirable for related government agencies to make use of data and information based on real experiences in the Pilot activities.

With regard to villager's capacity building, especially that of technical dimension, on-the-site demonstration by extension staffs can cover the most part. However, in so far as administrative dimension is concerned, the results of analysis on Pilot activities suggested importance of governance and leadership of village chiefs and cadres influencing on participatory performance. These key persons in the villages should therefore attend course of leadership training though training does not necessarily radically improve their capacity of proper administration. Extension staffs desirably assist TA to rectify a built-in concept of village chiefs and their clan believing that village resources are intrinsically vested property to them and they give favor for their villagers to use them. In so far as such concept dictates or governs the community, donated inputs tend to be monopolized by the chiefs and clans, thus undermining equitable distribution.

Improvement of existing or newly established villager's group or village organization(s) in charge of VNRMP constitutes one of the tasks vested to the extension team. In order to make the existing, relevant organization more functional and active, radical renovation is often needed as amendments of by-law including method of electing committee members, provision of general assembly where all the villagers can join and claim their requests. Whenever VNRMP is implemented in a participatory approach, the relevant village organization should function as a prompter and manager of participatory works, where importance is attached to how to coordinate and grasp the mind of participants towards closer solidarity and sustainable attendance to the organized works scheduled in the Plan. The worst case has been observed in which village committee only advocates village chief's private interests without regarding benefit at large. Villagers gradually leave their tasks provided in the original participatory plan as they preview fruitless outcome anticipated in the end of participation. They don't have spare energy to spend for helping well-off people in their neighbors. Therefore, equitable treatment of

all the participants with both duty and benefit is the minimum prerequisite to make a participatory scheme sustainable.

PIU provided a training course for better management of forestry activities and IGA during the final stage of Pilot Study to which at least a few committee members from all the target villages joined. The focal debate in this training course was concentrated on how to satisfy participants with limited benefit gaining from nursery production and IGAs. Some villages had past records of attendance to the participatory works in the registry notebook of the village, and this enabled committee members to objectively evaluate individual contribution of the participants to the targeted tasks. Other villages failed to treat the participants equitably due to lack of records on their attendance to site works. In sharing offspring of goats, group members rear pooled herd of goats taking turns and keeping division of labor. In this case, no particular problem of inequality arose because group members had initial commitment thereon, including the order of receiving offspring during their rearing for pooled herd. In this way, a host of factors intervene the function of village organization and they may decide the final result of participatory activities.

5.4 Revised Village Natural Resources Management Plan (VNRMP)

5.4.1 Factors Considered in VNRMP

In July 1999 Department of Forestry publicized "GUIDELINES FOR FORMATION AND STRNGTHENING OF VILLAGE NATURAL RESOURCES MANAGEMENT COMMITTEES" for empowering officers to facilitate establishment of VNRMP as many villages as possible. This dictates a legal procedure to be advised to the villagers, but it didn't give any concrete ideas for them to pursue. So, it is really necessary for the villagers to advise what to do in their committees established as VNRMC.

The first and foremost factor to be regarded in the formulation of any VNRMP constitutes the current status of natural resources and inventory of available resources in the village concerned. This is because the plan must be based on the observed, actual availability of resources, current land use and status of labor force that can be mobilized. More concretely, the first step starts with resource inventory or the baseline survey. Also, topographic, soil and climatic conditions as well as availability of human, water, soil, lignous and mineral resources can be useful tools in formulating VNRMP. From these background data, villagers can come to a mutual agreement on what to do and what not to do for properly conserving, rehabilitating currently available resources and creating new resources, thus making their resource base recover from damaged and degraded state to restored one.

5.4.2 Community Participation in the VNRMP

(1) What should be planned in VNRMP

In the results of the Pilot Study, the major issues confronted by the villagers in the target villages have been made clear. They constitutes: desertification process leading to poorer crop harvests, dwindling vegetative cover through exploitation or rampant felling and consequent depletion of surface water in the streams, endangered fuel resources within the villages, escalated soil and nutrient erosion from the village field. Many villagers have recognized that these undesirable outcomes or trends deteriorate their base of livelihood and finally lead them to recurrent famine and poverty.

These problems and issues suggest the villagers to make a practical plan to restore and protect their living environment and remaining, available resources with proper management that can restore what has been destroyed and lost. In order to get rid of chronicle vicious circle of poverty, villagers have to self-control of refraining from poaching of precious resources

remaining in their villages for the time being, until regenerated and created new resource base can be ready to avail.

VNRMP should give clear picture on present state, availability of village resources, villagers' household demands for these resources and their difference, i.e., amounts and means of filling gaps between supply capacities and demands. It should define the participants, their duties and rights of creating, managing and using village natural resources, while it should deploy strategies of rehabilitating, creating and managing village natural resources in clear conformity with land use plan.

(2) Basic Concept of Community Participation in the VNRMP

Participation of local community members is prerequisite for a sustainable rehabilitation, creation and management of natural resources, as they are the main actors and beneficiaries of the activities, and village natural resources are common assets of the whole villagers. Therefore, the community has to take a full initiative in planning, implementing, monitoring and evaluating the VNRMP, which aims at bringing sustainable development of villager's livelihood together with conservation and restoration of its environment. If thieves from other villages come to steal the resources, it's the responsibility of the villagers to avoid theft damages by taking preventive measures, because no one living in other villages would help prevent or guard assets belonging to other villages. As natural resources become scarce, number of theft cases would inversely augmented, implying that one of the major objectives of VNRMP should be placed on organizing a group on the alert to safe-guard village assets.

However, as revealed in the Baseline Survey it was identified that the target villages in the Study Area have currently not effectively organized or empowered to carry out such tasks unless some measures were taken to build and strengthen the capacity of the community. Need of capacity building was often reiterated during the discussions with different community organizations including VDCs. Therefore, capacity building of local communities and formation of an effective community organization to function as VNRMC has been placed as an essential component of VNRMP. In this context, it is important to stress that capacity building and formation of community organizations cannot stand separately from other components of VNRMP. These are the components necessary to achieve objectives of other components.

Another impedimental factor beside theft damages arises from recurrent famine during rainy season, affecting cropping cultivation practices and tree planting activity. Villagers chronically suffer from lingering food shortage, have to endure by minimizing physical energy consumption to survive and overcome famine season. To cope with such critical situation, implementation of VNRMP desirably be coupled with food for work, paid construction works for public facility or IGAs and AF accompanied with initial input supply from outside.

(3) Supporting media to Empower Villagers Tackling VNRMP

Most villages have village committees for development or management, but villagers do not necessarily have experience of dealing with natural resources. They need support from outside to tackle environmental issues. Ministries concerned have to take measures of supporting them until they are fully empowered to do all for implementing VNRMP. Extension team mentioned above offers official support that can sensitize and empower villagers to establish their own VNRMP, to implement it until finally they can reach targeted goal of environmental restoration. At least one extension team is desirable in a TA (usually 200 or more villages belongs to a TA) to extend sufficient supporting activity to the beneficiary. It will take at least one month to assist a village for establishment and functioning of VNRMP, or the team can assist only 5% or less of the total villages belonging to a TA. In order to diffuse VNRMP throughout a TA, the first tactic to be taken by the team is to persuade head of TA. There are few heads of TA who actually understand and practice environmental conservation or restoration, while majority do not have

any idea of conserving nature. As the proverb says that seeing is believing, the most effective way of motivating them is to take them to a successful model project site, so as to make them to compare and find the difference in environmental conditions between the scenarios with relevant measures and without them. Once the head of TA acquires better understanding on measures for dealing with environment, it can provide strong support for diffusing VNRMP among their villages.

In rural area, many villagers are still found who believe that trees and grasses are spontaneously repeating regeneration process without any artificial action. Like majority of the world population, they are also ignorant and indifferent of recent development of accelerating process of desertification that inhibits such natural recovery process prevailed over their land decades ago. One of the important missions of the extension team is therefore to make them aware of this endangered natural regeneration, thereby to let them have their own intention to take restoring measures towards the crisis of degrading nature around them. This task is not so difficult to perform, but all it has to do is holding a workshop and let the gathered villagers compare present availability of water flow, wood, bamboo, grass, birds, fish, game animals and other village resources and past one, say a decade or two decades ago. They would appeal marked decrease in resource availability. Then, extension team can attribute all these trends to man-made destruction and drastic climatic changes and stress the necessity of taking aggressive measures to retrieve the loss occurred for these decades.

(4) Formation and Strengthening of Community Organizations for VNRMP

For the planning of VNRMP, the community needs to be sensitized and trained for extracting and analyzing their needs, problems and constraints as well as to recognize the relevant issues and tasks to determine the components of VNRMP identified and formulated by the community. For the implementation of the VNRMP, consisting of wide range of activities as components and of the program, the community has to form a group capable of formulating the strategy, overseeing each component and co-ordinate its activities. Results of the Pilot study have shown that vitalization and capacity building of existing committee through leadership / management training, input supply and subsequent proper resource management can motivate and stimulate existing members of the committee to be engaged in and to actively participate in the implementation of VNRMP. Leadership training provided for village chiefs and committee staffs gives positive influence to the effective arrangement and implementation of VNRMP under the strong support by participating villagers. In any participatory activities, the village organization in the form of a group or a committee plays key role of mobilizing participants, give directions and instructions to them and sharing duties and benefits among participants, and finally make the implementation sustainable.

(5) Setting Targets that VNRMP should fulfill in the Long Run and Short Term

Taking account of current situation and confronted problems, villagers have to identify the extent of environmental deterioration that has been brought about by random exploitation of available resources by themselves in the past decades, to reflect into VNRMP. Then, based on the recognition of present issues and constraints, members of VNRMC can decide what to do in order to restore their environment for the time being and also in the long run. In setting targets of VNRMP, the extension team should advise reasonable levels taking all the factors into account, including nutritional situations, extent of prevalence of AIDS and malaria, available quantities of inputs etc. Currently, village population and household tend to decline and this trend will be kept for a decade ahead, judging from extraordinary frequent funerals within the Study Area, to such an extent that desperate effort of resource rehabilitation will not be needed owing to shrinking demand and relented pace of environment destruction.

However, current trends may undergo changes in a long-term outlook, so just because demographic trend is falling now, it does not follow that villagers can dispense with VNRMP.

Further, targets should be proportional to outputs of works, and the latter is a dependent of inputs. Therefore, targets are limited by availability of inputs. Likewise, realization of targets are affected by ambient environment rather than efforts of participants, arbitrary set targets do not have any substantial significance. As mentioned before, targets should be expressed in tangible numbers since villagers do not have quantitative scale in their life. Table 5-3 gives a standard to set targets for VNRMP.

After all, what will be required in future for soil and water conservation by village should be concretely covered and planned in VNRMP. Assuming that climatic desertification proceeds on at current rate and rainfall pattern follows orogenic, in other words, as much rainwater as possible from very intense but less frequent rainfall dropped in a village must be retained in soils in the village area. The more runoff flows out from the village, the drier environment will result, thus process of desertification will be spurred. In order to enhance rainwater retention, several measures can be applied, but the most reliable and sustainable ones are increased canopy cover and artificial soil conservation. The former is realized through reforestation and AF practices, while the latter is fulfilled by the installment of marker ridges and box hills, filling of rills on the roads and field.

Table 5-3 Land Use Inventory in The Study Area

Village	Village household number	Total Surface area (ha)	Culti-vated area (ha)	of which Dimba area (ha)	Grave yard area (ha)	Current woodlots area (ha)	Outplanted by Pilot* Activities	Land not yet allo-cated (ha)	Required firewood lot (ha)	Planned AF plot (ha)	Planned Tree Crown %
Makonokaya	56	164	76	4	22.1	11	2.4	11.5	-9	42	47%
Siyamudima	168	119	58	3	1.2	3	2.1	13.1	-2	32	32%
Kaumbata	114	316	176	4	6.3	20	0.4	5.5	-19	92	38%
Mdala	306	801	192	5	6.9	10	1.2	69.0	-16	97	14%
Nanjiwa	160	234	97	3	2.5	5	1	9.0	-9	52	26%
Chikoja	169	233	115	3	4.7	11	3.2	7.1	-2	61	34%
Manjelo	67	69	23	2	0	4	2	2.2	3	14	33%
Teula	250	127	55	4	8.9	7	1.7	9.1	31	32	63%
Chakana	55	49	16	3	2.5	6	1	0.5	10	11	62%
Lemu	496	349	145	4	4.5	12	2.1	14.0	7	77	29%
M. Ngondo	80	107	52	1	0	3	0.8	18.1	9	27	37%
Kammata	290	171	36	1	8.7	3	4.7	4.0	87	19	72%
Kumanda	46	127	38	3	0	9	1.3	4.0	6	22	30%
T. Kenji	56	36	6	0	0.9	1	2	0.0	14	3	58%
Chilangali	40	51	21	0	0	1	3.3	2.6	18	11	65%
D. Mbeza	41	70	39	0	0	1	1.6	0.8	-3	20	32%
Kamwendo	154	315	152	1	15.7	24	1.4	0.0	-2	77	37%
Peter Bilila	72	129	14	1	1.4	3	0.9	6.8	24	8	29%
Ndemanje	79	144	88	2	17.3	30	0.1	5.8	-10	46	65%
S. Mpombe	65	45	21	2	1.4	1	1.3	1.2	9	13	57%
Kateya	23	15	5	0	0	1	1.4	0.0	1	3	43%
Maluwa	62	45	20	1	2.3	2	0.4	7.0	2	11	39%
Kumponda	43	190	23	1	1	1	2.4	1.8	9	13	14%
K.Chigumura	160	102	15	1	5.3	1	2.1	2.2	56	9	72%
T o t a l	3,052	4,008	1,474	49	113.6	170	36.3	176.2	211	792	33%

Note: * included in currently available woodlot

(6) The Estimated Potential Area to be covered by VNRMP in the Study Area

VNRMP should cover all the area of the village that establishes it, but it is actually difficult to implement at once the whole Plan and complete it simultaneously, particularly in a large one with several hundred hectare of surface area. In such cases, it will be more practical to divide the village area into a few parts, classifying them according to the extent of deterioration, choosing one that has least been degraded for example, so that least measures can be taken with

least material and labor, leading to faster manifestation of the result of what is planned. The chosen part will serve as a model and the rest parts can follow it with desirable improvement to be added from the lesson learnt through the implementation of the first batch. However, kinds of natural resources to be rehabilitated, to be managed and to be increased differ from village to village. In many cases it's beyond the capacity of villagers to judge or select priority area of exigency where villagers have to immediately tackle.

From Table 5-3, current coverage rate of tree crown in the Study Area remains at barely 7% of the surface area, or 93% is barren subject to runoff erosion. Canopy coverage in lower Shire exceeds 20%. This is the reason why Middle Shire has been condemned as major contributor of sediment filling into power generation dams in Shire River. Such aftermath of erosion not only spoils the functions of public facilities, but also causes loss of precious topsoil from the crop field of villages inside the watershed.

5.4.3 Agro-forestry Diffusion

(1) Significance of Agro-forestry (hereinafter referred to as "AF")

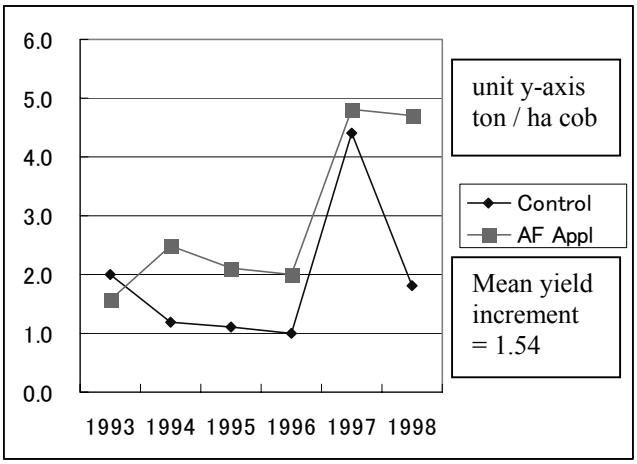
Survey on land use in the Pilot Study revealed that about 40% of village area has been used as arable land. Except marshy (dimba) patches, futile mineral soils with very low humus contents, belonging to Oxisols, Inceptisols and Entisols are widely distributed over arable land. Because these soils have low water holding capacity due partly to lack of organic matter, partly to little clay content by erosion, crops and tree seedlings growing thereon are more susceptible to drought damages. Crop yields are greatly affected by such soil properties and also by lack of plant nutrients since farmers cannot afford to buy chemical fertilizers. Under such conditions, AF provides a promising solution for the supply of both organic matter in the soil and nutrients for crops. Farmers in and around the Study Area have already practiced a type of AF, the combination of pigeon pea (*Cajanus cajan*) and white maize around a half of cultivated area.

The pilot activities have introduced new types of AF practices in target villages where farmers establish around 30 ha of agro-forestry plots mainly planted with *G. sepium* seedlings raised in village nurseries and some Chinese hairy pea (*T. vogelii)* directly sown to the crop plots. Diffusion of these types of AF is easy only if material or seed is available, and majority of farmers desire to practice it. Target area of AF extension is tentatively set at half of the arable land (excluding area under pigeon pea) plus dimba, in total 1,700ha in the Study Area.

AF tree species are planted every other ridge at an interval of 1m ~ 1.5m according to availability of seedlings or seed, as practiced in many sites in Blantyre and Chirazulu Districts. This is called alley cropping, or hedgerow practicing with a single AF species for three or four years continuously on the same plot. Under Pilot activities, direct plantings of *G. sepium* to farm plots and direct sowing of *T. vogelii* to farm plots on every ridge have also been tested with acceptable results. Cuttings of *G. sepium* and seed of *T. vogelii* are collected from village seed banks. In future, use of cuttings will be more diffused because farmers do not have to raise seedlings in their nurseries, nor have they to dig large planting dibbles on crop field, thus saving labor and input if they maintain their seed banks properly. Seed of Egyptian rattle pod (*Sesbania sesban)* and *Leucaena leucocephala* is also available in some seed banks but these species seem to be more suitable for use in more humid area.

Seed of AF species are expensive for farmers to buy except that of *T. vogelii* (bumper pod bearing) and this has led to establishment of village seed bank from which participants in AF can receive free seed. Both *T. vogelii* and *G. sepium* can grow fast, bearing pods within two years if planted in favorable sites without giving damage of cutting. Recently, *Leucaena leucocephala* was repealed from the recommendation list of Department of Forestry and ADD because of poor germination rate and susceptibility to aphids and leaf spider, though FRIM still sells seed thereof, and Pilot Study lifted buying the seed from 2003.

Figure 5-5 Effect of Nutrient Supply of *G. sepium* to White Maize



The manuring effect of AF is not clearly manifested in a year or two, but practice of three consecutive years will give remarkably positive effect to the applied crops owing to higher content of nitrogen and soil moisture. The following result of increasing maize yield was obtained in a test plot in the field of ICRAF in Makoka, 20km away from the Study Area. A trial of AF for six years with and *G. sepium* recorded yield increase of white maize by 54%, with the rate of applied organic matter amounted to 3.2 ton/ha, leading to the yield level of 2.9 ton of maize cob per hectare as compared to 1.9 ton on average for control. If this rate is applied to an average farm household holding arable land of 0.6ha in the Study Area, with an average yield of maize ranging 0.8 ~ 1.2 ton/ha, an average increment of the yield by 0.3 ton per household is envisaged. This is equivalent to 80kg of increased ration for a household member and this will bring a great stabilizing effect on food security. Comparing this with the value of major IGAs, the value of the yield increment will outweigh the annual benefit delivering from IGAs. However, a household should practice AF all over its arable land to realize this benefit.

Likewise, AF species planted in alley cropping will regularly be regenerated, i.e., every 3~4 years. Then, firewood can be harvested at the rate of 4,500 kg /ha in the case of *G. sepium*, or 1.5t / year / ha. This amount is equivalent to 600kg or 0.75m^3 per household, meeting annual requirement of firewood for a household. Again, the household should cover all of arable land with AF practice to realize this amount of harvest. Almost all verified AF practices fall on alley cropping, but other two cropping techniques are considered equally important especially for reviving soil fertility in fallow plots, in the light of the fact that fairly large area in arable land have been left idle as fallow (munda o gonera) due to exhausted fertility. Table 5-4 gives basic idea of three major AF practices applicable to the Study Area and its neighboring areas.

Table 5-4 Major Agro-Forestry Practices Applicable to the Study Area

Practice	Major Objective	Site Specification	Rotation Period
Alley Cropping	supply of green manure	cultivated flat/slope field	every 3 ~ 4 years
Intermixed Cropping	rapid recovery of fertility	fallow/ intermittent plots	1~ 3years until recovery
Relay Cropping	rotation of planting ridges	futile, exhausted plots	every other, two year(s)
Practice	**Planting Density**	**Recommended Specie**	
Alley Cropping	every other ridge, 1~1.5m	*G. sepium, T.vogelii, S.sesban, L.leucocephala*	
Intermixed Cropping	every other ridge	*S.siamea, S.spectabilis, F.albida*	
Relay Cropping	dense direct sowing	*Ateleia Herbert-smithii, S.sesban, L.capassa*	

Envisaged benefits brought about by AF practices can be summarized as follows:

1) High affiliation or harmonization to eco-system, keeping denser vegetative cover on arable land including fallow area, intercepting hitting energy of raindrops on ground surface, thus mitigating soil erosion with surface runoff,
2) Source of green manure to enrich nutrient status of tillage layers, at the same time bestow arable soils with higher water retentive capacity through both soil moisture absorption by humus and storage of capillary water in the increased aggregates of soil clods and
3) Additional source of firewood supplied in the year of regeneration, particularly for the households without private woodlots or difficult access to other sources of firewood supply.

Anticipated disadvantages of AF practices are interpreted in the following:

1) As to competition of soil moisture between AF species and sown crops, it is negligible because root zones of these two plants develop in different horizons, for root zone of the former develops deeper and closer to phreatic surface, or near groundwater level, whereas that of the latter does shallower or closer to the ground surface, because limited depth of tillage by the farmers. AF planners selected deep rooting and vigorously growing shrub species for AF practices, leading to higher survival rate in drier climate.
2) As for additional labor requirement to establish and manage AF, farmers do not have to repeat the same practices every year, for the planted AF trees can last three ~ four years. Also, they can save their labor by adopting direct sowing of seed of AF species to farm plots instead of raising tube-pot seedlings in nurseries. Only, substantial labor is needed to incorporate green manure into soils, but this is the substitute of expensive chemical fertilizers, so farmers are willing to practice it for dispensing with chemical fertilizers.

(2) Target Area for AF Exploitation

Tentative target acreage in the Study Area for AF practice is shown in Table 5-3, equivalent to 33ha per village, or 54% of the arable land including dimba and half of arable land where farmers have not planted with pigeon pea, i.e., there is possibility of immediately adopting AF practice. Maize field currently cropped with pigeon pea (*Cajanus cajan*, called "Nandolo" that has rhizobial nodules on its hairy roots, is also deemed as a form of AF) accounts for 35% or more of the cropping field, where planting of other AF tree species are considered difficult, therefore the area of this mixed planting is excluded from the target area. In particular, as intense farming consumes soil fertility faster than sedentary one, all of continuously cropped rain-fed farmland, dimba (irrigated farmland) should be counted as a target of the AF practice.

As mentioned above, it is significant to convert futile fallow kept idle into fertile cropland for expanding base of crop production. However, current maize field is priority target area for the time being where the practice is tried, and actually farmers planted *G sepium* over 20ha (0.8ha per village) of farm plots. Also, irrigated plots in dimba are included in priority practicing target of AF, because humus contained in topsoil can prevent leaching of plant nutrients supplied from chemical fertilizers, thus cultivators of dimba can save them.

(3) Current Extension Efforts for AF Exploitation

Almost no positive effect is expected to appear in the 1st year of AF practice on increase of agricultural production, nor on improvement of soil fertility. Effect of AF on the farm crop production will appear from the 2nd year, where the effect gradually becomes prominent year after year, as shown in Fig.5-4. Extension staff belonging to ADD, RDP have already been trained to instruct AF techniques in ICRAF and other research institutes, they can advise farmers relevant batch of practices suited for the sites. Adjacent the Study Area, there is a village called "Michongwe" where similar natural conditions to the Study Area prevail, and the yield improvement has been observed several years after starting AF practice.

The result of villagers' workshops revealed that there is a fairly good understanding on AF among the villagers represented by village chiefs. Yet, only mixed cropping with *Cajanus cajan* has been practiced in the field, due mainly to lack of AF seedling and seed for raising such seedling. Seed farms created in the target villages in the Pilot Study now bear seed and harvests by the villagers have started for *Gliricidia sepium* and *Tephrosia vogelii*. About 40 matured standings of seed bank trees can annually supply seed to more than 100 households that start AF practice with 300 seedlings of *G. sepium*. (Effects of other species are shown in Annex B-11).

5.4.4 Basic Approach to the AF Development Plan

(1) Objective of AF development

Practice of AF has high potential of improving villagers' living standard through control of soil erosion, improvement of soil fertility, supply of fodder, material for cottage handicraft, and subsidiary firewood, etc. The objectives of introducing AF are not merely confined to nutrient enriching or substitute of chemical fertilizers but are covering multi-purpose usage including erosion control and soil conservation, fodder browsing, in the light of current situation and requirement of villager's agricultural production inputs and conservation of environment.

(2) Land Preparation for Practicing AF and Organizing of AF farmer's group

Those who cultivate crop on the field of low fertility had better practice AF. It is recommended that AF practices may start at the cropped field belonging to the members of the nursery committee, or participants in the village nurseries, because material of AF tree species is easy to obtain. Additionally, it must be a requirement that the members should have strong intention of practicing AF. Also, if farmers want to resume cropping on their fallow land, it is the best to practice AF at the resumption of cultivating crops. Village chiefs and committee members can delineate farmland tract within their villages especially for developing AF.

AF is desirably practiced through organizing target villagers into an AF farming group or consolidation of certain villagers groups. Tentatively, the villagers' group will practice AF names as " AF farmers group" on this plan. It is recommended that a minimum of 20 farmers in the same village should be participated in organizing the group that will start practicing AF under the instruction of an extension staff. Ideally, the 20 participants will collectively manage a grouped farm plots that are not individually owned for a smooth initiation of AF practices, but actually in the communal societies in the Study Area, it would take a long time to form such a coherent solidarity, and farm plots have been too much fractioned as an aftermath of succession to realize an enclosed lot to be practiced by a group.

Extension staffs should help villagers to organize an AF farmers group in a target village, in order to popularize and disseminate AF practices. The group, once established, can prepare a demonstration AF farm plot on a communal land close to village nursery, if such a site not yet privately allocated to anyone is available there. Members of the group can take turn to manage and cultivate the demonstration plot where risk of failure would not directly affect private granary. However, where villagers need to begin AF is very strong, there would be no need of establishing an observatory farm plot since both farmers and extension staffs are confident of leading the AF practices to a success. In fact, there has so far been no such report to extension offices as failure of AF practice spoils crop yield seriously.

(3) AF Development Unit and adoption of AF techniques

A small piece of land with 100 square-meter is found suitable to begin with AF practice. Generally, villagers do not have any experience of dealing with metric units such as meter or hectare. A 40-meter rope with spacing marks will be useful for a homogeneous AF practice. Some of the tracts along streams are allocated mostly to individual farmers. In most cases, farmers are allocated small parcels of dimba for vegetables or sugarcane planting and those

plots have as small as one or a few hundred square meter, or 20 m wide along the rivers. From the standpoint of distribution of AF material to the group members, this size of land is handy to start and manage it. Also, the site where many farmers have their own plot in a compact space is convenient for extension staffs to demonstrate techniques of AF. From such point of view, it is recommended that a plot of 100 m square can be adopted as a suitable unit for practicing AF.

Simple and readily practicable AF techniques should be disseminated in order not to discourage villagers. The techniques should also be easy for promotion and extension by the extension staff. Technically, those techniques must make positive impact on the preventive efforts against soil erosion, on improvement of soil fertility, supply of firewood and animal feed, etc. Also, the techniques must be adapted to all possible AF-practicing farms in the Study Area. Moreover, AF practices should not make farmers exhaust by heavy labor, since it should be practiced during rainy season, equal to famine season. For example, farmers prefer insertion of cuttings into soil to digging big planting dibbles when they suffer from lack of food. In such an occasion, enough size of village seed bank offers advantage of providing enough cuttings of branches of *G. sepium* to the practicing farmers with energy-saving material. By the similar reason, direct sowing of *T. vogelii* with maize, sweet potato and other crops is advisable to save farm labor.

As a principle, the following criteria should be applied in selecting species for AF:

- The species that should be able to accomplish specific objectives of the AF,
- Those for which propagation material can be easily obtained,
- Those that can be grown fast and readily maintained,
- Those that are robust, resistant to pests, diseases and drought, and
- Those that have affinity to crops, or positive allelopacy with symbionts.

(4) Basic Concept of AF Nursery

A seed bank should be established and managed in each village in a sustainable way to allow participants to obtain AF seed and cuttings because nowadays the price of AF seed has skyrocketed beyond the reach of villagers. Also AF seed bank will provide scions/ cuttings for further or stock for providing propagating material, in compliance with AF farmer's interest.

An AF farmer's group will provide and manage a nursery in cooperation with other villagers' groups in line with a well-planned design. Equipment and materials for creating nursery and material production should initially be supplied from outside.

(5) Practicing Techniques of AF

(5-1) Practicing AF by Land Type

AF scheme is planned on the farmland through a grouping of land into four groups under different categories, classified by soils and slope gradient, as shown in Table 5-5. Suitable models of AF techniques will accordingly be applied to these different types of land categories. The standard size of AF practicing plot will be 10 by 10 meters. Spacing within rows and between rows can be arbitrarily decided, but availability of AF material and cropping operations must be taken into consideration. Farmers will also have options to vary spacing dependent on their needs. Within the above major soil types, farmers will adopt with or without modification of the currently tried AF techniques. A benchmark standard of planting spacing is also shown in Table.5-5. Seedlings or cuttings will be produced at AF nurseries / mother trees in village seed bank, are planted on these four types of land in accordance with the planned diagram. However, slope steeper than 8 % shown in Table 5-5 (Gradient E and F) is rather recommended to convert into/ utilized as the sites of woodlots or forest.

(5-2) Land Classification for AF Practicing

Field where participants have intention of practicing AF will be identified for introducing AF practices and also examined prior to starting AF practices. Members of AF farmers groups will be advised to produce and plant AF materials in their own individual crop field. The said farmers group may modify AF practices in their own identified land so that the most suitable planting techniques are secured on their crop field.

Table 5-5 Land Classification for AF and Benchmark Standard for pacing

Soil / Gradient	Less than 4 degree	4 < 8 degree	8 degree <
Sandy Loam	A	C	reforestation
Loamy Sand	B	D	reforestation
adopted AF specie	Less than 4 degree	4 < 8 degree	8 degree <
G. sepium	1.5m (h) x 2m (s)	1m (h) x 1.5m (s)	0.75m x 1m(s)
T. vogelii, *S. sesban*	1m (h) x 2m (s)	0.75m (h) x 1.5m (s)	0.5m x 1m(s)

Note: (h) horizontal, (v) along slope

Within the above land classification for AF, farmers will adopt with or without modification of the currently tried AF techniques as shown in Table 5-6 on adoption measures of AF techniques.

(5-3) Advisory Entities of AF Farmers Group

Prior to forming or consolidating AF farmers group, an enlightenment program will be provided for the villagers at target villages. Concept of AF is implanted in village workshops to enhance participant's willingness and interest. Then, initial program of the AF will be commenced by confirmation of villagers' intention, through the assistance of extension staff in charge. AF farmers group will thereby start their activities and an advisory program in these villages will be initiated for supporting their activities. The extension staffs will take charge of:

- Administrative advice for operation, management and monitoring of the AF farmer groups,
- Technical advice and demonstration on AF techniques,
- Technical advice to the group members by the foreign specialists of the Pilot Study or an international agent i.e. ICRAF, and
- Enlightenment activities to sustain farmers interest to the AF.

(5-4) Adopted AF Techniques

Four AF techniques will be applied to cover all types of potential AF area in the SA. These are a) Alley cropping, b) Intermixed cropping, c) Short-term improved fallow and d) Relay cropping. Four of these AF techniques can cover all potential area in the SA. The following matrix shows how to adopt these types by field.

Table 5-6 Matrix for Selection AF Technology by Field

Necessity of farming Soil fertility (example)	High	Middle	Low
Medium (Vertisols)	alley cropping	intermixed cropping	intermixed cropping
Poor (Entisols)	alley cropping	relay cropping	relay cropping
Very poor (Oxisols)	intermix cropping	short improved fallow	short improved fallow

Note: alley cropping is also called "hedgerow".

Basically, leaves and branches have to be plowed into soil of the AF practicing field separately. Leaves can spread and place all over the field and branches should be buried into soil between ridges. Transplanting or seeding plant at above branches in the soil should be avoided. In dimba, placement of organic matter into the soil should be carefully incorporated, especially during or

before rainy season. Not enough digested compost (manure) may cause injury to the roots of crops. Therefore, in dimba, only leaves can be ploughed into soil and branches should be placed on the surface between ridges as mulch. Seed should be sown into the AF treated soil after enough decomposition of incorporated green manure, say about one month after incorporation.

(a) Alley Cropping

This technology involves planting rows of trees in farms along contour lines (marker ridges) and crops between alleys of such trees. Alley trees usually consist of fast growing ones at high survival rate to serve for copious supply of leaf biomass. For instance, from the second year after transplanting some branches and leaves can be cut off and incorporated into soils as green manure. Law leaf weight per stand ranges 0.2~0.5 kg / harvest depending on growth and specie.

Objective of the technology: The technology aims at addressing the problem of low agricultural yields through improvement of soil fertility by application of green manure. Quite often, such technology also helps prevent soil erosion on steep area where terrace like beds eventually evolves naturally, because raindrops falling onto crop field can be intercepted by leaves.

Recommended Site: The techniques will be established in all the targeted villages to the verification survey. Slop areas with a grade of exceeding 4 degrees and above will have more plots to assist in soil erosion control.

Species : The species to be used will mainly be *Gliricidia sepium. Sesbania sesban* will also be tried. *Tephrosia vogerii* and *Senna spectabilis* can also be applied over the slope for contour hedge grow at interval of 3 - 4 ridges. Extension staffs refrain rom recommending *Leucaena leucocephala* because it's highly susceptible to mealy-bugs or aphids and mealy poor resistance to drought.

Spacing and Season: Planting of trees will be 50 cm apart within the rows and 5.4 m between the rows. On steeper area, closer spacing between rows will give better effect for controlling soil erosion and for securing higher level of biomass production. Since it is advised that thick transplanting with later thinning keeps adequate growth of the species on steeper slope, more planting material will be needed for slope field. Incorporation is best practiced before the onset of rainy season so as to ferment buried leaves into nitrogen-rich manure in wet soil mass.

Establishment: Alley will be planted from tree seedlings grown in AF nurseries. Initially, agricultural crops will be inter-cropped with trees within the alley rows. Inter-planting will be lifted for regeneration when crown shading does not allow crop growing.

Management: Start pruning hedgerows during the second crop season when the trees are about 1 meter tall. Strip off leaves and small twigs, then, apply them to the soil along the ridges between the alleys. Collect stems and use them for firewood or small construction material.

(b) Intermixed Cropping

This technology involves inter-planting crops between rows of trees. It is a modified form of alley cropping. The difference lies in that the spacing between the rows of trees is reduced in such way that no large empty space between rows of trees is placed. The trees density per ha is also considerably higher. The main reason of increasing density of trees planted is to produce enough organic matter to cover the whole plot, capable of applying 5 tons of raw leaves / ha.

ICRAF commenced a trial intermixed cropping at 1993 in its experimental farmland adjacent to the SA. A result that indicates increasing maize production is shown below. Except first year, yield of maize at AF practicing field have exceeded standard (none AF or control). Data obtained in farmer's maize plots in Salima where *Cassia spectabilis* and *Faidherbia albida* also gave fairly positive results with a yield response rate of 0.4kg of maize grain per kg of dry leaf.

Table 5-7 Effect on Maize Production by Intermixed Cropping by ICRAF

year	Production of maize (t/ha)	
	Standard control (AF not applied)	AF practicing field
1993	2.0	1.6
1994	1.2	2.5
1995	1.1	2.1
1996	1.0	2.0
1997	4.4	4.8
1998	1.8	4.7

Objective of the technology: The technology aims at addressing the problem of low agricultural yields through improvement of soil fertility by application of green manure. A result of research by ICRAF indicated that maize yield per ha with and without trees increased from 1 to 4.8 tons and from 0.4 to 3.5 tons for the years 1993 and 1998 respectively without applying any inorganic fertilizer. AF practice can attenuate parasitic damages by witch flower Striga on maize.

Recommended sites: The techniques should be established in all targeted villages and flat areas with deep soils will be preferred to apply this technology.

Species : Mainly *Gliricidia sepium* but *Senna (Cassia) siamea* as alternative tree specie.

Spacing: Tree spacing will be 90 cm within rows. Rows of trees will be planted every other ridge, with an interval of 75 ~ 180cm. Practically, original spacing between ridges was 90cm but has now been modified by farmers to about 75cm. The spacing between ridges may therefore be about double of this spacing or 150cm. In that case, spacing between rows of trees will be 150cm rather than 180cm.

Establishment: Tree seedlings are planted along furrows while crops are planted along ridges.

Management: Start pruning rows of trees from the second year. Incorporate leaves and small twigs into the soil on ridges. Each row of trees feeds the adjacent ridges with green manure. Stems can be collected and used for firewood. Pruning should be timed to minimize crop/tree competition. Dry matter yield per stand reaches 0.3 ~ 0.5kg per cutting depending on growth.

(c) Improved Short Term Fallow

This technology involves planting short-term shrub plants in fields left fallow due to exhausted soil infertility or excessive dryness. Readily multipliable AF species like *Tephrosia vogelii*, *Cajanus cajan, Crotalaria juncea* and other species are planted without host crops for a period of two years. Strong nitrogen fixing tree species are recommended because their nitrogen-rich leaves and decaying roots can greatly improve soil chemical and physical properties.

Objective of the technology: The technology aims at rejuvenating soils, which have been impoverished through continuous cropping. Currently, soil fertility has been exhausted as evidenced by extremely low crop yields and growing of an indicator weed, fields are abandoned for periods of six years and over to rejuvenate them. This is not easily practiced in countries including Malawi where land holding size is marginal. With the proposed system, rejuvenation period will be reduced to 2 years. Research in Zambia indicates that improved fallow system can double or treble maize yield and can eradicate striga parasite from the infested fields.

Recommended sites: The techniques will be established in the already abandoned fields in Nanjiwa or Kaumbata village where some crop field has been abandoned but could be rehabilitated applying this technology.

Species: The species to be used will mainly be: *Sesbania sesban* (jelejele). *Tephrosia vogelii, Cajanus cajan* (nandolo) and *Crotalaria juncea* can also be tried in adjacent plots.

Spacing: Tree spacing will be 1m x 1m (square), equivalent to 10,000 plants per hectare of land. On the other hand, a plot of 20 m x 20 m will require 400 plants each.

Establishment: Trees will be propagated from tree seedlings. Direct sowing can also be applied but take a longer period before maturity. Plant maize crop and when knee-high, plant *Sesbania sesban* seedlings raised in village nurseries.

Management: Inter-crop AF trees with crop during the first year. After harvesting maize crop, leave *Sesbania* to continue growing. During the second year trees should be allowed to grow alone as shading is anyway too heavy. Clear-fell all trees at the end of the second year and apply the leaves and small twigs to the soil. Pulled out stems or coppices can be used for firewood.

(d) Relay Cropping

The technology involves planting of short rotation nitrogen fixing shrubs with crops and the land is continuously cropped instead of leaving it fallow. In fact, currently popularized planting of pigeon pea (*Cajanus cajan*)is in itself a system of relay cropping.

Objective of the technology: The main objective of the technology is to enrich soil by adding organic matter from by-products like paddy straw. Such organic matter contains some quantity of nitrogen when it is fresh and also other crop nutrients like phosphorus pumped up from deeper soil layers and hence improves soil without addition of inorganic fertilizer.

Recommendable site: All the villages where mono-culture (single) cropping has continuously been done in rain-fed or irrigable field or both.

Species: Mainly *Sesbania sesban* (jelejele) and *Tephrosia vogelii*

Spacing: 1m x 1.5m - Within rows and planted every other row of maize or other staples

Establishment: Direct sowing of seeds or planting of seedlings later in the season after maize has germinated. Better use *Sesbania* for vegetable garden because *Tephrosia* attracts nematodes.

Management: Leave shrub growing in the field after maize harvesting. At the time of land preparation, uproot shrubs and incorporate leaves and coppices into the soil.

(5-5) Recommended Species of Trees for AF

(a) Selection of Suitable AF Species

Participants in AF practice should select suitable species based on their intention or felt needs. Each RDA has the list of recommendable AF species for the villages in its jurisdiction. Other than the following species, there are other candidate species i.e. fruit trees of citrus varieties of lemon, tangerine, custard apple (*Anona senegalensis*), Mexicam apple (*Casimiroa edulis*) etc., species to supply material for cottage industries or timber for house or furniture making (sisal hemp or *Agave sisalana*, reed, bamboo, etc.). Species of bamboo (*Arundinaria alpina* and *Phyllostachys pubescens*) and the case of similar project case in Kenya are reported. Number of species should be minimized to those with known record of growth in similar areas.

Besides, it is advised that scrutinized review on the specie selection be tried prior to the final designing so that dimension of logistics can be considered as to how to obtain necessary amount of seed and scion material of the planned species. In this context, it is advised to begin with already existing indigenous or exotic tree species in the villages (for example, *Tamarindus*

indica in Nanjiwa village and *Moringa oleifera* found in Kamwendo village) for mother trees. Since trees for AF practices are also made use of by women on farm plots, gender-based consideration on the selection of useful species is essential. To this end, additional species / varieties of AF trees will be employed through a questionnaire survey for the selection thereof to beneficiary women, prior to fixing the plan of implementation.

(b) Specific Attributes of the Recommended AF Species

Following are salient features of species.

・Preferred species group I

Faidherbia albida: Unique indigenous leguminous tree in that it fixes nitrogen from air for use by crop. Yields of crops under the tree have been observed to increase by 250% compared to those grown in the control plots. Deep rooted species, drought resistant and does not compete with crops much because its leaves are on during dry season and are shed off during wet season when other crops are growing with maximum requirement for sunlight (7,500-10,000 seed grains per kg).

Gliricidia sepium: A fast growing exotic tree/ shrub that originated from Central America. It has copious supply of leaves, which are used for soil organic matter. This is ideal for nutrient cycling due to its deep-rooted nature. The tree can survive and grow well in dry areas. It is readily propagated from seeds (6500-8000 seeds per kg), and from rain-planting of cuttings.

Leucaena leucocephala: A nitrogen-fixing evergreen shrub that originated from Mexico. It is ideal for fodder and soil enrichment due to large concentration of nitrogen in the leaves and stems. Very fast growing and appropriate for land reclamation. The species can be propagated easily, as it is prolific seed producer. It is also good bee-forage (13000-34000 seeds per kg).

Melia azedarach: The tree, originated from South Asia, is good for firewood and can easily be propagated, as it is prolific seed producer with high germination rate. GOM introduced the species before Eucalyptus plantation round 1985. There is no new plantation of the species after the start of Eucalyptus planting during 1980s. Some farmers have planted the tree and such trees could be conserved as a source of planting material (500-3000 seeds per kg).

Senna siamea: The tree species, originated from Southeast Asia, is tolerant of extended drought and is not easily attacked by termites. It is prolific producer of leaves and hence ideals for soil organic matter and prevention of soil erosion. Good bee-forage. The tree has been planted in a few areas of the Study Area and extension staffs are familiar with its propagation (about 39,000 seeds per kg). Unlike *Leucaena* this is immune to insect attack and resistant to drought.

Senna spectabilis: Good species for land mulch, originated from tropical America, which is also good bee-forage. The tree is fast growing on good sites but slow on poor sites (about 39,000 seeds per kg). This is also highly tolerant against drought and prohibiting attack of insects.

・Preferred species group II

Acacia polyacantha: Growing about 20m high, indigenous species. It's deal for soil reclamation and soil fertility due to its nitrogen fixing ability. Leaves and roots of the tree have medicinal value and the specie is also used for fodder and firewood (14,000-16,000 seed grains per kg).

Calliandra calothyrsus: This is an important multi-stemmed, nitrogen-fixing shrub. Leaves and twigs good for fodder and soil organic matter. It is very fast growing on good sites and can be used for stabilization of stream banks and soil erosion control (about 19,000 seed grains per kg).

Albizia lebbeck: This is a deciduous legume tree with rhizobium on roots. The fruit contains tannin and wood serves as material for durable furniture and branches for firewood. This is also

used for fodder tree for feeding to goats, and good nectar source for honeybees. (around 2,000-2,500 grain beans per kg).

Tephrosia vogelii: This is a shrubby legume, which has high capacity for nitrogen fixation and by implication soil fertility improvement. It can be inter-cropped with maize in relay cropping resulting into significantly higher yields. The specie stands for drought (15,000 seeds per kg)

Ziziphus mauratiana: This is one of drought resistant tree species, serving truly multipurpose and highly useful in dry areas where other trees cannot be grown. Its fruits are already widely marketed in the Study Area. Its roots are good for medicine. The tree is also good bee-forage and live fence, highly resistant to drought (430 – 2,000 seed grains per kg).

(c) Recommended Species of Fruits and Production Cottage Industries Materials

Table 5-8 Recommended Fruits and Material Trees in the Study Area

Indigenous fruits in the Miombo		Commercial fruit	Material species
Scientific	English		
Uapaca kirkiana	Wild Loquat	Avocado (*Peara Americana)*	Sisal hemp
Parinari curatellifolia	Mobola Plum	Banana	Bamboo
Strychnos cocculoides	Monkey Orange	Citrus (Tangerine, etc)	Elephant grass
Flacortia indica	Indian Plum	Guava (*Psidium guyava*)	Papyrus (Paper reed)
Azanza garckeana	Snot Apple	Local Mango (*Mangifera indica*)	Reed
Vangueria infausta	Wild Meddler	Mexican apple (*Casimiloa edulis)*	
Syzygium cordatum	Water Berry	Papaya (*Carica papaya)*	
Adansonia digitata	Baobab Tree	Pineapple	
Ficus vallis chudal	Sicamore Fig	Sugar apple *(Anona senegalensis)*	
Sclerocarya birrea	Mfula Mango	Tarmarindo *(Tamarindus indica)*	

Note1) Miombo indigenous fruit: ICRAF is carrying research on such indigenous fruits for commercialization. Some of species are already in the process of trials in the field.

3) Commercial fruits: Vvumbwe agriculture research center recommend fruits at the SA

4) There are both indigenous and exotic bamboo in the MA. Exotic bamboo has been transplanted by villagers for roof frame and other construction/furniture material

Table 5-8 shows a recommended species of fruits and cottage industries. Fruits speceies included commercial and possible indigenous fruits in the Miombo Forest. AF farmers' groups will choose their preferable species as their villages production.

AF Nursery Construction, Equipment and Material Supply Plan

Table 5-9 Estimation of Seedling Demand by AF Nursery

Supplies	Area (ha)	Seedling demand	Reference
AF seedling	10	50,000-60,000 [1)]	10ha: 0.5ha x 20 participants. (AF farmers group)
Vegetable seedling in the AF practicing field	1	40,000-50,000 [2)]	1ha/ village, 10 % of AF practicing field
Individual woodlot Village forest	15	66,000 [3)]	5ha/village, rotation by 6~7 years

Note 1) Average seedling demand of RRA for the three villages practicing implementation of AF. survival rates 75 %, 50 % for surplus production other than subsistence production.

Note 2) Planting density 2,000/10a (cucurbit varieties), survival rates 75%, 50 % for sales

Note 3) Total afforestation target area in the MA 934ha. Average annual afforestation area is 15 ha per AF nursery (rotation by 8 years, construction 8 AF nursery, planting density 2000/ha, survival rates 75 %, 50 % for sale.

(6) Village Nursery Establishment in the Target Villages

Nurseries have been established and managed in all the villages in the Study Area where strong willingness has been felt towards the production of both forestry and AF material, tree seedling

and sweet potato seedling. Henceforth, multi-purpose nurseries where AF species can also be raised should be located at convenient sites for every villager who commutes to, or to whom various kinds of seedlings are distributed. In fact, creation of village nursery at each village is necessary, even if land availability were limited. It is verified during the progress of the Pilot Study that all the villages started to utilize village nurseries for raising seedlings of AF species Actually 26 have been established in target villages.

The proposed locations of these village nurseries will allow every villager to reach the nursery site for daily managing works within 25 - 30 minutes of commuting on foot, walking almost 2km at maximum.

(7) AF and Soil Conservation

Since tree row(s) can be provided through the practice of AF at the lower edge of a parcel, it is expected that soil loss from the parcel can greatly be controlled by this practice. Yet, it will still be necessary to practice contour ridging inside the parcel, desirably practicing box ridges for cropping in rainy season. This practice should be demonstrated through extension staffs for further dissemination in parallel with promotion campaign for AF. Particularly, in Nanjiwa and Chakana Villages where crop field has been developed on slope coincided with the distribution of highly erodible soils delivered from granites and gneisses (gully is apt to form under such conditions), it is recommended to such plant species with thriving root zone as *Molus alba* and *Tea sinensis*. (The former is abundantly found within the Study Area and the latter have been planted in Tyolo, 30km south of the Study Area). These can be planted along the hedge of parcels along inclination, as a device to minimize soil loss from the rill surface.

Table 5-10 Facilities to be Established for AF Activities

Item	Function	Facilities
Seedling production	Production seedling	Nurseries for tree, AF, vegetable seedling production
	Maintain seedling propagation material	Germination bed, cuttings/scion / stock farm, etc.
	Storing equipment and materials in safe, working shop	ware-house, workshop space
	Preparation pot media	Manure depot
	Watering	Weir, manual watering system
	Security	Guard house 24 hours
		Fence surrounding the nursery
		Wind, shade forest
O & M Villagers group	Meeting space for the group	Nursery manager's bulletin
Tech. transfer, extension activities	Resident or temporal extension officer	Residences for extension officers
	AF technology transfer	AF nursery AF demonstration lot
	Forest technology transfer	AF nursery demonstration forest
Trial & research	Fast growing species	Af nusery demonstration forest
	Collection seed by villagers	
	Alternative seedling raising methods to seedling pot-tubes	
	Direct sowing of tree seed	
	Propagation material (bamboo, etc.)	

To show the achievement and share the experience with other community members, tables or graphs showing progress of work will be hung on a bulletin board. Materials to construct the board will be provided to the community. The place to create nurseries will be discussed and decided by villagers.

(8) Inter-location tours by the villagers with project implementation

During the course of leadership and managerial training and study tour, affiliation must have been built between villages with project implementation in the same year. Inter-location tour among three or more villages is proposed to monitor each activities and share and discuss their experienced techniques, difficulties and their countermeasures. The villagers to be visited by others will present their progress so far made and show others, in such a way their future target and activities will be defined and clarified again.

Basically, committee members will be the participants of the inter-location tour. Since each activity is related each other, monitoring tour group will visit more than one kind of organization and monitor overall activity components practiced in the visited villages. They visit each other four times per year to monitor each step of their progress.

(9) Inter-location tours by the village without project

During the Baseline Survey and introductory workshops, a lot of inter-linkages were found with those in neighboring and nearby villages. These are, for instance, villagers from neighboring villages graveyard clear cemetery once a year to prevent bush fires. Another example is organizational activities; borehole or school committee is formed covering several villages to manage, operate and maintain one resource together. People have close connection with neighboring villages, and they work together in terms of development activities. In addition to the above inter-monitoring by people concerned, neighboring villages, especially the villages in which activities will take place subsequent year, should join this monitoring activities. Therefore, they can learn from forerunner and can modify the way of implementing activities in the following year. It will make easier to expand and diffuse the activities year by year. On the other hand, villagers who are visited by outsiders would brace themselves to be monitored and evaluated, and at the same time, they could feel much confidence of showing others the proceeding activities.

Table 5-11 Inter-Location Tour by the Villagers

No. of participants/Tour	No. of tour/Year	Total Participants/Year	No. of visiting villages
8	3	24	2～3

(10) Environmental Education for Children

Since children are playing important role to support their parents' livelihood activities such as fetching firewood and farming, they cannot be left out whenever development activities are considered and envisaged. School curriculum should contain field planting demonstration.

In the village, children used to learn and follow tradition, culture, customs and community events through informal education which is a kind of local knowledge handed down from generation to generation at community and at home. However, through past surveys, it was noted that it is being threatened due to the influence of Christianity and modernization. Number of boys and girls who have gone through initiation ceremony has been declining.

However, no relevant message has so far been conveyed from their parents or teachers of primary schools to children as to due care for environment. Here, it is desirable for them to have right understanding on what has happened in their environment and what should be coped with. As a first step, awareness creation should be take place. Children are asked to gather at school after the class, and film show, drama and band music containing environmental message are played. NGO with ample experience on these activities can provide these material if it is involved in a tree planting campaign. After the entertainment, Forestry Assistant will teach them how to prepare nursery, plant trees and take care of them. Manuals containing pictures are served as useful teaching material for this task. School nursery may serve as the starting point.

Establishment of nursery will be started together with the activity of VNRMC in the same or nearby village. An example was already found in Kaumbata village where school children from Nasonjo primary school established their own nursery adjacent to the village nursery. Wildlife club, which was organized by NGO for the purpose of environmental education and activities, can be the core group to manage nursery. Trees can be planted in their school plot.

Table 5-12 Primary School in the Study Area and Proposed Villages to Work with Them

Name of Primary School	Grade	Location (village)	Name of village to work with
Nasonjo	5	Siyamdima	Kaumbata
Mtengowambalame	8	Simon Mpombe	Ndemanje
Kachere	8	Mdala	Mdala
Monekere	4	Lemu	Lemu
Chigodi	6	Kumisati Chigumula	Kumisati Chigumula

5.4.5 Forestry Extension Plan

Sustainable forest should be developed through pertinent approach of the forest extension plan. It must meet following conditions.

- the reforestation measures must meet villagers' interest and benefit,
- norm of works for reforestation activities must not be exhaustive to the villagers,
- villagers' interests and needs on reforestation should be directly or indirectly reflected into their well-being and/or self-consumption.
- villagers should be helped form forestry groups that facilitate them to develop activities, and
- developed forest must be maintained in sustainable conditions.

Following are basic approach to the forestry extension plan that will be able to meet conditions for developing sustainable forest.

- As regards introduction of indigenous or successful exotic species, the former is basically preferred to apply to reforestation measures for restoring similar natural conditions prevailing before deforestation, but they grow slower than exotic species. Extension service should find a compromising composition for recommending villagers for their out-planting, taking account of extent of firewood scarcity and available land space for out-planting.
- As to target area of reforestation, it should be planned to utilize any available sites where tree planting can be made, mainly in homestead and close proximity area of the villagers i.e. arable area or low-utility sites, shrubs, roadsides, school yard, etc.
- For group activity, it is the best way to organize villagers groups to raise seedling for their reforestation project by collecting or self-supplying seed. Exotic species are partly planned as a trial, since rapid growth species can satisfy villager's desire and needs for forestry products and meet function of soil and water conservation.
- To develop sustainable management of forest and/or public lots, a long-term projection and mutual commitment on proper use of resources are indispensable, and this is an ultimate goal of VNRMP. Steady and aggressive pace of desertification fostered by greenhouse effect may accelerate land degradation in near future, then, villagers will have to guard their natural resources against poaching and theft. Stronger solidarity is required to keep alert patrol around them.
- Reforestation measures should be set at only one step up from an existing level of techniques and must be affordable, easily understood and readily accepted by villagers.

(1) Forest Development Potential of the Study Area

(a) General

The Study Area once carried a large diversities of and densely populated trees before the current population had settled the area. Historical evidence adduced during workshops indicates that there once existed densely developed forests in the area. Remaining varieties of tree species were quite large according to the inventory of trees made during a transect tour of the villages, resembling that found in reserved miombo forests. The size of original vegetation can also be deduced from inventory of the vegetation in graveyards of the target villages. Other than the spots where the dead villagers have been buried, the rest of vegetation in the graveyards is intact and a true reflection of the original vegetation. Most of villagers remember very well about past fertile vegetation. Currently villagers can imagine a landscape of villages surrounded by rich forest and intend to restore such degraded vegetation. Baseline Survey has also conducted an inventory listing of tree species found in the target villages, as summerized Table 5-13.
Mostly, exotic tree species dominate in the upper rank of trees found in the StudyArea, and all of them have been introduced as trees for artificial planting as fuel wood for curing tobacco leaf, fast growing pole wood, or escaped ones from foreigners' gardens. On the other hand, most species of indigenous origin consist of major tree species in indigenous forests with prominent drought resistance. Out of these major constituents of existing stands, rank 1 to 5, rank 8 and rank 10 have been used as nursery seedlings in the Pilot activities.

Table 5-13 Remaining Exotic/Indigenous Tree Species in the Study Area

RANK	ORDER	BOTANICAL NAME Origin	REASON for POPULARITY
1	1.8	***Eucalyptus*** *spp.* Exotic caMaldulensis, grandis, saligna	♦ Favoured for poles and firewood ♦ Grows fast, easily Managed & coppice well
2	2.6	***Mangifera indica*** Exotic	♦ Used for food (fruit) ♦ Source of income
3	3.9	***Senna siammea*** Exotic	♦ Grows on its own after seed dispersal
4	7.3	***Melia azaderach*** Exotic	♦ Coppice well and Fast growing
5	7.7	***Terminalia sericea*** Ind.	♦ Used for firewood and charcoal
6	8.0	***Gmelina arborea*** Exotic	♦ Coppice well, but absorb much water
7	10.3	***Brachystergia bohemii*** Ind.	♦ Used for firewood and charcoal
8	12.0	***Lonchocarpus capassa*** indigenous	♦ Coppice well, resistant to drought ♦ Retained for fixing soil nutrients
9	13.8	***Psidium guajava*** Exotic	♦ Vigorously thriving fruit tree
10	14.6	***Piliostigma thoningii*** Ind.	♦ Used for firewood and charcoal

Note: Ind.; indigenous, ORDER; mean order of appearance in 24 target villages

(b) Area of Forest Development in the Pilot activities

Aerial-photo interpretation carried out by MP has been used for basic estimation on the potential area of forest development. This was revised with the results of Baseline Survey conducted in 2002 and finally again corrected with transect by PIU staff. Any social forest development plan should be based on product requirement of the community that plans it for implementation. Current supply situation of firewood serves as a base of the planning. The estimation is not easy since villagers used to measure wood not by weighing balances but by head-load, and evaluation of wood yield from a hectare of existing forest is complicated because it heavily depends on the extent of deterioration of stands remaining in the woodlot.

Assuming that fetching villagers usually collect decayed debris of twigs and branches fallen or hanging therein, the yield must be derived from density of tree stands and mean height. As no tariff table is available to estimate firewood in the forestry offices, some of the extension staffs

use the following method to do rough estimation of annual wood yield (m^3/ha), i.e., Y = 2HD / 5 where H indicates mean height (m) of the stands and D represents number of stands in a square-meter for a moderately degraded woodlot with indigenous species. In the case of the Study Area, H ranges 3.5 ~ 6.5 and D does 0.5 ~ 2.5, hence 3 m^3/ha is a reasonable estimation for annual unit yield of ordinary woodlots. As concern growing stock, it is estimated as 5~6 times as much as the annual yield for moderately degraded stands. Poaching invaders fell stands or cut live twigs, thus deterioration of the stock tends to escalate in the woodlots located nearer to urban area. In the Study Area, degradation of existing woods proceeds more rapidly in highly populated villages located at southern part than those in sparsely populated northern villages.

Table 5-14 shows current forestry status and necessary land area for planting to self-supply firewood. Recently, villagers used to burn crop residue, dried grass and other non-wood combustible material in addition to wood for cooking and warming rooms. In addition to currently available woodlots, 211ha will be necessary to self-supply firewood provided that current fuel use pattern is extrapolated in future.

The result of estimation shows there is no more room for the expansion of village forestry because land has mostly been allocated to individual village households, and conceivable forms of woodlot development can be classified into three categories, i.e., expansion of privately owned woodlots, rehabilitation of existing lots by facilitated regeneration and practice of AF on crop field. With a view to meeting self-supply of firewood, 38% of the total surface area should be covered with wood lots as against 7% as existing now, in addition to the envisaged practicing of AF.

Table 5-14 Land Use and Potential Area of Reforestation

(unit: ha)

	total surface area in the Ma	remaining available wood lot*	individual lot expansion	existing lot regeneration	AF practice on crop field	additional lot for firewood self-supply
Individual lot	170	138	0	138	0	0
Village lot	135	32	0	103	0	0
Arable land	1,474	0	0	0	786	0
Homestead	545	0	545	0	0	0
Stream banks	38	0	0	0	0	38
other land *	1,678	0	359	0	0	173
Total	4,008	170	904	241	786	211

Note : * including 105 ha of grave yard.

(c) Village Natural Resources Management Committee (VNRMC)

VNRMC, a village organization to be supported by the RFOS, taking charge of forest rehabilitation and expansion at village level, is also planned, functioned as a core of reforestation activities. It is recommended to promote establishment of new VNRMC or consolidation of existing VNRMC. The groups can be established at each village or some of certain number of villages. It has already been confirmed that villagers now recognize necessity of forming group activities for reforestation through participatory approach. Village development committees can play role of VNRMC even though no by-law has yet been drafted for the management of village resources.

Very few villages have so far established their VNRMC and this is a reason that villagers do not have their own plan to properly manage resources available in their villages. Even though they do have VNRMPs, they have not been implemented yet due to lack of instruction, experience, input supply etc. Many villagers have a common mistaken notion that their works must be remunerated with labor wage, as they call it "piecemeal return (ganyu)". RFOS has been eager

to assist villagers to establish VNRMCs, but both budget and staff are not enough to cover to provide assistance. NGOs concerned on environment conservation have also positive attitude toward assistance, but in the most part they lack technical staff to help villagers by giving technical advice for the preparation of VNRMP.

(2) Components of Forest Development in the Study Area

Forest Development Components and Fortification of Participatory Approach

Following four types of reforestation are planned, 1） is reforestation on private land already allocated, 2) - 4） are forest activities on communal (customary) land or common site for public use. It is expected to cover whole potential area in the Study Area through the proposed plan. Following 1） to 4) are a summary of each forestry plan and 5） are summarized all of them in a table. After 5), detail plans are described on b) - e).

1) Individual woodlots and conserving forests at stream-banks or other water sources: Majority part of land in the Study Area has already been allocated to individual household. First type of reforestation is provided for the area where individual villagers plant trees on the allocated land to individuals as a scheme of participatory reforestation. Allocated land consists of homestead area, farmland, fallow land, stream banks, roadsides, etc.

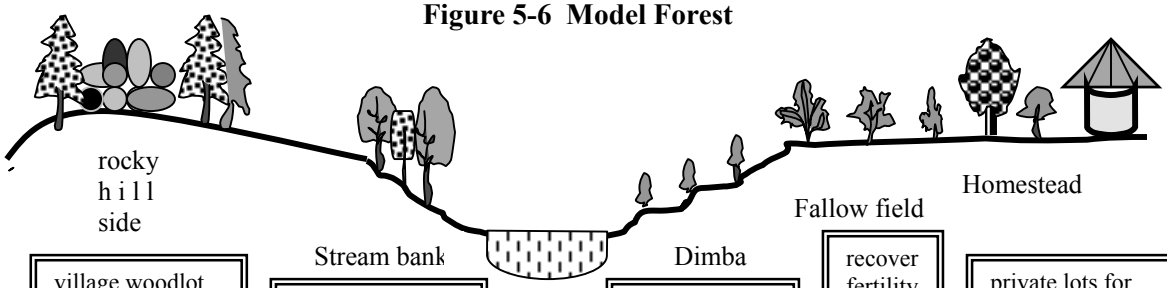
2) Village forests for a trial of fast-growing species: Second type of reforestation is provided for planting trees at unallocated land, if any, in the villages. Reforestation on these village forests also comprises a component for trial reforestation of rapid growth tree species and mixed forest development. Therefore, it is advised to establish this type of reforestation sites around the plots of AF practice. In other cases, if villagers intend to create village forest, villages can choose the area depending on availability of unallocated land, for example, borrowing long-abandoned fallow owned by absentee holders (who often live in urban areas).

3) Environmental Reforestation on common space, i.e. graveyard, sites of borehole/shallow well, road side, school, church, etc.: for rehabilitating deteriorated secondary indigenous forests that fall into the same category of planting on unallocated land for village forest. Other reforestation on public land is also proposed for improving environmental condition that is not aimed at establishing forests fir fuel-wood or timber.

4) Indigenous forest rehabilitation: This aims at reforestation to restore degraded indigenous forest at unallocated land at each village. For instance, at Nanjiwa and Ndemanje Villages, degraded area is found in and out of the villages. This type of reforestation is planned to adopt different technology of reforestation to create village forests.

5) Summary of the forest extension plan: Figure 5-5 illustrates a forest extension plan with forest components.

Figure 5-6 Model Forest



village woodlot making use of unused space	village woodlot for soil conserv-ation on slope	private lots for live hedges to prevent erosion	recover fertility of fallow with AF trees	private lots for homestead plant-ing of fruit trees
about 70 ha, mixed planting of Eucalyptus with indigenous species including *Azadirachta indica, Melia azadirach, Afzelia quanzensis, Senna spectabilis, Senna siamea, Faidherbia albida Albizzia rebbec, Terminalia sericea*	about 40 ha, mainly indigenous species such as *Kaya anthotheca, Pterocarpus angolensis, Acacia polyacantha, Afzelia quanzensis, Albizzia rebbec, Molinga oleifera,* and seed banks of *Gliricidia sepium, Sesbania sesban.*	about 50 ha, mainly fast-growing species like *E. camaldulensis, E. terticornis, E. grandis, E. saligna, Combretum molle, Sesbania sesban, Lonchocarpus capassa, Acacia garpinii*	about 200 ha, drought toler-ant AF species, *Faidherbia albida, Sesbania sesban, Senna siamea, S. spectabilis, Bauhinia thonningii , Leucaena leucocephala,*	about 50 ha as not yet planted space of garden, *Molinga oleifera, Tamarindus indica, Zizipus mauritiana, Anona senegalensis. Carica papaya, Mangifera indica, Persea Americana, Anacardium occidentale, Delonix regia.*

(3) Formation of Effective Participatory Works in Village Nurseries and Out-planting

As in the AF development, organization in charge of seedling raising and out-planting plays key role in the forestry activities. Satisfactory rate of participation can be realized on a basis of close solidarity of participants led by strong and equitable governance. Willingness of the participants will induce better collaboration with extension services, with close contact and mutual cohesion between extension staffs and beneficiary of technical transfer. Positive attitude of the participants towards new skills and useful knowledge can attract extension staffs to the sites of works and workshops. If there are villagers who have ample experience of planting trees, or are actual creators of private woodlots, their experiences can be shared among the villagers along with advice and instruction delivered from the extension services. They can also serve as committee chair-persons or members who are responsible for planning and implementing actual raising of seedlings and out-planting them. Their woodlots gives proofs /evidences on growth and effects of already applied techniques on forestry activities to those who observe them, and even extension staffs make use of their fruit/ experiences to choose relevant method of tree planting. Table 5-15 summarizes conceivable implementation bodies and target area by component.

Table 5-15 Organizations of Implementation and Target of Reforestation Component

	Component of Reforestation	Implementation body		Target area
		Main	sub (support)	
1)	Individual woodlot reforestation	VNRMC	Extension staff	Allocated private land
2)	Trial on fast growing species, demonstration in village forest	-do-	Extension staff	Communal land
3)	Regeneration at woodlots in common land	Villagers' groups	VNRMC	Reforestation at the common area /space
4)	Rehabilitation degraded natural vegetation	VNRMC	-	Communal land

(4) Establishment of Individual Woodlots, Riverbanks and Water Source Conserving Forests

This type of reforestation in individually allocated land has the objective of self-supplying firewood for household consumption, as well that of conserving river terraces and water sources for tube-wells, perennial or seasonal streams. Most of the land along main streams in Kaumbata and Ndemanje villages has already been allocated to individuals. Hence, creation or expansion of individual wood lots along with reforestation on conserving forests at the stream banks or other water sources should be carried out through the participation of individual villagers. Of which, the former has main objective of self-supplying firewood for daily use in future.

In the Pilot Study, villagers created about 25 individual woodlots per village on average, increasing private lots from 83 to 679 in 24 target villages. According to their custom, all the trees standing in their villages belong to individual except those planted on common land. Therefore, housewives go to fetch firewood to her lots or common shrubs on unallocated land. Now that wood resources on common land become scarce, they must develop their own lots.

The VNRMC recruits participants to be engaged in the seedling production in village nurseries provided by the committee. In raising seedlings to this end, they organize a group for sharing works in the nursery, to which technical and managerial support is granted from extension services. The target area to be covered by individual and common wood lots managed by villages is given in Table5-14 as estimated from future supply-demand balance of firewood.

In this connection, the reforestation on stream banks is objected at effective land use and prevention/ mitigation of soil erosion, facilitation of the water harvesting effect by canopy cover, and finally, enhancement of farm productivity in the irrigated vegetable (dimba) field which will be developed along the streams. The active farmers will, on their own initiative, raise seedlings for individual wood lots that are catered by themselves, thereby planting them over stream (and dam) banks or idle dimba as conserving forests. Some villagers have continued to practice such tree planting long before the Pilot Study as already mentioned in Chapter 4.

The tree species to be employed for individual wood lots are initially selected among those recommended by FRIM, ICRAF and Bvumbwe Research Institute, for which seed is readily procured. However, the seed collection from mother trees selected within the villages should be fortified in the long run to achieve higher rate of self-procurement. For those to be planted in the conserving forests along stream banks or other water sources, priority selection shall be given to the tree species with higher survival rates and fast thriving, that are also suitable for improving farm productivity in irrigated plots along the streams and for preventing soil erosion thereon.

Fast growing species such as some species of Acacia, such as *F. albida* and *A. polyacantha* are recommended for reforestation in individual woodlots. Citrus trees, banana, papaya, avocado or bamboo are recommended to plant over stream banks and watershed reforestation that will be able to protect land erosion and supply materials for cottage industry or timber. Also *Khaya anthotheca* (red mahogany, mahogany family) and *Pterocarpus angolensis* though slow growing, are recommended tree species for planting around stream banks (they prefer humid soils to dry land) as reforestation in view of their excellent quality for timber and the fact that they have already been growing along streams, often found in Mdala and Makonokaya Villages.

(5) Creation of Village Forests and Test Trials of Promising, Fast-growing Tree Species

According to the results of Baseline Survey in 2002, farmer's intention of planting trees was limited, in favor of fast growing Eucalyptus species. This is so to speak the positive aftermath of government promotion campaign since 1980 that still continues for expanding firewood and pole production. As it takes time to renovate farmer's concept to diversify the species to plant, it is planned for the time being to begin with improvement and reforestation with conventional fast-growing Eucalyptus species as far as the planned reforestation in individual woodlots with a participatory approach is concerned. However, during the Pilot activities villager's concept and recognition underwent a drastic change as mentioned in Chapter 4, into more progressed one conceiving matters scientifically. Generally, the advantage of planting Eucalyptus is best brought about in semi-arid areas since it can grow fast even in the driest climatic regime. At the same time, they begin to be conscious of shortcomings of relying too much on fast growing tree species that are liable to disturb ecological balance and make bio-diversity narrower including extraordinary consumption of groundwater by fast growing species like Eucalyptus species and *Casuarina equisetifolia* or *Gmelina arborea*.

Also, Eucalyptus species have some other shortcomings: they are highly inflammable with higher risk of catching fire, they form single and exclusive colony, hence they are often inconsistent with environmental improvement, except for such an area of adverse conditions on which only Eucalyptus specie can survive. In other words, little positive effect can be expected if one aims at amelioration of soil productivity, erosion control, increased water retentive function and other common benefits of forests or those of enhancing IGAs and farming productivity. Taking these into consideration, it is planned to try to rectify the hitherto farmer's fixed concept inclined only to Eucalyptus (called "blue-gum") into wider scope of selecting diversified tree species on one hand, as well to select proper varieties of fast-growing Eucalyptus other than *E. camadulensis* for the limited purpose of producing log-wood. In parallel with reforestation with Eucalyptus varieties, other fast-growing tree species like *Senna spectabilis* and *G. sepium* are planted in the woodlots adjacent to village nurseries to be served

as a model of mixed forest and concomitant trial lots in which different fast-growing Eucalyptus varieties are planted for growth comparison, thus promoting farmer's wider vision and innovation of concept.

(6) Reforestation for Environmental Conservation over Common Land,

Table 5-16 Nursery and Out-Planting Indicators for Planning

Item	Description of Standard Planning
(1) Nursery	
location & number	near water sources, preferably near village center, 30 households / 1 nursery
surface area	100 ~ 250m^2/site, depending on area to annually out-plant, 1.5ha / 100m^2
water source	preferably on the bank of perennial stream, large dimba,
filling earth	better to use streamside deposit soils mixed with farmyard manure
compost preparation	1 m^3 / 10,000 pot tubes, cattle /goat /chicken droppings for material of manure
marker ridge	better ridging in nurseries with slope, 10 meter interval for slope of 5%
fencing & shade	thatching grass fencing with live fencing trees, shade depends on tree species
participants	5 m^3 /participant but depending on farm implements available to participants
raising season	beginning from July, sowing in August, hardening in December
seedling specie	diversification is desirable to disperse risk, selection based on outplanting plan
seed procurement	collecting from own seed bank and mother trees, buy only supplementary
seed treatment	removal of seed-cap, nipping at endocarp, immersing warm water etc.
watering/ shading	interval depends on age of seedlings, 3~4mm every 3~5days
weeding	weekly pulling of weeds from germinated tubes and ground
pest/disease control	hand killing, use Guinea fowl for cricket/locusts, spray of garlic extractant
root pruning	for tube-pot seedlings, 30~45days before out-planting,
hardening	requiring 45~60days, removing shade and decreasing frequency of watering
uprooting	up-rooting of bare-rooted stocks with soil cutting knives
transportation	by means of wheel burrows, cereal bags, carefully carried for bottomless tubes
(2) Out-planting	
location	homestead, along farm path, plot boundary, rocky slope, around existing lots
site selection	depending on seedling species, use of wasted, fallow and rocky land patches
site clearing	field burning for killing weed's seed, removing weeds /shrubs and leveling off
seedling distribution	procuring numbers to plant village lots, then sharing among participants
spacing	depending on seedling species and objective, usually 1.5~2.5m x 1.5~2.5m
pit digging	better digging wider and deeper pits, with micro-catchment, or turcana basin
soil treatment	digging pits by separating topsoil from subsoil, mix soil with cinder and humus
transplanting	first planting with tube, then remove it, top cutting of for too-grown seedlings
timely out-planting	better in rainy season, mid January has recorded highest probability of survival
post-planting tending	weed the planted lot when rainy season is over, make 5m wide fire belt
watering	when planted near water source, water in the basin if no rain follows a week
weeding	take care not cut off top of seedlings while weeding, weed once~twice a year
filling scorched hills	to save pitting, use vacant pits of last planting, preferably with another specie
termite control	use extractants of garlic bulbs or leaves of neem as repellants of termites
dry-season planting	applicable to fruit seedlings and AF species with watering basin over pits
inter-planting	use indigenous seedlings for regenerating planting inside indigenous forest
thinning	dense planted lots should be thinned to 2~3m x 2m or sparser after a few years
fire-breaker belt	especially required for exotic (Eucalyptus) species susceptible to field burning
branch pruning	to harvest straight poles, better prune lower branches and use them for firewood
(3) Seed Bank	
site preparation	better choose lowland or dimba to establish high yielding seed bank for AF
planting	to realize early harvest, wider spacing is preferred without injuring seedlings
seed collection	refrain from branch cutting until harvest, collect matured pods before they split
cutting utilization	after trees grow higher than 6m, use cuttings to plant *G sepium* to farmplots
seed self supply	select mother trees for collecting seed for nursery use besides seed bank trees
seed processing	collected pods/seed is sun-dried until splitting off or enough dried they sieve it
seed regeneration	when seed yield begins to decline better replant the bank with new seedlings

Graveyard forests in this area have so far been conserved with almost natural vegetation since felling or even fetching firewood therein has traditionally been refrained. However, vegetative cover in these graveyards is recently endangered due to increasing numbers of new tombs and poaching of branches by invaders, while difficulty arises in the expansion of cemetery and the land procurement for new cemeteries. To cope with this particular issue, as need arises from villages, it is advised to plant indigenous tree species around the existing grave yards, as "inter-planting" along the access roads to cemeteries and the sites scheduled for new cemeteries. It's needless to say that reforestation workers should observe traditional beliefs in planting trees and entering into the yards. Such regenerative planting contributes to increase water conservstion.

Other than graveyard, there is also a space for reforestation in common land, for instance farm paths, road side, yards of church, school, clinic etc. Those public spaces should be filled with tree for environmental improvement. Past campaigns of school pupil's tree planting should be resumed. Implanting custom of tree planting into children can serve as a useful tool for securing sustainable future activities for community forestry and village environment conservation. It is recommended that the concerned villagers group (borehole committee, PTA/school class, etc) should undertake reforestation activities for the ground of such public facilities. Their reforestation activities can be supported by VNRMC for technical and material requirements.

(7) Restoration of Deteriorated Indigenous Tree Forests

A tract of gentle slope extends down to the original streambed of Nkokodzi River in Nanjiwa village, Kaumbata village and Mdala village. The part of gentle slope has already been allotted to village farmers for cultivation, but gradient portion still remains unallocated. Useful tree species have so far been all exploited and natural shrubs thrive over the slope. Even such shrubs have been poached, and it is anticipated to become completely barren sooner or later, unless some rehabilitating / monitoring measures could not be taken. This slope is covered with futile and gravelly soils. So, it is advised to reforest it taking these into consideration. It mainly aims at fuel-wood production, and VNRMC carries out the reforesting works. The proposed works comprise planting on new lots, inter-planting, land preparation in view of accelerating regeneration, creation of fire preventive belt and others. Seedlings for the planting works can be raised in village nurseries.

(8) Summary of Reforestation Activities by Component

Type of forest, target area and objective are summarized by the reforestation component.

Table 5-17 Salient Features by Reforestation Component

Reforestation component	Type of forest	Target area	Main Object
1) Individual woodlot, stream banks, watershed forest	Individual woodlot	Allocated private land (farmland, home garden, etc)	firewood/timber
	Riverbank forest	Riverside allocated to farmer	environment
	Planting border	Homestead or farmland border	-do-
	Planting surface stream	Along with surface stream causes land erosion	-do-
2) Fast growing species trial, demonstration, village forest	AF nursery village forest	Adjacent to AF nursery or individual village forest located in the customary land	Timber production
	Trial forest	-do-	-do-
3) Environmental reforestation at public land	Graveyard forest	Surrounding area of graveyard, etc	Environmental improvement
	Bore hole forest	Surrounding area of borehole	-do-
	Road side forest	Reforestation of road under village O & M	-do-
	School forest	School site	-do-
	Church forest	Church site	-do-
4) Rehabilitation of degraded natural vegetation	Village forest	Communal land	Firewood, timber

5.4.6 Firewood and Material Supply Plan

Firewood demand including consumption by cottage-industry, is 0.44 m^3/year/person. Current population of the Study Area (calculated based on ratio of area) is 11,000, and growth rate is estimated at 0%, since population is decreasing now without any outlook of recovery until 2015. 7,040m^3 of firewood is demand to supply to the population. In addition, further income generation activities will be promoted under this plan. Hence, increase of firewood demand will outweigh wood supply.

AF exploitation and forest extension plan will supply 5,220m^3/year of firewood in the Study Area and 1,820 m^3 of firewood is shortage. It is impossible to cover whole firewood demand by supplying tree energy. On the other hands, current consumption of firewood other than wood is estimated as 4,928m^3/year and balance of firewood can be supplied from this. When completion the plan, newly over 3,000 m^3 will be able to put into soil as an organic Material for soil improvement. Following table shows "Firewood supply plan".

Table 5-18 Firewood Supply Plan

Firewood sources	Area (ha)	Supply per ha (m^3)	Demand/Supply (m^3)
Demand			4,400 note 1)
Supplies			
Still Available lots	138	3.01	415
Reforestation	211 note 2)	3.01 note 4)	635
AF	786 note 2)	1.28 note 4)	1,006 note 5)
Crop residue, weed	1,840 note 3)	1.28	2,355 note 6)
Sub total supplies			4,411
Balance			11

Note 1) Conventional figure of per capita, annual firewood consumption in rural area. Source: Department of Forestry

Note 2) Woodlot, and 20 % of homestead, waste land and other land (included none firewood forest i.e. fruit, school forest, graveyard forest, etc).

Note 3) Half of rainfed plus area under dimba, 1,849 ha consists of all arable land plus other non-woodlot area

Note 4) Current average growth of village forest

Note 5) Estimated firewood volume produced by AF practicing (*Gliricidia sepium*). Source: ICRAF

Note 6) Crop residue, weed is calculated as 80 % of current consumption, area of supply includes farmland and grass land

Table 5-19 Firewood Yield from AF

AF type	Spacing	plant/ha	growth /ha (m^3)	Area (ha)	Yield m^3/ha/yr
・Alley cropping	0.5 x 5.4	3,704	0.7	18.9	13.23
・Intermix alley cropping	0.9 x 1.5	7,407	1.4	5.8	8.12
・Short term fallow	1.0 x 1.0	10,000	7.0	2.2	15.40
・Relay cropping	1.0 x 1.5	6,667	0.5	3.2	1.60
Total growth					38.35
Weighted growth / ha					1.28

Provision of Seed, Cuttings, Scions and Planting Material

RFOS is supplying purchased tree seed from FRIM to VNRMC for reforestation project. Also, donation of AF seed from ICRAF can be counted for new development of AF into the target villages. The same procedure regarding seed and material supply will be employed for the proposed implementation of the plan. Meanwhile, VNRMCs' activities have to be suspended when the supply is delayed. There is also occasional lift of extension activities by RFOS. Thus critical factor to control forestry activities must consider issues such as materials supply mainly seeds and the extension services.

Therefore, trial on alternatives i.e. seed sources or seedling pot tubes, becomes key factor for O & M of sustainable village and individual woodlots / forests. Since AF nurseries are planned to produce propagation material such as cuttings, scions, grafting stocks of fruit trees or AF material, mother tree etc., a device should be examined in a way that villagers will propagate seedlings by using stands in homestead or other places as mother trees for self-supplying seed collection. Further, trials are suggested for raising seedlings by means of ground bed instead of polyethylene pots. With regard to these techniques, ICRAF researches will be available to the planners to meet the requirement.

5.4.7 Income Generation Activities

Development Potential

Rationale

Rural population have ever tried a great many components of IGAs under the assistance of NGOs, especially those handling micro-credits, but most of them have not made success or

ended up in failure because of lack of outlets of products, of difficulty in procuring inputs or in acquiring skills. In order to compensate slow return of forestry or AF activities, it may be the best way to couple forestry woks with IGAs that can make use of resources available within the villages where forestry works are implemented. If IGAs are planned to make forestry works more sustainable, it is an essential precondition that participants in forestry works can be engaged in the introduced IGAs so as to utilize benefits brought from them for energy of the efforts to promote forestry activities. There have been reported many failure cases where beneficiary of IGAs quite differs from participants in forestry operation. Because slow acting woodlots, forests and AF plots will arrange desirable environmental order to sustain IGAs, inequity will result from a discrepancy between benefit takers of IGAs and effort makers of environmental conservation. As far as IGAs consume communal resources, participants in IGAs should replenish what they have consumed by reforestation and other relevant activities.

Market

A few Markets are located in the vicinity of the Study Area, such as Mombo trading center, Dziwe trading center and Lunzu Township Market. The former two markets open twice a week, namely Wednesday and Saturday, and the latter does every day. Vegetables, cereals and livestock produce are traded in these markets throughout the year. If sufficient lots of vegetables can be marketed from the Study Area, direct sale to larger markets including urban markets in Blantyre and Limbe is also possible depending on their quality and quantity of demanded lots.

(1) Vegetable production / sale by means of treadle pumps

As agriculture serves the mainstay of villager's life in the Study Area, IGAs are as a matter of course mainly confined to the activities related to farming, as well as availability of resources within the target villages. Their farming has faced with various constraints. Prevailing climate within the Study Area has a rainy and a dry season in a year but the precipitation occurs as a rule in rainy season only and it shows a long declining trend. Another farming problem arises from depleting soil nutrients caused by soil erosion (both surface run-off and wind) that is often fostered by deforestation. However, year-round production can be realized in very limited farm plots along perennial streams where irrigated farming can be practiced to produce value-added cash crops like vegetables, beans, spices, fresh maize-cobs, sugar cane and sweet potato.

Farmers could avail water from perennial Lunzu river and its tributaries such as Nkokodzi, Ntenjela and Nasonje as well as Milala and Namingamba tributaries of Nkokodzi, Currently, small-scale hand-irrigated gardening has been practiced on the terraces of these streams for raising vegetables. A serious problem also arises from yearly dwindling surface water in these streams where hitherto perennial streams have dried up as early as July or August and farmers have to dig water pits on the stream beds to extract depleting submerged flow later.

As the catchment area of these tributaries is limited and available quantity of water for irrigation is also under the declining trend, room for the expansion of vegetable garden plots equipped with small-scale treadle pumps is narrowed contrary to expanding demand for irrigation. Current vegetable farming is little diversified, with quite primitive production techniques due to insufficient technical guidance by extension workers. Hence, there is room for improving usage of irrigation water, maintenance of irrigation facilities, crop variety diversification through the instruction by extension services. It is indispensable for these irrigation groups to conserve water sources by planting trees, since they have been participants in forestry and AF. Peak season of irrigation falls in dry season after maize harvest and out-planting trees, during which demand for vegetables and irrigated crops becomes bullish with attractive price levels.

They are advised to practice AF on their irrigated plots to supply nitrogen and organic matter thereto. Stream banks and dimba where their vegetable plots are located are highly erosive, so that particular protective measures should be taken thereon, such as marker ridging with

Vetiveria zizanoides, and box hills with AF hedging species. Here, use of *T. vogelii* should be refrained because this shrub tree attracts nematodes.

Irrigation sub-committees have been established in all the villages adopting irrigation with treadle pumps. Under the village sub-committees, production / sale groups under the guidance of extension staff have been established so that group activities are envisaged for purchasing input material by themselves, planning crop rotation, quality management prior to marketing to mutually adjust quantities and period of vegetable marketing, thus avoiding glut supply of single kind of vegetable with higher risk of dumping sale. Only a half of the villages in the Study Area face to large perennial streams, and this has limited beneficiaries of irrigation due to lack of reliable water sources during dry season, since only ephemeral water is available in the tributaries with limited catchment area.

Use of treadle pumps is recommended to establish participatory vegetable / green maize and sugarcane production for the following reasons:

a) treadle-pump does not need marketed fuel that is expensive for farmers,

b) it has been produced in Malawi and spare parts are readily available,

c) it is convenient to carry and lasts long if used properly,

d) it suits for use in a group where even children can tread it for lifting water,

e) it costs cheaper than other irrigation devices, cost can be covered in a few years,

f) it enables participants to save energy to be consumed for fetching heavy water.

In view of current trend of dwindling surface water, construction of weirs is recommended in parallel with tree planting in the watershed, along the main tributaries, in order to store water for the dimba irrigation. Based on the discharge condition, interval of weirs is proposed as about 1.0 km in a tributary. Two types of weirs are advised. Type I dimension is 8 m width, 2 m in height, capable of storing surface flow equivalent to 12,000 m^3 and the other with 5 m width, 2 m in height for small tributaries storing 7,500 m^3. They are filled with stone pieces pasted with cement, or indurated by gabion nets (2.0m x 1.0m x 1.0m) if any available. Considering evaporation, 50 % of water, 90,000 m^3 in total will be usable and about 12 ha of irrigation plots in dimba will be irrigable. After construction of weirs, dredging should be necessary once per year by the participants in treadle pump irrigation. Dredged earth can be used for filling in planting pits of out-planting trees in the watershed. In this connection, tillage practice with marker ridges and digging of drain channels will be advised in the parcels along perennial streams where remarkable soil erosion occurs.

(2) Goat rearing

Goats have been kept in many households, but recently number of households keeping goats tends to decline on account of frequent theft, prevalence of skin disease and equinococcus, accelerating impoverishment of village households etc. Herds of cattle almost disappeared in the Study Area as an aftermath of chronic robbery by burglar groups invading beyond borders. As a result, major part of grass resources have been kept idle. This is why the extension staffs in charge of Pilot activities introduced Boer goats from Mwanza District to distribute them as stocks to the nursery participants who planned to rear them. Boer goat can grow to twice as heavy as ordinary Nubian variety if properly fed, and their hybrids are robust and easy for farmers to rear. This variety can tolerate drought conditions but susceptible to humidity, liver fluke and FMD. Fortunately, the stocks brought from Mwanza District have adapted themselves to dryness in the Study Area and they have been favorably and rapidly multiplied in spite of repeated damages of theft. The conceivable reasons why goats rearing can successfully be diffused are as follows:

(1) Goats can be fed with naturally grown grass and crop residue,

(2) even children can rear them without particular skill,

(3) they have short maturity with a cycle of seven months for bearing offspring,

(4) they are readily sold at local markets at favorable price to the sellers,

(5) most village households have experience to rear them and need them as live deposit that can be converted into cash as exigent needs arise.

It is advised that participants in nursery raising and out-planting works join into a goat-rearing group because goats can be fed with fodder shrub trees and goat dropping can ideally be used as material of manure used for nursery raising and out-planting. Many tree species are useful in feeding goats and some of these give also edible fruits, such as *Mangifera indica*, *Persea Americana*, *Tamarindus indica* and others are utilized as green manure, for example *Sesbania grandiflora,Leucaena leucocephala, Crotalaria juncea*.

Participants should provide catering for feeding she-goats with maize bran for supplementary feeding to facilitate better lactation, and also feeding weaning kids with it to stimulate growth. Deworming is necessary to control liver fluke and intestinal parasites at around the age of six months. Efforts of participants to control contagious diseases such as FMD, equinococcus, brucellosis, anthrax and skin ulcer are also essential through vaccination and alert vigilance with faster isolation of infected herd.

About a dozen of breeder goats are necessary to establish pooled a goat stock for group rearing, consisting of a fourth of bucks (not castrated) and three fourths of she-goats, and offspring is allocated as private animal for the participants The participants who received offspring should give back the first kid to the pooled stock herd. The members of a rearing group cater during daytime in the huts (Khola) where goats are tethered, fed with cut grass, litter of vegetables, crop residues and water. They also pasture on crop field during off-season, and keep the animal inside their houses during night lest they should be stolen. It is advised to keep goats at night inside bed rooms constructed with fire-brick and cement-added wall mud because thieves aim at houses made of sun-dried brick and ordinary mud that can be dissolved in water and then brick cakes are easily pulled out.

(3) Bee keeping

In the Study Area, apiary is only observed in Ndemanje village where traditional hive-boxes are used. Though honey plants as nectar sources do not remain much as deforestation has been escalated, the expansion of bee-keeping is possible making use of stream-side woodlots or shrubs and ample mango trees. Installation of new comb-boxes can be practiced at shrubby areas along Lunzu river and its tributaries, Nkokodzi, Milala and Ntenjela streams. Through the process of planned reforestation of such indigenous deciduous trees as *Brachystegia* species, *Acacia* species, citrus trees and other honey plants as nectar sources, together with vegetable flowers like rape, the scale of bee-keeping can be gradually expanded. Referring to the scale of apiary practiced in the vicinity, it is advised to start with ten boxes per unit keeping group.

Bee-keeping does not require feed and heavy labor, and rural population has made use of honey bees and wild African wasp to collect honey, collecting it during night by burning honeycombs with fire and killing bees. This primitive honey collection gives heavy damages to swarms and also dangerous to honey collectors. So, NGOs plan to popularize improved hives so that collectors wear bee-suits and blow smoke to deactivate work-bees for a while to collect honey several times from the same hive. Honey collection shows a peak period during dry season without any farming practice, and this is great advantage to the farmers engaged in apiary.

Unlike other IGAs, bee-keeping requires special skill to facilitate and maintain honeybee's colonization, prevention of invaders and predators like mice, ants, yellow jackets. These skills

are required to prevent early absconding and promote higher yield of crude honey. Likewise, it is essential to get accustomed to identify colonization, to judge period of timely honey collection by keen and frequent observation of swarms. Selection of hanging sites of beehive boxes constitutes one of the basic factor to induce earlier colonization where height from the ground surface, relative luminescence, masking effect of ambient biotope, wind or condition of ventilation are related to the preference of bees to colonize the swarm. These conditions are only learnt from experiences of professional honey collectors.

Another important factor stems from presence and density of nectar sources, and ideal conditions for honey production lie in the abundance of nectar plants flowering every month, though major blossoming months concentrates on dry season. In this context, adequate scale of bee-keeping should be proportional to the availability of nectar sources, in other words, it will be necessary to plant trees of nectar sources to make bee-keeping success in the long run.

(4) Small-scale fowl rearing

Since almost all farm households actually rear or have experience of rearing fowls in a limited scale, it is possible to organize groups for rearing fowls, especially chicken and Guinea fowls that can be kept in a free barn system around homestead area. All farm households in a village can be selected as target of husbandry orientation for which group purchasing of seed chicks / fertilized eggs, feedstuff, and sale of produce by group are programmed. In this connection, Guinea fowl rearing has not been introduced to the Study Area. It follows that not only farmers but also extension staff should be instructed to establish rearing techniques thereof. Since NGOs that extend activities in the vicinity of the Study Area have ample experiences of the rearing, their cooperation can be counted on at the beginning of the rearing as to purchase of seed chicks, rearing skills and sale tactics etc. Another option lies in the technical transfer from veterinarians stationing in the middle part of Malawi to those who are in charge of the Study Area, because Guinea fowl rearing is getting popular in central Malawi. Initially, the produced fowls in a group would be self-consumed but sale can be planned by themselves.

In Blantyre, a cooperative for poultry rearing was established in 1991, with the currently functioning 17 groups in which 600 members have been affiliated. These cooperative practices planned sale of the products under the guidance of ADD. From this experience it is advised to join the existing cooperative or to organize a new cooperative for coordinated sale of what is produced by the group. Guinea fowl can be to some extent fed with natural feeds except cereal grains, and this makes them differ from chicken relying mainly on feed grains, evidently competing with human food. It has another advantage, immunity to New Castle disease that has seriously affected survival of chicken reared in Blantyre District.

A serious problem has arisen from hatching of Guinea fowls, for eggs of fowls constitute sale benefits along with marketing of matured fowls but to realize laying of many eggs by a fowl, incubation by chickens should be employed to hatch chicks of fowls. However, nowadays chickens are rarely available in the Study Area on account of prevailing New Castle disease. It is possible to make female Guinea fowls hatch their own eggs, but then these females stop laying eggs and eventually affecting sale of eggs. Two ways of solving this have been proposed, using an incubator for a substitute of chicken and employing female Guinea fowls at the sacrifice of egg laying. Both methods can be done only during rainy season because Guinea fowls lay fertile eggs only during rainy season, and the range of acceptable atmospheric humidity for hatching eggs prevails only during the same period.

(5) Storage and primary processing

Seed production of sweet potato and cassava has been tried in the Study Area with a view to diversifying the staple crops and procure their yields. However, Mango fruits on dispersed Mango trees are abandoned and rotten due to lack of storage or processing techniques. Within

the Marketing sphere of Lunzu Township, primary processing is not yet developed, nor any trial seen at household level. Food storage techniques that can be extended at household level include dried Mango, dried chips of sweet potato, boiled and dried sweet potato and bean cake dressed with cane syrup. The methods of food storage are also developed by ADD and diffused through extension activities, and now they are available for farmers. As far as the existing techniques are concerned, villagers can obtain the skill of primary processing through the instruction by extension staff of community development. However, so long as diversified primary processing techniques are concerned, technical transfer to both extension staff and villagers would be necessary because both of them have not any practical experience thereof.

Introduction of sweet potatoes for processing aims to alleviate chronicle starving of majority villagers from late dry season (October to November) to late rainy season (March to April), not relying too much on dried pumpkin leaves (called "Mfuso" that does not contain nutrition but let eaters forget hungry feeling for some time) but trying to feed themselves by their own efforts. This is why the extension staff of the Pilot Study decided to widely diffuse sweet potatoes in the target villages. They began demonstration in June along with training of tree nursery practices. Original idea resided with desire of some villages for the expansion of their tree nurseries. The area expansion may enable them to plant sweet potatoes therein, thus capable of distributing among nursery members (free of charge) and interested villagers (charged).

All 24-target villages now have village potato-vine bank that can supply vines to interested farmers in the villages. Seed potatoes have been planted near tree nurseries and other suitable plots to plant potatoes. They were purchased from Bvumbwe Agricultural Research Station located in the suburbs of Blantyre City, consisting of four varieties, namely, Kenya, Mugombe, Sanya and Salera.

They mostly thrive in a vigorously growing with vines measured at 50cm long, reaching matured stage of cutting for transplanting in planned plots. Under their leaves aerial roots are formed that shows high survival rate when transplanted into field. If they are planted in January, farmers can expect harvesting in April ~ May. 14 villages expressed willingness of promoting sweet potato production and 3 of them have been selected as demonstration sites for potato processing. PIU provided potato tubers, firewood and such cooking utensils as bamboo-screen mats, steaming-pans and knives. PIU members demonstrated villager ladies how to process steamed and dried potato slices and the villagers practiced it. Improved Enzaro-Jiko stoves were used to cook potatoes.

Processing Procedures:
Washing potatoes - putting gravel pieces at the bottom of cooking pots covered with straw and pouring water so that gravel is immersed - packing potatoes and putting pot cover - steaming for 30 minutes until potatoes can easily be broken into two pieces - cooling and slicing into 3 ~ 4 long and flat pieces - spreading cut slices on mats and keep under the sun for several days until they are dried to contain less than 20% moisture - storing dried slices in between dry grass panicles so that white crystals of starch covers over the surface of slices.

(6) Inland fishery

There are many artificial dams constructed by the Government 40-50 years ago in Middle Shire, counting 22. Some of them have already been silted up, like Ntenjela Dam located in the south of the Study Area. These dams serve precious water source for villagers, and fish lives in about half of them. In order to keep water storage capacity and lacustrine resources, it is imperative to increase crown coverage in their watershed located upstream of the dams. In particular, fishing people should join to organize groups to plant trees inside their catchment areas to prevent siltation and to secure flow into them. The following is a typical example to realize this advice.

In the center of the Study Area, Milala Dam is functioning as a precious water source where three villages, Teula, Manjelo and Lemu occupy the lakeside. The dam, constructed in 1958, has fairly large catchment of around 5.8 km^2 and effective storage capacity of 40,000 m^3, with the maximum depth of 4.5m, storing water of somewhat eutrophicated but still acceptable quality for habitats. Here, a few hundred kilo-grams of Nile perch, *, Tilapia rendalli*, *Barbus paludinosus, Oreochromis shiranus* (predominant)*, O. mossanbicus* and *Clarias gariepinus* have annually been caught. It has been served as a supply source of fingerings to inland fishery institute located at Domasi in Zomba. Test catch recorded 52 - 158 kg of landing using a borrowed net.

Already a fishery committee had been established with an agreed constitution for fishery management, managed by 5 members selected from the three villages mentioned above, holding a bank account for accounting. To make efficient use of existing fishery resources, material of fishing net (nylon net, ropes, float, sinkers, raft board and used tires) was supplied and techniques of their usage and repairing were instructed. Further, staff of Kashintula Fishery Research Center was invited to give demonstration of fishing, conservation practices for fishery resources to the members of fishery group. Member of fishery are the same as those of nursery and out-planting in three villages concerned, and they are fully aware of importance of watershed rehabilitation to sustain fishery resources in the dam.

(7) Bread Baking

Home-scale bakery using local product of white maize four has successfully been run by villagers group in TA Chigalu with a support from an NGO and handy and cheap baking ovens manufactured from metal water drum are available through the extension staff in charge of community development. As considerable amount of firewood is needed to bake local bread, only the villages with ample firewood supply can run bakery, but this activity has an effect of facilitating participants of the bakery group to plant fast-growing trees to sustain it. The following is a successful example experienced in the Pilot activities.

Based on a proposal from Blantyre District Gender Office, the extension staff reviewed the significance of introducing this component to the Study Area. The conclusion was positive because scone (buns) type bread is now becoming daily rural staple in this District, and if locally available material and inputs can be used in this activity, it can contribute to economic development of the area without spoiling natural environment. After an ample debate, it was decided to introduce a home bakery to Manjelo village located half way from two trading centers, namely Lunzu and Mombo. The village was selected based on willingness, achievement in the previous year and expected advantage of sale in the area remote from existing trading spots. Two extension staff belonging to the above mentioned office made a design and instructed 12 members of established group in Manjelo Village how to bake home made bread and sell it. The group mastered the techniques and management of bakery, continuing baking twice a week and the sale of products within the village. All the products have been sold to villagers and inhabitants of adjacent villages.

(8) Livelihood improvement

- Improved fireplace

Serious deficit of daily consuming firewood prevails not only in the Study Area but also in the entire watershed. Women spend three hours to seek for and fetch firewood everyday. Despite that acute desire for using improved fireplace that can save the amount of fuel expands among housewives, the actual use couldn't be observed except few cases in the Study Area. Also, the employed fireplaces had not enough rigid structure to last for months, but are subject to get broken through weathering in a few months, leading to failure of diffusion to the neighbors.

Under such circumstances, possible and practical measures to introduce Enzaro-Jico type of fireplace that is increasingly diffused among households in west Kenya and other places have

been tried. As a result, more than 550 improved fireplaces (called "mbaula JICA") have been installed, out of which 350 have still been utilized for daily cooking. Based on an experimental trial, 18% of firewood can be saved as compared with conventional three-stone stove. Also, the improved fireplace can help keeping cooking people's posture upright, thus allowing them to relax during cooking. Some modification has been added so that the improved fireplace is readily accepted among villagers, including variable number of cooking pits according to number of family members, use of sun-dried bricks for molding furnace.

A problem encountered among builders of improved stove was lack of long and thin stone pieces to be used for assembling top part of cooking range. Other material, brick and mud, is readily available anywhere else. Some stoves had cracks over stove range and eventually collapsed, but the broken part can be remolded and repaired. Improved stoves with 2 cooking pits have also been devised and installed instead of 3 holes. Rainy season is not suitable to install stoves because sun-dried brick is difficult to make and the installed stoves take long time to get enough dry to be ready for daily cooking.

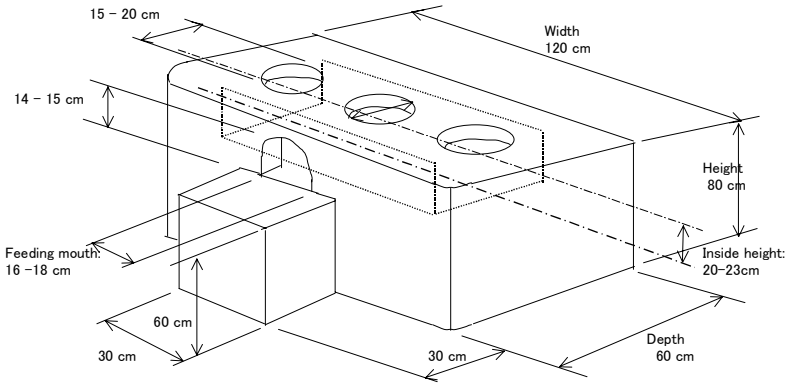
Installing rates and actual use have some bearing to availability of firewood. The obtained result shows higher rate of diffusion as firewood supply becomes tight. Whereas, rate of continued use of already installed ones gives lower percentages in relatively ample firewood availability, possibly because of cumbersome repairing once the part of pits gets broken. In such cases, households return to traditional three-stone fireplace (mafwa) for they can also burn dried grass as a combustible material.

After the trial period of using sample fireplaces with necessary re-modeling and the recommended type for popularization is selected, extension staff displayed the sample to demonstrate how to install and utilize it. They chose a few housewives and their children willing to employ the improved type and teach them how to make it. Thus, children learned the installing techniques and improved cooking in order to economize heating efficiency to master and to function as expertise instructors. During ten days after the completion of the fireplace and allowing it to dry, the cooking time and consumed firewood were recorded. The record can be compared to that after the drying process.

The extension staff employed a woman's group and children to propagate installation and use the improved fireplace to the interested households. After a few months, the mobilized children fulfilled their duty to teach method of installation for their friends' households and even beyond the village boundary. Thus, it has been diffused at a faster rate than initially expected. In addition to the efforts paid by the extension staff, contribution of the group and children (established in Kumisati Chigumula village) is highly evaluated. There are a number of conceivable reasons that have enabled the community to employ improved fireplaces, among which:

- Housewives have long suffered from short availability of firewood, and really wish to save it as much as they can,
- The employed group was very active to extend the improved fireplaces wider,
- The material need for installing them is readily available around the villages and
- The villages headed by village headwomen tend to have installed more improved fireplace than those headed by headmen, because of higher interest and demand.

Figure 5-7 Improved Fireplace



Strategies of developing IGAs

The Study Area extends over a hilly plateau (EL. 500 - 700m) where river terraces are allocated individually to villagers based on their usufruct right. There has not found any suitable site for farming water use than small reservoirs established during 1950s for dam construction with government initiative. Recently, decentralization has been becoming a leading policy and top-down type of decision for dam construction is fading away. Taking these into consideration, it is advised that villagers establish the plan of IGAs by themselves in the following Manner:

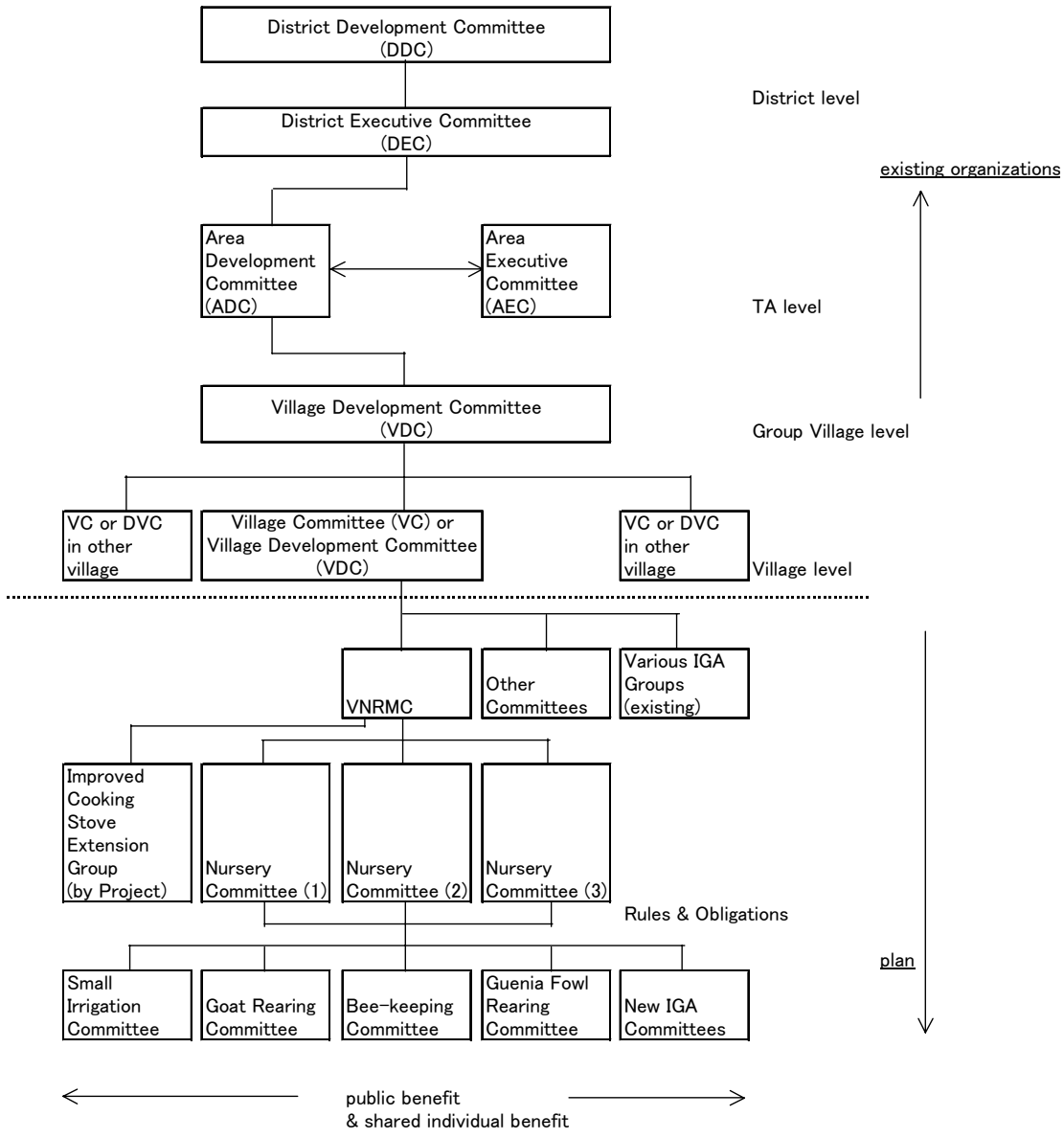
- To select IGAs based upon deep-rooted and traditional skills to the area concerned that can be readily implemented and sustained by local population. These include vegetable production in dimba (marshy areas), goat-rearing, apiary and Guinea fowl rearing.
- To try to establish IGAs that can make use of readily available resources within villages, otherwise participant groups should pay for material or feed affecting profitability.
- To avoid internal competition with sales outlets as much as possible as recommended in commodity campaign known as "one product in one village".
- To provide an equitable distribution of inputs for IGAs among forestry participants groups so that as many of them as possible have equal opportunities to be engaged in the proposed IGAs.
- To attempt promotion of livestock husbandry taking account of environment in the Study Area where dietetic behavior of villagers based to cereal consumption and organic matter has been depleting in the soil.
- Likewise, to try new, rational storage methods and primary processing of farm produce to make more rational use of their products like sweet potato, mango, pulses and sugarcane.
- Keeping deep-rooted individualism (lack of experience in group activities) of villagers in mind, to formulate the plan more oriented to human development that can make them accustomed to group activities.
- Since technical transfer by extension staff is limited in both quality and quantity, and it lacks dimension of their living, the plan should include technical transfer to FA along with that to villagers.
- Basically, FA, FHA or CDA are responsible for the technical transfer to villagers, which that to the instructors or extension staff is performed by experienced RDP, FA in other jurisdiction or NGO staff with ample experiences or experts of related research institutes. Especially, the instructor of apiary should be selected from well-experienced experts with sufficient background.
- To promote diffusion of improved fireplace so as to limit acceleration of firewood consumption through due demonstrative schemes for better cooking and improvement of living standard.

5.4.8 Community Organizations

(1) Basic Approach to Community Organizations

(a) Importance of Community Organizations

Figure 5-8 Organizational Structure of Community Organizations



(1) Accessibility will be increased to be established more small nurseries in the same village.
(2) IGAs are also increased or separated along with the new nursery.
(3) Also increasing the accessibility for Improved Cooking Stove by meas of establishing other small groups. Once the its group completely finished to make the stoves in the group, the group will be dissolved.

The VNRMP is a plan for the improvement of the community, which is prepared by the community based on its needs and should be implemented by community organizations. As the VNRMP is a comprehensive plan including measures in many kinds of disciplinary such as

public infrastructure, agriculture, AF, social forestry, livelihood improvement, education and awareness creation, etc., several community organizations by objective should be formed for the implementation of different components of the plan. In addition, each of the Village Committees (VC) is to be formed for the supervision, co-ordination and support of these various community organizations. VC should be systematically integrated into administrative networks, as shown in Figure 5-8, so as to communicate with relevant offices for appealing, requesting and reporting their needs, issues and contributions.

(b) The Role and Structure of VC

For the implementation and Management of VNRMP discussed above, it is essential for each village to have an organization capable of formulating an overall work plan, supporting and overseeing various community organizations and coordinating their activities. Under the District Development Planning System (DDPS), the VDC is formed at Group Village Level and it is composed of 3 representatives (village headman/woman and one female and one male representatives, respectively) from each village. To implement VNRMP, each village should prepare a Village Committee consisting of these 3 village representatives and the representatives of other newly formed or existing community organizations, responsible for implementing the VNRMP components.

Placing Village Committees at the village-level sub-committee of VDC is not only in line with the above DDPS but also acts as an important point of contact among community organizations in both horizontal and vertical Manners. The organizational structure of VC and other community organizations under the DDPS is shown in Figure 5-8 above. Here, it should be stressed again that leadership training and management training for the committee members are quite necessary to build capacity of administration as public servants.

In the above structure the VC's roles should be defined and summarized as follows.

Table 5-20 Roles of VC

role	activities
Formulation of VNRMP work plan at village level	• Identification of villagers' needs and preparation of VNRMP through PRA and PCM • Preparation of overall work plans for VNRMP • Planning of organizational structures
Implementation of public works in the VNRMP	• Mobilization and utilization of labor and local resources (land, water, sand, rock, grass etc.) • Implementation, monitoring, evaluation and management of public works
Supervision and support of community organizations for the implementation of VNRMP	• Support for community organizations in drawing work plans • Support for community organizations in implementing activities in the fields such as procurement, construction and management. • Support for community organizations in monitoring, evaluation and management of activities
Coordination among community organizations for the implementation of VNRMP	• Coordination of activities among community organizations • Mediation of problems among community organizations or within a community organization
Liaison between community organizations and VDC	• Liaison and co-ordination between VDC and community organizations

The VC is composed of VC chairperson and vice-chairperson, VC secretary and vice-secretary, VC treasurer and assistant treasurer, village headman/woman, who would promote the VNRMP as the core members of VC, as well as the chairperson and the treasurer of each of the community organizations.

The work carried out by the VC members should in principle be onerous and the fund is considered to be best obtained through parts of profits accrued by each of the community organizations, though no particular allowances have so far been paid to them. However, the matter should be defined and prescribed in the VC operational framework, which will be set by VC members. As of September 2004, VCs have been established in 77% of 24 target villages in the Study Area, but no committee member has ever received any allowance from the villages due to lack of funs kept by the committees.

(c) Types of Community Organizations and Methods of Organizations

The measures and activities proposed here, as well as other development activities, may be loosely classified into two categories depending on the target beneficiaries as follows.

- Measures, which bring benefit to all the villagers, such as rehabilitation and construction of social infrastructures, reforestation of village forest areas, effective use and management of existing water resources, etc.
- Measures, which bring benefit to individuals who are participating the activities, such as small-scale irrigation scheme, introduction of AF practices, various IGA activities, etc.

For the former category of activities, it is best planned and implemented in an equitable manner by all the villagers communally. Some of the activities of this category, such as public works including rehabilitation of roads and bridges and construction of weirs, may be organized and villagers may be mobilized directly by the VC, with technical expertise provided from relevant agencies if necessary. Others, which are also for the interest of the public, such as reforestation of communal areas and management of existing water resources, may be best organized by more specialized committees such as VNRMC and the Dam Committee with technical support by extension staffs. The members of the above mentioned community organizations, which act for the interest of the wider public, as well as the VC should be elected in an equitable manner by the villagers, who fully understand the objectives and roles of the organizations.

For the latter, groups will be formed by individuals who are interested and willing to take part in particular activities. Establishing equitable rules of sharing both responsibilities and profits among the group members is essential for the sustainable evolution of the project.

(d) Supporting System for Forming Community Organizations

Currently, formation of community organizations is initiated and supervised by extension staffs in the related fields. For example, Village Development Committee initiates the VNRMC by the help of forest extension services. IGA groups do IGA Committee and the Health Committee assisted by the health surveillance officers. However, as described previously, extension services are not functioning well and the majority of extension staff who are engaged in such activities are not trained in forming community organizations. Thus, the sensitization of the community and formation of community organizations will desirably be taken care of by the donor agency or an NGO with ample experiences in the field of human resource management and capacity building (hereafter referred as community organization expert). Relevant extension staffs will take part in the above process, that are initiated by the community organization expert, as on-the-job-training, so that they will be equipped to assist formation of community organizations, awareness creation of the community, extension and education in addition to their assistance in technical matters.

(2) Procedure and Measures for Forming Community Organizations

(a) Procedure of Forming Community Organizations

Following the above-mentioned basic approach and recognizing the weaknesses found in the existing community organizations, community organizations will be formed and strengthened so that they will be engaged in the implementation of the project in a sustainable manner. Table 5-21 shows the process of formation and capacity building of community organizations. First of all, the PRA and PCM will be conducted with the participation of the whole community in order to identify and analyze the problems and needs of the community and how to meet them, as well as to define the measures to be included in the VNRMP. Then, after conducting a series of sessions for awareness creation and sensitization of the community relevant to the activities set for the VNRMP, formation of community organizations will take place. For the formation of community organizations, members will be selected and then leadership and other training is provided to the members before setting up the organization's operational framework and drawing work plans (implementation plans, an example shown in Table 5-21).

Table 5-21 Procedure of Formation and Strengthening of Community Organizations

	Item	Activity	Organization
1	Analysis of community needs Drafting of VNRMP by villagers	PRA and PCM	The community organization expert / C/P organizations (OJT)
2	(Sensitization of community)	Open air gathering	The community organization expert / C/P organizations
3	Formation of VC (1)	Election of two VC members (village representatives)	The community organization expert / C/P organizations (OJT)
4	Formation of VNRMP community organizations (1)	Defining members (participants) for community organizations Selection of group representatives to the VC	The community organization expert / C/P organizations ditto
5	Formation of VC (2)	Finalizing VC members	The community organization expert / C/P organizations (OJT)
6	(Leadership training)	Leadership training for all the community organizations	ditto
7	(Capacity building for members of community organizations)	Study tours to relevant and advanced projects	The community organization expert / C/P organizations
8	Formation of VC (3)	Setting VC operational framework Drawing VC work plan	The community organization expert / C/P organizations (OJT) The community organization expert / C/P organizations
9	Formation of VNRMP community organizations (2)	Setting operational framework of each community organizations Preparation of project plan Drawing work plan	The community organization expert / C/P organizations (OJT) The community organization expert / C/P organizations ditto
10	Monitoring, evaluation and support of VC and VNRMP activities		The community organization expert / C/P organizations
11	Post-ante Evaluation		The community organization expert / C/P organizations

Note: C/P organizations include verification study team, and the number shows time sequence

(b) Needs of Analysis and Sensitization of the Community

1) Preparation of VNRMP based on the needs analysis of the community

Through the whole community will be facilitated in communally analyzing their problems and drawing a basic plan of community development and environmental conservation. For this purpose, the community organization expert will organize a 5-day PRA/ PCM session in each village. The concept and the objectives of VNRMP should also be fully discussed during the

PRA. Based on their identified needs and the objectives of the VNRMP, the components of the development plan should be defined by the community during the PRA/PCM session. The organizational structure of the development plans should also be discussed and the functions of VC, other community organizations and implementing agencies need to be well understood by the villagers. By planning the VNRMP themselves through PRA and PCM the villagers will them acknowledge themselves as the owner and the implementers of the VNRMP, instead of taking it as something imposed by outsiders. Therefore, this exercise should include as many villagers as possible as well as relevant extension staffs to prepare the outline of development plan consented by the community as a whole. This process will enable the community to attain the ownership of VNRMP. Forestry and agriculture extension staff, who will provide the community with technical support, have to explain what they can do and what they cannot do, so as to avoid the community's excessive dependency on the government services.

2) Sensitization of the community

After the PRA session, the community suffering from lack of information or biased information, needs to be further sensitized over the issues related to the components included in the VNRMP in order to expand their knowledge and understanding. Relevant experts will be invited to discuss the issues with the community. For the IGA component, for example, a extension assistant of community development (hereinafter referred to as CDA), a (extension assistant of forestry (hereinafter referred to as FA), an international organization or an NGO with an experience in working with different IGA groups may be invited to discuss and provide information on how to launch and initiate the different types of IGAs, success and failure of some of existing IGA groups, available (micro)credit sources, etc. by giving concrete examples. This will help the community to understand the issues in a more concrete way and to explore their possibilities among villagers.

(c) Formation and Strengthening of the VC

Two representatives from each of the community organizations, either existing and strengthened or newly formed for the implementation of the VNRMP, will form the VC (the procedure of forming community organizations will be discussed later). In the presence of the villagers the formation of the VC will be announced and the members be introduced. Rules concerning the roles of VC, terms of VC membership, holding of regular meetings, recording of minutes, etc. will be drafted by the members and endorsed with the agreement by the community as a whole.

Member of VC

VC Member :	Representative of Village (one man and one woman)
Members of VC :	Elected Village Representatives (2 persons from each organizations)

1) Leadership training for VC members

The VC members need to be trained fully so as to facilitate and co-ordinate various activities of the VNRMP. All the VC members will participate in the training session concerning leadership, gender, problem solving and project management skills, so they can play a leading role in planning, implementing and managing the VNRMP. In particular, the village headman/woman, who is the non-elected member of the VC and whose position is passed on through family based on the clan system, needs to be exposed in a fair and transparent way of governing the community and promoting community development. As representatives of all the community organizations are members of the VC, the leadership training targeting the VC members will serve as capacity building of these community organizations. Therefore, a 5-day training course

would be organized as soon as representatives are chosen from each community organization and the VC is formed. Through the training they must learn how to treat villagers equitably.

The training course would take a period of 5 days at Lunzu Residential Training Center and the community organization expert will organize the trainers. The training course will be organized for the VC members participated from several villages, providing an opportunity for the trainees from different villages to exchange/ debate their ideas and opinions.

2) Study tours and Inter-location Tours

Once problems in the community are analyzed and the projects to counteract those problems are identified, opportunities of visiting similar projects and visualizing the possible outcomes will boost villagers' morals and help villagers as well as extension staffs formulate more concrete and practical plans. To this end, study tours to near-by, advanced areas will be organized for the VC members, members of relevant community organizations and extension workers. Listening to the fellow villagers, with whom people can identify themselves as they were previously suffering from same difficulties as the villagers in the Study Area, regarding their accounts on the progress of their lives and benefits brought by the project will give them the confidence that they can also make impacts and achieve goals by taking initiatives. Learning about how the fellow villagers have overcome the problems in the process of achieving their objectives will also lead them to prepare a more realistic and effective work plans.

No successful project comprising of various components following a comprehensive approach, which is similar to the one proposed in this study, has been identified in the surrounding area. Therefore, a number of projects with a single component in the field such as AF, community forestry, etc. will be chosen for the target sites of the study tour. For the purpose of inter-location monitoring, the study tour and inter-location tour will be organized with the participants of many villages. At the end of the study tour the participants will have an opportunity to share their ideas and lessons learned from the study tour, leading them to establish rapport among villages and to exchange information and experience in the course of inter-monitoring. In the returning buses, extension staff distributes questionnaire paper to the attendants to fill their observation comments felt during the tour to feedback to the next stage.

Table 5-22 Proposed Study Tour Sites

Study Item	Site	Remarks
AF	ICRAF and areas supported by ICRAF	AF techniques were introduced to some villages in Chiradzulu in 1998 with the assistance from ICRAF. Farmers have already seen some benefit and further increase in the yield is expected in 2001.
Forestry		
Nursery Management Team Tree Planting	Matindi Youth Organization Tobacco company sponsored nursery groups	A tree nursery managed by a group of youth (secondary school graduates). Demand for seedlings is high and proceeds are utilized to expand the nursery.
Agriculture		
Land Husbandry	Tyolo	AF practices and soil conservation by group farmers.
Inland fishery	Domsasi	Project type technical assistance by JICA.
IGA		
Bee-keeping	Mangweru village forest area in Lundu	FRIM introduced bee-keeping and currently 22 beehives are Managed by the group.
Guinea fowl rearing	Mwanza	Supported by GTZ and NGO.

Table 5-23 Study Tour Arrangement per Village

Participants/Tour	No. of group/Tour	Total Number. of tour*	Total participants/Year
8	2	3	24

Note: *Calculated with the provision of 6 groups per village.

3) Establishment of operational framework and preparation of work plan

After the leadership training, the VC will determine the operational framework and also prepare an overall work plan based on the VNRMP defined during the PCM.

The VC operational frameworks will be established following the examples set by the villages that implemented BCFP (Blantyre City Fuelwood Project sponsored by NORAD). Although this framework was set by the villagers and endorsed with the agreement of the VNRMC members, they were mainly a list of penalties and restrictions. The VC operational frameworks should include following items:

- Objectives of VC;
- Organization of VC, VC members, and selection method and terms of VC members;
- Declaration of VC activities;
- Work plan (schedule) of VC;
- Provision of allowance to VC members, if any decided; etc.

The main responsibilities of the VC are listed in the roles of VC in Table 5-20. For the public works for village public infrastructure (such as culvert crossing the road) defined under the VNRMP, the VC will take direct responsibility in implementing the project (though the Pilot Study didn't include such public works). With the assistance of community organization expert and the C/P organizations, the VC will prepare a work plan concerning the following items:

- Support and supervision of VNRMP community organizations;
- Co-ordination of VNRMP community organizations;
- Liaison between community organizations and VDC;
- Preparation of an implementation plan for public works: finalization of construction and procurement plan; budgeting of implementation cost and payment plan; plan of village labor and village natural resources (land, water, grass, sand, gravel, rocks, etc.) provision, requests of input supply to relevant government offices;
- Support for VNRMP community organizations to prepare work plans; etc.

(d) Formation and Strengthening of VNRMP Community Organizations

As described above, based on the activities planned under the VNRMP, various community organizations will be organized. As shown in the Table 5-21 the formation of community organizations will take place after the outline of VNRMP is prepared through PRA/PCM and two village representatives to the VC are selected. The types of groups organized will depend on the project components selected by the villagers.

In principle it is expected that during the PRA the community will prepare the VNRMP taking account of the items shown below. In other words, these items will serve as a menu, from which the villagers will select the items that motivate the villagers for implementation or meet their needs. Community organizations will be formed for the implementation of these items.

As the VNRMC are organized all the villages in the Study Area, the VNRMC is taken as an example of strengthening (reorganising) existing organizations. As an example of forming a new organization and its capacity building, an IGA group will be referred to.

1) Formation and capacity building (reorganization) of VNRMC

Basic approach

In 1999, the Department of Forestry (FD) published a pamphlet "Guidelines for Formation and Strengthening of VNRMC" in order to promote forest management at village level. For the implementation of forest rehabilitation under the VNRMP, this guideline will basically be followed to form and strengthen the VNRMC. However, as the use of this guideline is so far limited, the content may need to be further reviewed and improved. Any findings and remarks will be utilized for this purpose. The Study Team has provided technical support and strengthening measures to the C/P organizations and their extension staffs through workshops and demonstrations on the sites, OJT and manuals. The extension staff attended the above training course, have stationed near the target villages and visited them to support the VNRMC. Nurseries and demonstration lots for out-planting prepared in 24 villages served as main bases for technical transfer.

Procedure of VNRMC formation (reorganization) and capacity building

As shown in the Table 5-21, after the Formation of VC (1), the formation (reorganization) of the VNRMC will be started and committee members will be selected. After the leadership training and capacity building for members of community organizations, the members will prepare their operational framework (constitution) of the VNRMC and draw up a project and work plan.

Selection of VNRMC members

The community organization expert, together with the forest extension staff in charge of the village, will explain to the villagers about the roles of VNRMC and the organization of committee members (10 members including chairperson, vice-chairperson, secretary, vice-secretary, treasurer and vice-treasurer) and their roles/requirements. The villagers need to agree on the method and date of selecting committee members. The selection thereof will take place on the date set by the villagers in the presence of community organization expert and the forest extension staff. When ten committee members are selected the formation of VNRMC should be officially declared. The chairperson and vice-chairperson will represent the VNRMC in the VC.

Preparation of VNRMC constitution

At the first committee meeting the following issues will be discussed and agreed upon by the members: objectives of VNRMC; functions and roles of members; term of office; condition of dissolving the committee; procedure of filling vacancies; regular meetings; method of drawing its structure and its work plan; wood management such as reforestation etc. The community organization expert and the forest extension staffs will attend the meeting and provide advice if necessary. The items agreed upon should be recorded as a constitution by the secretary and sent to C/P organization/the district forest office.

Preparation of work plan

In the presence of the community organization expert and the forest extension staff, the committee members will prepare a concrete work plan for the activities, which are identified as the responsibility of the VNRMC during the PRA and PCM. The work plan should include a concrete reforestation plan by villagers (location, tree species, annual target, ground preparation, nursery management, etc.). Seedlings will be produced in the village nursery in co-operation with the forestry and AF participants. When a borehole/school committee, a church organization or any other organization wishes to plant trees in the premises of borehole, schools, churches and other communal areas, the VC will co-ordinate the activities with the VNRMC.

The work plan also includes the monitoring and evaluation plan for each reforestation project. For this purpose the following items will be recorded by the VNRMC.

Approval of constitution and work plan by the community

As the VNRMC implements the activities of public interest, the constitution and the work plan need to be approved by the community. In cooperation with the VC, a village assembly will be held where the above-mentioned items will be discussed and consented.

2) Formation and Strengthening of IGA Groups

Formation of IGA groups

For the IGA components, interested participants in forestry /AF activities will be identified and organized as a group based on the activities identified during the PRA, such as Boer goat-rearing, treadle pump irrigation, bee-keeping, guinea fowl rearing, vegetable production, food processing, etc. Depending on the activities there may be an imbalance of participants between men and women. In general, female-headed households are resource poor and women normally carry out heavy norm both in the field and household. On the contrary, participation of men is very limited because they are inert to do anything or tend to be sick with malaria, HIVS, tuberculosis etc.

Thus, the community organization expert should make all out effort to let as many healthy male participants as possible involve in both forestry and IGA activities.

Table 5-24 Items to be Recorded for the VNRMC Monitoring and Evaluation

Item of works	Detail of works	Matters to be recorded
Growing seedlings	Amount of seeds	villager's name / tree species / date
	Number of seedling transplanted to poly-pots	ditto
	Number of transplanted seedlings	ditto
Planting trees	Number of transplanted seedlings	ditto
	Viability and growth	villager's name / tree species / date Year 1: quarterly, Year 2: biannually, after Year 3: annually No. of dead trees, tree height, dhl, etc.
	Supplemental transplanting	villager's name / tree species / date
	Maintenance of planted area, tending practices	villager's name / tree species / date under story weeding, thinning cut, ridging, etc
Harvest	Thinning, harvest	villager's name / tree species / No. of trees / stems, coppices, etc

Selection of group representatives

From the participants, two members (chairperson and vice-chair) will be selected to represent the group in the VC. Further members for other positions, such as secretary and treasurer, will be selected depending on the group's activities. The selection method should be fair and transparent and agreed among the participants.

Setting operational framework

The members will discuss and agree on the operational framework such as: objectives of the group; allocation of work; distribution of proceedings; collection or non-collection of member fees; term of office bearers; condition for dismissal or re-election of office bearers; etc. The items agreed upon should be recorded as the group's operational framework (by a group representative or the secretary). If initial inputs are to be provided from an outside source, the group should formulate a method to manage both inputs and the benefit as a group and share the gain equitably among the members. For example, if a guinea fowl is provided to a certain number of individuals, the group may make a rule to give the second hatch to a new member.

Preparation of work plan

Following the objectives, the group should prepare a concrete work plan. Those who took part in the leadership training as VC members will lead the group in drawing the work plan. For the IGA activity, production, transportation, storage and marketing of produce should be well planned based on the market analysis. Parallel to the technical assistance given by the C/P organizations, experts, international organizations, etc., the community organization expert will assist the group in preparing the work plan relevant to the technical level of the group. The work plan should include following items to meet the implementation plan:

- Production and marketing plan of IGA products:
- Procurement and production plan (farm produce) of equipment and material;
- Processing plan;
- Plan of operation and marketing personnel;
- Financing plan; etc.

Monitoring and evaluation of activities (see Table 5-24) will be included in the work plan, so as to improve the performance of the IGA group year by year. Specific monitoring criteria will be selected according to the activity, though the following items will serve as basis indicators. For the basis of comparison, basic indicators should be recorded as benchmark values at the time of group formation. Basic indicators will be evaluated annually while other indicators would be summarized and evaluated monthly and quarterly to monitor the performance.

Table 5-25 Basic Indicators for Monitoring and Evaluation

Items	Contents of monitoring / evaluation / feed-back
Basic Indicators	Income of group members, main assets (bicycles, furniture, etc.), income generating means, education level, etc.
Procurement of production Material Volume of production Volume of production by IGA Volume of sales by IGA Financial status of the group IGA operational items and labor	material and sale quantity are expressed in head-load and cash amount, presence of debt, bank account, days and hours of field labor etc.

Technical support to the group

Experts and extension workers, who have knowledge and experience in the relevant field, will visit the group regularly and provide necessary support and advice. The group also needs to be assisted with the strategy to be deployed for marketing, expansion or adjustment of business.

(3) Capacity Building and Extension

Basic Concept

When we look at the present condition of extension system, it is impossible to meet the demand and expectation of people in the Study Area. There is a limitation of devoting to extension services on supplier side. Especially it is difficult to recruit more staff to ease their load covering too many villages to cover by one extension staff. Therefore, capacity building on receiver's side should be considered to make extension service more effective. Whenever the chance to be visited by extension workers is there, all the information given from them should be fully absorbed by villagers. Capacity building for community side should be highly considered.

It is proposed to form strong community based organizations according to their interest and activities. Committee members of each will be strengthened and will act an important role to organize meeting with extension workers, learn technology from them and also become a

village extension worker to pass the message to all the group members. They also have to recognize that it is they who should start action to improve their life instead of waiting until government supply something for them.

On the other hand, capacity building of extension staffs is required to meet the demand of community. Since most of the activities proposed in this project are under the management of forestry and agricultural staffs, training should be provided for them to improve their knowledge and techniques on the proposed development activities.

Efforts should be made from both sides, one is from community and another is from the extension staff side. Details are discussed below.

(4) Capacity Building and Strengthening of Extension Staffs

(a) Target to Rural Population

The extent of exploiting natural resources has already reached the maximum capacity the land holds, leading to such serious problems as declining farm productivity and difficulty in fetching fuel-wood, resulted in higher demand for sustenance to meet BHN. Technical extension will be successful if the extended techniques meet the demand. However, under current situations of top-down stream of administration, rural population has been accustomed to subdue what is commanded from the authority. It follows that a paradigm shift is essential for rural population to take up activities in a bottom-up mode. On the other hand, rate of literacy remains low among rural population, and this limits the application of formal training with written texts for what is required by them.

(b) Target Set at the Extension Staffs

It is imperative to make efforts of capacity building for extension staffs in the form of in-service training so as both to rehabilitate watershed concerned and to launch and manage the AF and reforestation program, as mentioned in the subsequent paragraph.

In view of currently available resources and systems in the Study Area, it is almost impossible to offer an extension service that satisfactorily meets the demand of rural population. As cited above, the constraints of the side of extension staff make this extremely difficult. It is quite a hard core to fill a number of vacancies in extension staffing with quite limited budgetary appropriation. The solution can only be found in the effort of covering staff insufficiency with effective logistics mobilizing the remaining persons.

Since some of the technologies recommended to be introduced in the Study Area have not been fully acquired by agricultural and forestry extension staffs who are in a position to provide extension service to villagers, it is indispensable to start with their capacity building. Even though community mobilization is important to implement a sustainable project, its part could be played by other sources such as NGOs at initial stage, while extension workers should concentrate on improving their technical skills, knowledge.

(5) Measures for Capacity Building and Extension

(a) Capacity Building and Qualification of Extension Staffs

What have been suggested in this report for rehabilitating the Study Area includes the skills and knowledge that are not yet mastered by agriculture or forestry extension staffs in charge of extension activities oriented to the Study Area. It follows that it is imperative to train the staffs in charge of technical instruction required for implementing the components as proposed in the report. In order to make the activities included in the proposed Pilot activities fully sustainable, cooperation by such assisting agencies as capable NGOs with ample experiences on village-based activities, in addition to extension staffs responsible for technical diffusion. They must learn to get familiar with methods of participatory approach in the course of OJT training.

1) Primary Training of Forestry Assistants and Guard-men

As for forestry assistant and guard men, who had little training but still have to act as a part of extension unit, preliminary training seems necessary to catch up with forestry offices and agricultural extension staffs (AA). Because of limited space for accommodation, one training course will be given to a group about 30 staffs. Proposed accommodation of rendering training courses for Forestry Assistants and Guards (RTC) is located at Lunzu township, where the following courses are advised as shown in Table 5-26.

Table 5-26 Training Courses for Forestry Guard and Patrol Man in the Study Area

Course	Number of participants	Trainer	Period
1) Basic knowledge on forestry	17 Forestry Assistants 70 Forestry Guards	Regional Forestry Officer	5 days
2) Extension methodologies	17 Forestry Assistants 70 Forestry Guards	Regional Forestry Officer	5 days

Note: Course 1) includes nursery establishment, wood lot Management, local collection of seeds, species identification and others.

2) Training on AF

In case of AF extension, forestry and agricultural extension staffs have to work hand in hand to attain its goal due to complex activities from both fields and make it easy for villagers easy to receive extension service. Therefore, training should be organized for both; forestry and agriculture staff, and the staff who cover same area should be in the same class. In addition to leaning on technical issue, coordination network as to creation village of seed banks, logistics of supplying AF material etc. could be established between them during the training course.

After the above basic training course is provided to Forestry Assistants and Guards, training on AF is provided to all forestry and agricultural extension staffs. A group of trainee counts about 30 with those coming from the same area. In addition to the technical training, workshop should be held to discuss future working plan in their villages (Table 5-27).

Land Husbandry Assistant (LHA) and Assistant Development Officer from EPAs, Women's Program Officer (WPO), LHA and Horticultural Officer (HO) from RDP, and WPO, LHO and HO from ADD could join the training course to obtain common understanding.

Table 5-27 Training Course for Forestry and Agricultural Extension Workers in the SA

Course	No. of participants	Trainer	Period
AF	98 forestry staff 47 agriculture staff	International organization	5 days

Despite the above-mentioned intensive training course, extension staffs are trained only theoretically, but not practically. In the first, second and third year of implementation, the same trainers have been invited to village and they have taught AF techniques directory to farmers together with extension workers. They have regularly visited; at least twice a month, therefore they have monitored the activities and provided technical know-how to support villagers and extension staff. Through these activities, on-the-job training has been given to extension staffs.

3) Other training courses

In addition to training for AF techniques, training are provided for forestry and agriculture extension agents as to newly adopted or not yet introduced techniques accompanying with the proposed activities. The extension agents of both forestry and agricultural sector are target trainees who have been assigned to the SA. RFO(S) and NGO staffs are trainers for these courses, but also local NGO experts with professional experience or expertise have been requested to assist them. Table 5-28 shows the proposed training courses mentioned here.

Table 5-28 Training Course for Field Assistant in the SA

Course	No. of participants	Trainer	Period
1) Boer goat rearing	15 FA,AA	NGO	5 days
2) IGA			
Bee-keeping	15 FA,AA	NGO	3 days
Guinea fowl rearing	15 FA,AA	NGO	2 days
Vegetable growing	15 FA,AA	BRI	3 days

Note: BRI: researcher from Bvumbwe Agricultural Research Institute

4) Leverage for assisting forestry extension system

Different from agriculture extension staffs who live within their service areas, forestry extension staffs often live far from their service areas To cope with this situation, it is proposed to assign three permanent extension staff for regular service in the SA, to whom accommodation and motor-bikes are provided for their convenience.

Besides AF, newly introduced or not fully understood techniques on agriculture and income generating activities (IGA) are taught to agricultural FA as follows.

As for agricultural AA, their residences are based at inside or nearby the Study Area while Forestry and Community Service Assistants live far outside of the area. It is proposed to assign three Forestry Assistant with house constructed in the Study Area. Provision of motorbike has been provided to improve their mobility.

(b) Capacity Building and Strengthening of Villagers

It is indispensable to always put villagers in the center for sustainable implementation of proposed activities. For this purpose, they should realize and keep in mind that these activities are brought from their own needs and they are the major actors who should play role of implementing the planned activities. Though awareness will be created with the help from outside, follow-up activities such as problem analysis, project formulation, action plan, monitoring, evaluation and feed-back should be provided and executed by villagers. However, this is not so easy for illiterate villagers. Young ones who have completed primary course of education manage to write for recording, as often observed during the implementation of Pilot activities. After receiving writing utensils, they used to carry notebooks with them to record what they saw and experienced. Administrative system in charge of adult education should distribute utensils to the members of village committees so that they record plans, procedures, participation, content of discussion, commitments and agreements, results of evaluation etc. as public evidences. It is also advisable for villages to establish bulletin boards where important information and notice can be made public.

(c) Monitoring Activities

1) Self-monitoring and evaluation

Once community based organization is formed where its activities, target and responsibility of each member are dictated, the level of achievement has to be monitored based on the planned schedule. If some constraints, obstacles or difficulties are recognized, the way of solving them should be discussed within members of the group. Here, majority of villagers do not have experiences of setting a concrete target to pursue, nor have they evaluate things. In such a case, facilitators of workshops use a problem tree to extract participants' intrinsic appeal and requests, then leading to let them consider what to do by themselves. Indicator to be monitored were discussed and set through the workshops held by organization members with the assistance of extension workers, and the members conducted periodical monitoring and evaluation.

2) Inter-location monitoring by the village with project implementation

During the course of leadership and managerial training and study tour, affiliation must have been built between villages with project implementation in the same year. Inter-location among target villages has been schemed to monitor each activities and share and discuss their experienced difficulties and countermeasure for it. The village committee members to be visited by the visitors from other villages presented their progress so far made and show them in such a way that their future target and activities would be defined and cleared again.

Basically, village chiefs and committee members are the participants in the inter-monitoring tour. Since each activity is related with others, monitoring tour group will visit more than one kind of organization and monitor overall activities. They visit one another twice a year to monitor each step of their progress and exchange views, comments and mutual advice.

Table 5-29 Inter-location Monitoring by Village with Project

Participants/ tour	No. of group/ Tour	No. or tour/ year/group	No. of tour/ term*	Total No. of tour/ Village	Total participants/ Year	No. of visiting villages
3~4	2	4	3	12	36~48	3

Note: ＊Number of organized group was considered as 6.

3) Inter-location monitoring by the village without project

In the Baseline Survey, a lot of inter-linkages were found with those in neighboring and nearby villages. For instance, once a year villagers participating from neighboring villages practice graveyard clearing so as to prevent damages of bush fires. Another example is found in organizational activities; borehole or school committee formed by several villages manages, operates and maintains wells and water sources together. Villagers living in a village have close connection with neighboring ones, and they work together in terms of development activities such as construction of roads, bridges, school building or clinic.

In addition to the above-mentioned inter-location tour by people concerned, neighboring villages, especially the village in which activities will take place subsequent year, should join this monitoring activities. Therefore, they can learn from forerunner and can modify the way of implementing activities in the following year. It will make easier to expand and diffuse the activities year by year. On the other hand, villagers who are visited by outsiders would brace themselves to be monitored and evaluated, and at the same time, they could feel much confidence of showing others the proceeding activities.

Table 5-30 Inter-Location Monitoring by the Villages Without Project (Outline of one village)

No. of participants/ Tour	No. of tour/ Year	Total Participants/ Year	No. of visiting villages
72 from 24 villages	3	216	3 (one day trip)

(d) Environmental Education for Children

Since children are playing important role to support their parents' livelihood activities such as fetching firewood and farming, they cannot be left out when we consider about the development activities.

In the village, children used to learn tradition, culture, customs and others through informal education which is a kind of local knowledge handed down from generation to generation at community and at home. However, through the Baseline Survey, it was noted that it was being threatened due to the influence of Christianity, Muslim and modernization. Number of boys and girls who have gone through initiation ceremony has been declining.

Even though many issues are still taught informally at home, environmental education could be provided from outside of the community, in such way, these children can also pass the important message to their parents. Besides, children are the ones that carry the load of the next era.

As a first step, awareness creation should be introduced. Children are called again at school after the class, where film show, drama and band music containing environmental message will be presented. These are routine events provided by NGO with ample experience on these activities and material. After the entertainment, FA will teach them how to prepare nursery, plant trees and take care of them.

Establishment of nursery will be started together with the activity of VNRMC in the same or nearby village. One example was already found in Kaumbata village where students from Nasonjo primary school established their nursery next to the one of the village. Wildlife club, which has been organized by NGO for the purpose of environmental education and activities, can be the core group to manage nursery. Trees can be planted in their school plot as in Table 5-33..

Table 5-31 Primary School in the MA and Proposed Villages to Work with Them

Name of Primary School	Grade	Participating village	Name of village to join with
Nasonjo	5	Siyamudima	Kaumbata, makonokaya
Mtengowambalame	8	Simon Mpombe	Ndemanje, Kumponda
Kachere	8	Mdala	Nanjiwa, Chakana
Monekere	4	Lemu	Manjelo, Teula
Chigodi	6	Kumisati Chigumula	Kateya, Peter Bilila
Milala	8	Chikoja	Chilangali, Kumanda
Ntenjera	8	Kammata	Tamve Kenji, Kamwendo

5.5 Proposal on the Follow-Up Plan of Pilot Study

5.5.1 Supporting System for the Deployment of VNRMP

Table 5-32 Schedule of Work Shop for Formulating VNRMP Assisted by a Team

Workshop	General	Forestry (FA)	Agriculture (AA)	IGAs (CDA)
first	Concept, extraction of constraints, problem, desire, transect to identify village resources			
second	task formation, role sharing by villagers, drafting of VNRMP by disciplinary field			
third	establish detail of VNRMP	nursery planning	AF planning	IGA planning
4th	assisting group formation	nursery group	nursery + AF	nursery + IGA
5th	individual role of member	raising / outplanting	AF material supply	input procurement
6th	technical transfer by role	raising techniques	AF practicing skills	crop/animal husbandry
7th	site demonstration and field lecture / disply for land and resource conservation techniques			
8th	presentation by participants	from nursery aspects	from AF aspects	from IGA aspects
9th	management of inputs	nursery implements	AF implements	IGA equipment
10th	trial of participatory works on village nursery site, clearing, leveling, fencing, shading etc.			
11th	review of techniques/skills	Q & A on raising	Q and A on AF	Q & A on IGAs
12th	summarization of VNRMP	report on forestry	report on AF	report on IGAs
last	submission of VNRMP to RFO(S) and request of input supply from RFO/ADD/DCS			

In the "Guideline" by FD in 1999, only FD and RFOs was designated as the supporting agencies where FA (Forestry Assistant) is to advise TA, group villages and villages for VNRMP.

Whereas, in this Study, it has been verified that a comprehensive approach involving wider disciplinary of extension services can help villagers establish organizations for formulating, implementing and managing VNRMP according to a strategy of "village vitalization based tree planting/ reforestation". Teams of campaigning VNRMP, consisting of FA AA and CDA can only deploy such comprehensive set of activities at the same time in a target area. An office with meeting room is desirable to accommodate these teams that deploy campaign of diffusing VNRMP in the target area.

A TA consists of 150 - 250 villages, and 9 TAs exist in the Middle Shire Area covered by MP study. A team comprising three extension staff, FA, AA and CDA can cover 4 group villages consisting of 20 villages during a period of campaign for 3 months, visiting a group village a day located on an itinerant route, so that it can drop in a group village once in two weeks (assuming 4 site-working days/ week, mean distance between two group villages measures 2 km). Schedule of the team is summarized in Table 5-32. Thus, a team can visit a group village 13 times during 3 months. All the committee members of the target villages gather in their group village to attend workshops on a fixed weekday every week. After every workshop, the team leaves the visited village a home task to be provided until the next workshop.

5.5.2 Input Supply for the Implementation of VNRMP

Two ways of input supply to the villages that formulated VNRMP are considered including supply of inputs through resources of donors or through assistance organizations like MASAF, and supply of funds to purchase inputs from funding institutions like micro-credit suppliers (for instance FINCA, HRFC small-holders fund). In any way, government subsidies have not been available for villagers for any forestry activities. The former offers very limited chance for villagers to get benefit, through Eucalyptus planting in Chilangoma hill (Nanjiwa village and Chakana village) and local road construction passing M. Ngondo, Chilangali villages so far implemented. The latter requires establishment of enterprising organization for IGA to which funds are released but only short term ones. These funds are mainly released to a small capital for retail vending of groceries, fuel, foodstuff etc., and even the fastest profit yielding activities like irrigated vegetable production and goat rearing can hardly pay back on schedule. As the major customers are retailers, the interest rates are also high, reaching annual rate of 20% or more, whereas gain from farming based activities ranges 5~15% in the most cases.

Loans from HRFC are most reliable because the granting conditions are milder than FINCA (6 months~1year without grace period, with the annual interest 12% on average), and ordinary farmers are eligible to borrowing funds, though available amount has been limited and many applicants wait in the waiting lists. Many sources of input supply are available if funds can be granted, including the target villages of the Pilot activities as a supplier of Boer goat stocks and vine of sweet potato. At any rate, input supply is the bottleneck of any development scheme just because villagers do not have any collateral for acquiring fund from funding institutions.

5.5.3 Time Sequence and Methodology of Implementation and

Management of VNRMP

As mentioned above, once the villages can manage to borrow funds for input procurement, they can start the formulated plans on schedule. In so far as the availability of inputs and/or funds for VNRMP remains unsolved, no definite schedule can concretely be proposed, but if an assumption can be allowed to discuss on the expected future development, then the following progress could be envisaged as shown in Table 5-33..

Table 5-33 Estimated Implementation Cost and Schedule of VNRMP in a 20 Villages

Input supply	for 20 villages		Amount in MK
Assumption: funding of revolving fund from a donor source: US$ 22,000 = MK 2.3 million			
nursery implement	tube pots, watering tins, wheel burrows & others	20 sets	MK365,833
transportation	15,000 pots, 5 burrows, 20 tins, 20 implements	ditto	MK180,000
seed and material	tree seed, cuttings, cement, brick etc.	ditto	MK140,000
vegetable irrigation	treadle pumps, farm implements etc.	ditto	MK1,065,167
transportation	30 treadle pumps and irrigation equipments	ditto	MK362,500
goat rearing inputs	200 Boer goat stocks, hut material etc.	ditto	MK140,000
Total			MK2,242,500

Note: The cost tabulated does not include office expense for mobilizing extension staff and clerical costs.

Activities	Duration	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Formulation of VNRMP	3 months									
Delivery of Inputs	2 months									
Establishing Village Nurseries	2 months									
Managing Nursery Works	6 months									
Initiation of IGA activities	5 months									

Chapter 6 Conclusion and Proposal

6.1 Conclusion

The Pilot Study has proved relevance of the proposed Model, as evidenced in the following, of coupling forestry with AF and IGAs that can be implemented in a sustainable manner to cope up with the currently faced environmental deteriorating problems:

- The Pilot forestation activities coupled with AF and IGAs carried out in a model area in Middle Shire have verified that participatory efforts by the villagers can bring precious contribution to environment restoration as analyzed in the preceding chapters. Despite consecutive and serious drought, the participants in village nurseries and out-planting succeeded in creating their own base of firewood supply, thereby overturning declining trend of woodlot area to increasing one just for those two years. This achievement has evidently been brought about by strenuous efforts and voluntary contribution of villagers, especially where equity of distributing benefit from IGAs to the participants concerned exists. Efficient AF / IGA technical transfer was realized by a multidisciplinary team, PIU
- Improved acknowledgement of villagers on environmental care has been highly appreciated in comparison with indifferent villagers who only consume remaining meager resources. Such drastic progress in understanding their own environment has been one of the fruits of efforts made by the extension staffs who have closely contacted with them. All the concerned extension staffs have worked hard in villager's field with them and this onward spirit has been appreciated together with technical transfer that enabled them to attain strong capacity building. The largest impression felt by the villagers lies in a drastic change between the state before and during the Study, i.e., rare visit of extension staff as reported in the Baseline Survey versus frequent and cordial collaboration with villagers.

The verified possibility of environment rehabilitation has, however, just established a bridgehead at the entrance of Middle Shire. The relevant administrative media on the other hand could now make full use of villager's enhanced willingness and devotedness for an impetus to expand tree planting into surrounded villages where inhabitants are increasingly interested in the outcome. It is therefore highly pertinent that GOM should make full use of this result for expanding towards the surrounding villages around the Study Area, spelled out as *Horizontal Expansion*.

Likewise, it is sincerely desirable that GOM should take relevant measures to sustain and further grow the on-going activities in the Study Area primarily at her own expense, spelled out as *Vertical Expansion*. The Department of Forestry should succeed the maintenance and deployment of what has been verified in the target pilot area, at least trying to support villagers to sustain the willingness to raise seedlings and planting them around their neighbors. This vertical expansion should be pursued at least up to year 2008 when first harvesting of planted trees during this Study is to come.

6.2 Lessons Learnt

Implementation of the Pilot Study has given valuable lessons that should be considered in pursuing the above-mentioned Horizontal and Vertical Expansions as well as implementing similar projects. It is expected to utilize these lessons in fit of each condition, but also to try out the disciplines asserted throughout the text in practice. The lessons learnt are:

1) First of all, favorable results of verified participatory approach was a fruit of thrusting budget support into mobilization of extension services in a form of transportation and

field allowances and also providing necessary equipment for IGAs to villagers and those pertinent response of staffs and participants.

2) Generally, in coping with causes of environmental deterioration oblique measures should be taken simultaneously with those directly addressed towards environmental rehabilitation. IGAs and AF constitutes of the former and forestry does the latter.

3) Participatory approach has been proved useful in introducing forestry and AF activities together with IGAs into target villages. Department of Forestry has adopted principle of Community-Based Natural Resources Management for social forestry activities where endowment of IGAs is acutely needed to make it fully viable and sustainable.

4) As to the order of development, village nursery should be established at the very beginning of all the activities, followed by all other components. Proper management of village nursery will enable the villagers smoothly to utilize wider spectrum of still untapped resources in their villages. This order of development can avoid a tendency of villagers indulging only in IGAs.

5) Single activities for forestry without coupling with IGAs are hardly sustainable in and around the Study area. As PIU staffs observed, other single forestry schemes implemented around the Study area has soon vanished just after the donor's assistance has been lifted. Also, selection of single village as core front for widening target activities ends up in a solitary object of envy among local communities where inhabitants of neighboring villages often steal only the fruit of development, not their techniques derived from the scheme.

6) Extension services capable of long-lasting technical transfer and organizing of the villagers have been proved indispensable to make development sustainable. In order to raise the effect of extending techniques, the forestry and community services should cover multi-disciplinary sectors targeted to fairly large number of participants at the same time with substantial input supply to the participants, and this can establish a base of sustainable development. In particular, installment of improved fireplaces (cooking stoves) has been proved successful in mobilizing interested villagers by the action of extension staffs involved in PIU to diffuse them into all target villages.

7) The villagers appreciate pragmatic attitudes of extension staffs and foreign visitors, and they welcome physical collaboration of these outsiders in nursery works and out-planting and tending practices with them. Their participation has been stimulated and sustained through joining of extension and Study Team staffs in site labor works for raising, out-planting and tending seedlings within their villages and direct and frequent dialogues between visitors and villagers.

8) Mobilization of the villagers into tree planting without paying wages has been sustained for three years, and this fact implies that further sustenance of planting can be envisaged because villagers have learnt and realized importance of planting. If it were done on the wage basis, they would have given up tree planting as soon as the Pilot Study phased out. The role of PIU staff for villager's capacity building / sensitization was crucial.

9) Though gloomy anticipation prevailed in disseminating AF practices arising from long embryonic period, much faster and enthusiastic diffusion has been brought about by an extension activity which made use of seed banks as source of both seed and cuttings as a method of labor / cost-saving propagation.

10) Among the tried forestry techniques, tending of planted seedlings with micro-catchment imported from Kenya by PIU staffs was proved useful in increasing survival rate of out-planted seedlings. Also, strict hardening and deep pitting for out-planting very often give positive results of both of their survival and growth.

6.3 Proposal to the Horizontal and Vertical Expansions

As illustrated in Fig.5-1 which presents the conceptual Model coupling forestry with AF and IGAs, the framework of the proposed follow up activities requires at least 7 years from planting during which villagers in the Model Area should sustainably toil for both environmental rehabilitation and their livelihood. Villagers concerned have been engaged in both forestry and income generating activities where the benefits gained from the latter partly nurtured the former. To realize this end, their efforts made during the Study period should be kept in the follow-up stage until they can harvest what they planted in the first year. Whether they further keep their positive attitude towards rehabilitation and the offices concerned assist them so that they can pursue what they aim at for rehabilitation or not will serve as a criterion of eligibility of assistance by NGOs and/or donors. As for above-cited framework, a 7-year plan including already implemented activities (2002 ~ 2004) and the future prospect is shown in Annex J-1.

Desirable follow-up actions include horizontal expansion to further expand the coverage of verified Pilot activities into adjacent or surrounding villages in the same TAs. This expansion may require further support by interested donor(s) for site selection and provision of initial inputs to the participants. This horizontal expansion can be pursued in parallel with vertical expansion of forestry and AF activities coupled with IGAs in the 24 target villages where only a part of the whole village population has participated in the proposed activities during three years of the Pilot verification. It is desirable to mobilize as much village population as possible to continue tree planting until self-sustenance of firewood be achieved and the Study Team believes that expense of this part of follow-up action could be met by the three ministries concerned on the self-help basis.

The following plan, Horizontal and Vertical Expansions, is proposed in compliance with on-going government strategies on promotion of environmental conservation through Village Natural Resources Management Plan. The relevant agencies including Department of Forestry in MMNRE, Land Husbandry in MOA and Community Development in MOGYCD are to make their own utmost efforts to sustain on-going activities by the target villages as well as to further extend those activities to neighboring areas, though some assistance from donor(s) may be indispensable to smoothly get along with the plan.

6.3.1 How to horizontally develop the Pilot Study Model to surrounding areas

Based on the analysis of 2002~2004 results obtained through the Pilot Study and taking account of factors influencing the results, the following way of expansion is herewith proposed. Based on the finding of the analysis that the verified combined model of reforestation with IGAs in the Pilot Study has so far basically been favorably going on, though some problematic parts should be corrected to use the model as a tool for further expansion. It is suggested that expansion of the verified model can be started from the surrounding villages out of the Study Area having similar administrative and natural conditions. There are two ways of expansion: one including all the villages in the same TAs and another beginning with selected villages as nucleus, thereby extending into adjacent ones. In order to minimize failure cases, it is considered better to begin with selected villages with relatively abundant available village resources, rather than diffusing into all the existing ones. The following describes process of the latter way of expansion.

(1) Correction of the Verified Model into the Model for expansion

According to the result of the analysis, the following should be improved to apply for expansion.

1) IGA components should be narrowed to Boer goat rearing, Treadle Pump irrigation and Apiary that have given favorable results based on resource availability.
2) Simultaneous establishment of nursery and coupled IGAs should be realized so that mutual complementarities can serve as real incentive to the participants in villages.

(2) Selection of the Target Villages for Expansion

Forestry activities are not always successful in all the villages in the area. In so far as village nursery is a starting point thereof, suitable villages tend to accompany reliable water sources like a lake or a perennial stream, where village nursery can safely be established. However, as also analyzed, the nursery site should be enough nearer to the center of the village, otherwise difficulty would arise from the management of the established nursery.

The analysis of the Study results has proved that as the first criterion water availability in villages governs the success of tree plantation. Hence, if one desires faster success of tree planting, it will be relevant to begin with villages with ample water resources rather than with drier ones where villagers always concern water depletion, provided that expansion of the proposed model follows selection of nucleus villages.

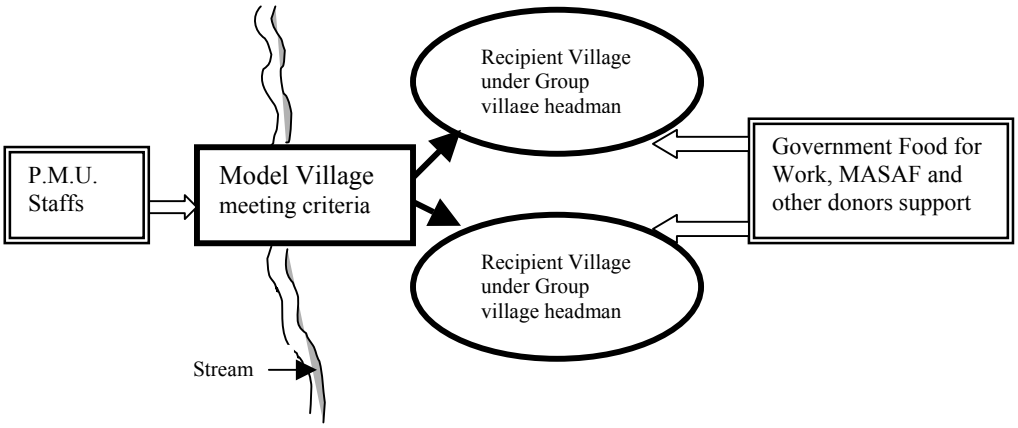
The second criterion lies in land availability for out-planting, because tree planting may affect space for crop planting in small villages. In order to create village wood-lots or to enhance agro-forestry activities, it is essential to procure plots or land for out-planting or practice. To assess this availability, village land should be taken account, classifying it by land holding.

The third criterion constitutes concentrated input of basic knowledge and skills on forestry, agro-forestry and IGAs to be transferred from extension staff. In the Baseline Survey, it was concluded that rare visit of extension staff to the target villages led to backwardness of technical ability therein. The Pilot Study has brought homogenous and concentrated visits of extension staff in these villages and the villagers have taken full advantages of technical transfer. This is evident from their high appreciation expressed in their self-evaluation of the Pilot Study. It follows that the villages located near the residences of extension staff have higher chances to receive concentrated lectures and training by their frequent visits, and this should be counted in the priority of selecting villages.

The fourth criterion for selection consists of governance or leadership, as high correlation has been identified in the analysis. This can be rectified through leadership training even if a village lacks it, as experienced through the Pilot Study. In some cases, village chiefs accumulate private assets by mobilizing their villagers without giving remunerative return to them. In such villages, any project gives only adverse effects to the villagers, widening disparity between the rich and the poor. However, this criterion cannot be abused since interpretation depends on political or administrative stance of the Government. Leadership can indirectly be assessed prior to the initiation of a project in such a way that some input-free trials like creation of improved fireplace or preparation of Changu manure (only "skill" is needed as input) are introduced and the progress is monitored. If a village is led through powerful leadership the fast diffusing rate continues with underlying solidarity, but if it has been governed with weak leadership the diffusion remains sluggish or spontaneously ceased.

Thus, nucleus villages can rightly be selected through the sorting process of checking these three criteria applied to the villages in the vicinity of the Study Area. The number of nucleus villages to be selected for expansion depends on the policy of the Government.

Figure 6-1 Structure of Nuclear Model Village



(3) Desirable Local and Foreign Support

Donor's support is still desirable though the Government agencies are the main actor to provide necessary support for the maintenance of the participatory activities in the Study Area. A form of technical support constitutes dispatch of a group of volunteers though provision of minor input supply by these staffs is institutionally difficult. Table 6-1 A and B give rough idea of dispatch of volunteers and an expert.

Table 6-1 Anticipated Roles and Characters of Stakeholders for Horizontal Expansion

A. For GOM

Stakeholders excluding villagers	Central Level of Offices	Regional Level of Offices	PMU staffs
Roles of the Project	Supervision and report to donors	Superintending PMU activities, Report to Central	Continue diffusion services with volunteers
Character on duty & performances	liable to follow-up actions, coordinate with the donor	liable to follow-up actions by arrainging manning and mobilizing PMU	liable to follow-up actions by extend-ing services within target villagers

B. For Experts

Stakeholders excluding villagers	Leader/ Forestry/ Agro-forestry	Land Husbandry/ Rural Development	Farmers Organization/Gender
Roles of the project	Lead the project, report to donor, advice in forestry/agro-forestry	Advice in land conservation, environmental protection	Advice in community participation, gender
character on duty & performances	liable to formulate the scheme, monitor the activities, coordinate with the donor	liable to arrainge manning and mobilizing PMU, give advice on his line	liable to mobilize PMU by extend services to target villagers, give advices on his line

(4) Proposal of Horizontal Expansion to the Surrounding Areas

The related local agencies of three ministries concerned should collaborate to draw a blueprint for horizontal expansion through the assistance provided by the foreign experts within the related two TAs, i.e., TA Kuntaja and TA Kapeni, first. The chiefs of these TAs as well as Blantyre District Commissioner should be involved in the horizontal development as mentioned above. The analytical results of this Study indicate that the verified model cannot necessarily bring success to all the villages where the model is applied. There are 166 villages in these two TAs where only about 80 villages are estimated to have favorable conditions for applying the

verified model, while others are too much urbanized, suffering from lack of perennial water sources, lack of village area for creating woodlots etc. Whether the whole block(s) of village cluster (1-2 group villages, approximately 20 villages) should be chosen for horizontal expansion and only those that with favorable ambient conditions should be selected is a task to determine prior to launching envisaged expansion of the model.

Figure 6-3 indicates possible location for horizontal expansion. Two cluster areas, each one in TA Kapeni and TA Kuntaja are proposed where the following site conditions can be satisfied:

a) Perennial water sources are available for establishing village nurseries,
b) The sites are easily accessible by current road networks,
c) Poaching risk is negligible, since urbanization has not yet been proceeding.

Participatory approach is proposed for lateral expansion where participants join the activities on their voluntary basis. High rate of participation is anticipated in these sites because they have been suffering from under-employment. Selection of around 20 core villages in each TA is targeted where a couple of group villages with high solidarity and leadership of village cadres can be chosen as core villages in these TAs.

(5) Strategy to be applied to the expansion

(a) Establishment of Official Framework in the Central Government

Establishment of a core unit (Project Management Unit, PMU) is advised to facilitate expansion of the verified Model, consisting of three Ministries concerned.

(b) Introductory Procedure

IGAs should be coupled with reforestation activities as an incentive. In the initial stage, existing village organization is oriented through workshops held by extension staff to establish participatory mobilizing plan with a schedule, and by-law should be agreed among concerned committee members to determine participatory work procedures. Then, a "village natural resource inventory" should be made by the members to decide their plans for out-planting and IGAs. Manuals are provided prior to IGA introduction. At the same time, study tour to existing model projects should be arranged to let the villagers make their own targets for out-planting and IGAs.

(c) Strengthening of Village Organization

Selection of nursery and out-planting committee members is a key issue. Chairman desirably has planting experience in the past, and members should have such private land as large home-stead, rocky patch, marshy lowland where seedlings can be planted. Also, the committee should consist of enough male members who can clear unused shrubs, grass bushes and other waste land to be converted into village wood-lots. The village development committee should cover both forestry/ agro-forestry and IGA activities so that the same participants can participate in these two activities. Capacity building training is essential to strengthen the committee.

Here, leadership is a prerequisite factor to lead the trial to a success, because village cadres including headman or head woman have mighty power over his/her villagers. It is relevant to start with leadership and equality of administration training to all villagers during the workshops in the selected nucleus villages including the following items:

i) Capability of strengthening the villager's solidarity to develop participatory activities
ii) Capacity to plan and formulate a series of works in proper order
iii) Capacity to communicate, disseminate timely information among villagers

(d) Planning Activities and Corresponding Input Supply

During the initial two years, mainly farm implements and seeds should be given to the participants in forestry activities. Inputs for IGAs should also be supplied according to available natural and human resources within the village. It should be confined to the initial input supply, but the recurrent costs for sustaining the activities should be borne by the group members concerned. At the same time, regular staff of extension should be assigned for regular visits to the target villages (once a week during nursery and out-planting period). Villagers' own ideas should be paid full respect rather than imposing built-in plan from the assisting agencies.

(e) Other Supports from the Government Agencies

The project sponsor and the Ministry of Mine, Natural Resources and Environment Affairs will mutually agree on input supply, including extension staffs. The Regional Offices concerned establish a coordination forum where Traditional Authorities concerned and Regional Forestry Office, District Representatives participate to deploy assistance, monitor the results, and give timely and proper advice. Technical support requires the following technical inputs to be supplied to the target villages:

i) Schematical village map and writing stationeries
ii) Some sets of tool kits like measuring tapes, line levels, trowels, knippers etc.
iii) Food for work in a spell of severe drought to dig planting dibbles in village woods

(6) Functions of the Proposed Model in Nucleus Villages

The proposed model has a combination of forestry and IGAs, where forestry component serves as a seedling supply source not only for the village but also for surrounding villages where suitable site for nursery cannot be found. The nuclear model village can supply not only seedlings, but provide manure and other materials for neighbor villages, where a sponsor can deliver inputs through purchasing thereof from the model village to the villages without village nursery. Villagers without their own nurseries can offer labor for nursery works to those who have them and in turn they receive a part of seedlings produced therein.

As mentioned above, three key factors as cited below must be taken into consideration in order to introduce the experienced participatory activities in the Pilot Study to the area around the Study Area. The first one constitutes the support of extension that functions both as the introducer of the activities into new target villages and the promoter to make the introduced activities sustainable. It is realistic to select the villages to which existing extension agencies can deliver concentrated services throughout the year.

Experiences of those who are concerned in such activity suggest that villages with larger surface area suit better as to these requirements because; they have been established earlier than other villages, often keeping better village resources than others, the chiefs of these villages have been in such position as to give advice and instructions to the smaller and late developing ones and very often exert influences towards neighbor ones. The basis of this assertion has already given in Chapter 4.3.2.

To expand the activities of Pilot Study, the following procedures are proposed to RFO(S) and Blantyre RDP; in order to establish practicable CBNRM (community-based VNRMP).

(i) to draw a map of residences of extension staffs and forestry guards/ patrol-men and delineate the areas encompassing 5km in radius, on the map of 1/20,000 provided by the M/P Study of Middle Shire, to provide forest area zoning for conserving/ reforesting,

(ii) to choose whether nucleus villages in TA Kuntaja and TA Kapeni surrounding current Study Area that are encompassed in 5km radius from houses of extension staff, according to service area distribution of current extension staff,

(iii) to conduct a baseline survey on these selected villages to make availability of resources clear, regarding local decentralization and land availability under title-deeds,

(iv) to give a bicycle per extension staff concerned and forestry assistants/ guards (by the supply of donors) so that he/she can help villagers establish a plan of village nursery and tree planting within their villages as a substitute of Village Natural Resources Management Plan as is practiced in the Pilot Study for each group-head village mentioned above and to hold workshop in these villages for sensitizing villagers,

(v) to hold workshops in new target villages for sensitizing, enlightening, mobilizing and empowering villagers towards rehabilitation of lost resources

(vi) to help the villagers establish a plan of forestry to attain self-sufficiency of firewood, of AF to enrich their crop productivity, of land husbandry to conserve soils / water, paying attention to recover/ enrich vegetative cover along stream banks,

(vii) to help them formulate a plan of an income generating activity based on their available resources, consistent with planned forestry activities to conserve village land,

(viii) to link the envisaged activity plans of group-head villages with the target villages in the Pilot Study Area as the fore-going model, consistent with planned forestry activities to conserve village land,

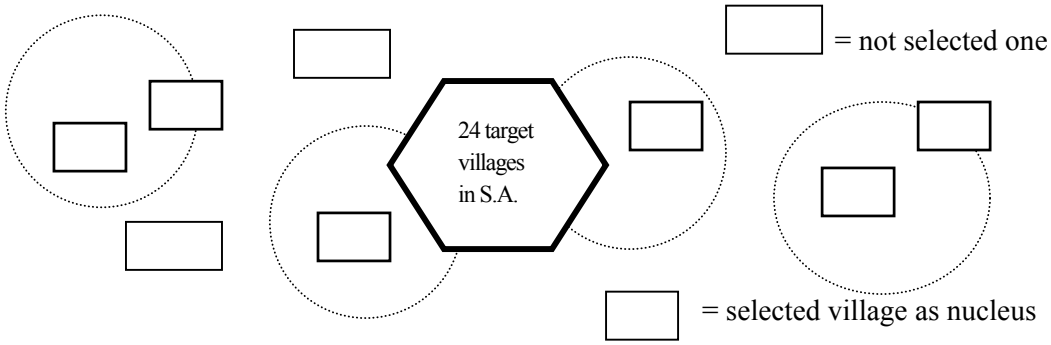
(ix) to purchase inputs (seed, seedlings, cuttings, kids of Boer goats, etc.) from 24 target villages of the Pilot Study so as to distribute them to the group-head villages.

Thus, the extension workers and forestry assistants/ guards living nearer to the villages selected in the light of selection criteria can transfer techniques so far achieved in the Pilot Study Area, organize villagers and finally mobilize villagers into participatory activities as experienced in the Pilot Study.

Coupling forestry / AF with income generating activities constitutes a basic frame to sustain the performance of the forestry / AF activities in the selected villages, so that effort-making ones to restore environment can remuneratively receive income generating chances to compensate for their energy consumed in their efforts (this can be expressed as an incentive because people subject to lingered hunger take food as their priority incentive). For this purpose, extension staffs in charge should keep fair records of work performance in these villages so that they can assess their efforts so far made in nursery and out-planting works and give advice to village cadres for equitable allocation of IGA inputs.

In the course of developing proposed Model in nucleus villages, 24 target villages in the Pilot Study Area can be utilized as both the examples of technical, organizational model and the source of input supply to newly selected group-head villages, e.g., AF seeds, cuttings, scions, tubers. Such supply can in turn reactivate 24 target villages through their earnings if the donors can provide fund in such official purchase for input supply. These villages can offer sites for demonstration to the villagers in newly selected nucleus villages that meet the above cited criteria and this can drive them into right sustenance of what have been created in the Pilot Study.

Figure 6-2 Selection of Starting Nucleus Villages in Extension Radius



The following lists show requests from relevant regional offices in keeping follow-up activities. Donor's supports are indispensable though the Government agencies are main actor to provide necessary support for the maintenance of the participatory activities in the surrounding Area. A form of technical support constitutes dispatch of a group of donor's experts with a provision of input supply by these staffs. Table 6-2 gives rough idea of dispatch of experts.

Table 6-2 Proposed Inputs for Expanding Activities to Surrounding Villages

A. Proposed manning for the expansion to the surrounding areas

Foreign staff	Leader/ Forestry/ Agro-forestry	Land Husbandry/ Rural Development	Farmers Organization/Gender
Expertise	Leader Forestry/Agro-forestry	Land conservation Rural Development	Community Gender, Livelihood
Period	7 years		
Input	Survey costs, mobilization, input supply, etc.		

B. For Advisory Expert

Stakeholders excluding villagers	Central Level of Offices	Regional Level Of Offices	PMU staffs	Foreign Expert
Roles in follow-up actions	Supervision and report to donors	Superintending PMU activities, report to Central	Continue diffusion services, work with expert,	Liaison to the expansion, Policy related advice to central and regional.
character on duty & performances	liable to follow-up actions, formulate the scheme, coordinate with the donor	liable to follow-up actions by arrainging manning and mobilizing PMU	liable to follow-up actions by extend-ing services to target villagers	Support to the expansion, Advice to formulate the scheme.

The expert should have knowledge and experiences of environment conservation or rehabilitation and ability to lead PMU staffs for the task of sustaining already introduced Pilot activities within the Study Area. To perform the task mentioned above as well as formulate the expansion scheme to the surrounding area, he/she will be engaged in field works with PMU staffs to lead related villagers and their organizations for the efficient maintenance /sustenance of tree planting and IGAs established by the Pilot activities. In detail, the expert has the following duties (whereas volunteers do not have particular duties unless otherwise imposed by their host government agencies they are belonging to) to the host agencies of the NGO(s)/donor(s).

(a) Advising PMU staffs to reorganize related village committee(s) so that other villagers than those already participated in the Pilot activities during the Study period can be newly participated in the same activities, thus enlarging coverage rate under the Pilot activities year after year,
(b) Advising PMU staffs to take timely actions to procure or self-supply such required inputs as tree seeds, scions and cuttings to be planted within the village, as well to urge relevant committees to share the benefits derived from already introduced IGAs between past participants and newly participating villagers in nursery works and out-planting practices,
(c) Urging PMU staffs to establish annual village-wise targets of rehabilitating deteriorated environment taking account of villager's ability and conditions,
(d) Monitoring and consulting PMU for the entire activities by the concerned village committees and related villagers, keeping records, analyzing results to obtain new technical and managerial findings about the follow-up activities,
(e) Assisting counterparts in formulating the necessary policy, guidance and establishing the programme and institutional framework for horizontal expansion.
(f) Functioning as a coordinator for liaison toward a proposed technical cooperation project in the Middle Shire Catchment Area that is supposed to be based on the programmes, the institutional frameworks & the outcome from the Pilot Study.

Manning of Foreign Volunteers / Advisory expert:

The following shows Terms of References to be given to the proposed staff.

A) Community Development
   I. belonging to RDP, under Land Husbandry, in charge of economic development in rural media,
   II. to introduce accounting and IGA management skills in the jurisdictional villages,
   III. to help establishing economically viable IGAs into the jurisdictional villages.

B) Forestry
   I. belonging to RFOS, under Forestry Extension, in charge of establishing and tending village woodlots in rural media,
   II. to manage existing village woodlots and advise tree planting in private land,
   III. to monitor and cooperate overall forestry activities in the jurisdictional villages.

C) Advisory Expert of agro-forestry
   I. belonging to RFOS, in charge of extending agro-forestry activities in the Pilot villages,
   II. to promote water and soil conservation through augmenting shrub canopy cover,
   III. to manage and utilize village nurseries efficiently to contribute to planting both firewood species and edible fruit ones.
   IV. to encourage villagers in the Pilot villages to sustain tree planting activities.

General terms of references of the proposed experts are mentioned above.

Table 6-3 shows the manning schedule for each stage and their time lags among stages.

Figure 6-3 indicates possible location for horizontal expansion. Two cluster areas, each one in T.A. Kapeni and T.A. Kuntaja are proposed where the following site conditions can be satisfied:

i. Perennial water sources are available for establishing village nurseries,
ii. The sites are easily accessible by current road networks,
iii. Poaching risk is negligible, since urbanization has not yet been proceeding.

Participatory approach is proposed for lateral expansion where participants join the activities on their voluntary basis. High rate of participation is anticipated in these sites because they have been suffering from under-employment. Selection of around 20 core villages in each T.A. is targeted where a couple of group villages with high solidarity and leadership of village cadres can be chosen as core villages in these T.A.s.

Necessity of Input Supply to Staffs of Extension Services:

To facilitate for PMU staffs to smoothly extend their services, it is advised to let them carry such vocational tools as stationary, recording notebooks, hand-levels, measuring tapes, weighing balances and a bicycle (to the staff who have not received a motorbike). As regards the minimum quantity, each staff requires stationary, notebooks and a bicycle, but a set of measuring kits can be jointly used by a team (consisting of 3 to 4 staffs) has been proved enough in the Pilot Study to perform their daily extension services.

Fig.6-3 Proposed Areas of Horizontal Expansion

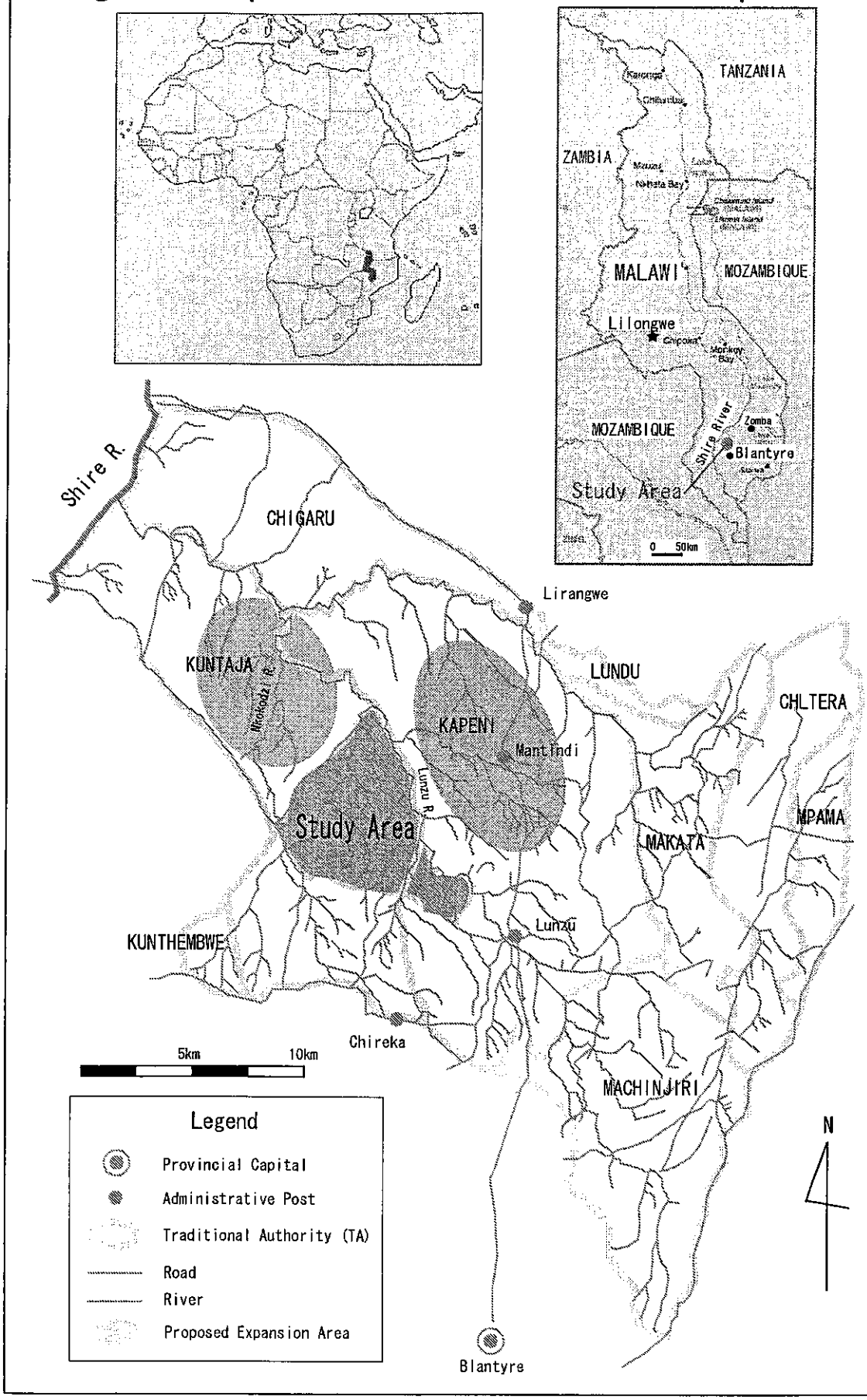
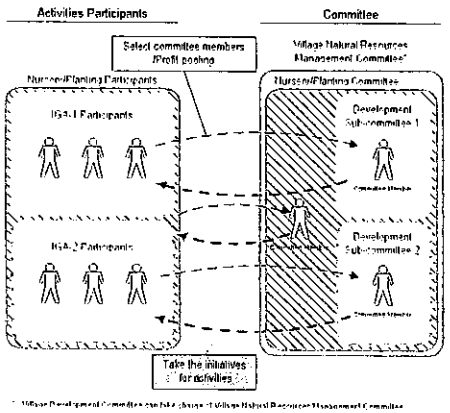


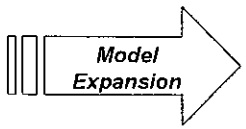
Table 6-3 Proposed Schematic Barchart on Assistance from the Donor County on the Stages from Followup to Expansion

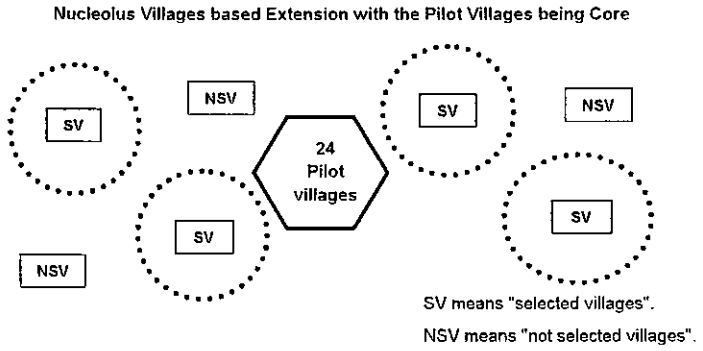
Stage	Scheme	Scope	2005				2006				2007				2008				2009				2010				2011				2012				2013				2014	
			1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q
1. Followup	Donor's Volunteers	Follow up of the pilot projects (24 villages)																																						
	Rural Development (IGA Volunteer)																																							
	Forestry/Agro-forestry Volunteer																																							
2. Liaison	Advisory Expert	Liaison to the expansion as well as policy related advisory																																						
3. Expansion	Technical Cooperation Project	Expansion to the middle Shire river catchment area from the pilot area																																						
	Request to Donor Country																																							
	TOR Discussion																																							
	Team Dispatch																																							
	Mobilization																																							
	Project Implementation																																							
	Team Leader cum social/agro forestry	Project Implementation Team to work with the Malawi Gvt.																																						
	Land Husbandry/Rural Development																																							
	Farmers Organization/ Gender																																							

Note: The first harvest of the out-planted Eucalyptus under the Pilot Study is anticipated in 2007.

total 7 yrs implementation (corresponding to the first harvest of trees)







6.3.2 How to vertically develop on-going Pilot activities in 24 target villages

What are needed after the Pilot activities include monitoring the aftermath and continuing to give advice to the target villages from the same extension staffs, even though frequency might be reduced. Extension staffs also discovered and admired capability of poverty and hunger prone villagers to accomplish survival of 200 seedlings per participant in adverse climate and creation of over 500 improved fireplaces that could not be achieved even in the original home-ground of Kenya. If such potential cannot be oriented into an upheaval of planting campaign, the efforts of administration would be accused of. This is the background of the following proposal.

In order to keep the momentum of willing participation in the activities of afforestation and income generation in the target villages, it is proposed to continue the currently provided support in a smaller scale, even after the Pilot Study phases out. Any radical change in the on-going support system is not necessary to maintain the established system because the adopted model has so far well been functioning for three years, as checked in the analysis on the performance. The proposed change in the supporting is as follows (PMU is explained in 6-1):

(1) Project Maintenance Unit (PMU)

Current PIU may be remodeled into PMU. The staff composition is reduced from 15 members to 8 on account of austerity budgetary situation of relevant regional agencies. The mandate of PMU staff includes monitoring the participatory activities, giving proper advice to the participants, transferring additional techniques / skills to the participants for the maintenance of their activities, regularly holding meetings for executing the plan of monitoring/ extension and exchanging information as well for reporting to the relevant agencies.

As for the meeting place, Lunzu Training Center in Lunzu Township should be considered, instead of holding them in Regional Forestry Office South, just because the proposed Center is located nearest to the Study Area and the concerned agencies can dispense expenditure. The eight members consist of three forestry assistants, three agricultural extension staff and two community development staff who all live nearest to the Study Area. For the new staff belonging to the forestry office, all the data and content of activities can be handed over from the existing PIU members to PMU. The supporting activities by PMU as proposed above can be done within the ordinary extension activities within the jurisdiction of these eight staffs.

Within the austerity regime of office budget, what is suggested above would be the most realistic choice for the purpose of supporting, monitoring and encouraging participatory activities, realizing the minimum expenditure for transportation, after the Pilot Study phases out. The report of monitoring and encouraging can be submitted to the Department of Forestry by one of the eight PMU staff by mail after every regular meeting. It is considered relevant that the Department of Forestry deals with these follow-up actions because the Pilot Study has envisaged environmental conservation as the major target.

The task to be imposed to the target 24 villages includes proper management of what has been created by Pilot activities, and the extension of what has been achieved into the remaining part of their own villages so as to cover the whole village area with canopy.

(2) Period of support by PMU

It is proposed for PMU to continue for 3 years from 2005 ~ 2007, because the first harvest of the out-planted Eucalyptus is anticipated in 2007 and after the harvest, the participants can get along by their own efforts to sustain planting and income generating.

(3) Contents of Support by PMU

Concerning material support, the following minor supply from 2004/ 05 as presented in Table 6-4 is considered proper to maintain current participatory activities, though basically input supply so far made for the third year of the Pilot Study can cover the requirement for continuing these activities in the target villages.

PMU should urge members of village development committees to take the following measures to realize vertical expansion of the components verified in the Pilot Study.

(1) to change or newly add participants in nursery and out-planting activities.
(2) to shift existing nursery or to establish additional one so that new participants can keep easy access to the nursery.
(3) to share or transfer nursery implements and part of IGA inputs to the new participant group for realizing coupled benefits.
(4) to advise existing participants to teach what they have learned so far to the new participants along with PMU staffs.

In addition to the above advice, PMU staff should give services on the additional instruction on how to self-supply and reuse seeds, seedling pots, continued training on how to collect seeds of indigenous trees within their village in order to make full use of nurseries. In the case that experts or volunteers from donor(s) are stationing, PMU can collaborate and consult with these foreigners on sharing data, instructional works and issues of reorganizing villagers or of additional input share for new participants etc.

Table 6-4 Proposed Input Supply to Follow-up Action in 24 Target Villages

Input Item	Annual input supply
Tube pots	6,000 / village (also the secondhand should be used)
Seed (excluding self-supplied one)	1kg / village/Forest/AF (some from individual seed bank)
Farm implements	no need of supply (individual village maintenance)
Material for IGA	basically no need of supply (individual village maintenance) except veterinary medicines & pesticides
Visit of extension staff (groups such as PMU)	Once a week / village

(4) Desirable Foreign or Local Support

Donor's support is still desirable though the Government agencies are main actor to provide necessary support for the maintenance of the participatory activities in the Study Area. A form of technical support constitutes dispatch of a group of volunteers though provision of minor input supply by these staffs is institutionally difficult. Table 6-5 A and B give rough idea of dispatch of volunteers and an expert.

Desirable follow-up actions include vertical development of forestry and AF activities coupled with IGAs in 24 target villages where only a part of the whole village population has participated in the proposed activities during the three years of the Pilot verification. It is desirable to mobilize as much village population as possible to continue tree planting until self-sustenance of firewood be achieved and the Study Team believes that expenses of this part of follow-up action could be met by the three ministries concerned on the self-help basis. It should also include horizontal expansion to further expand the coverage of verified Pilot activities into adjacent or surrounding villages in the same TAs. However, this expansion may require further support by interested donor(s) for site selection and provision of initial inputs to the participants.

Table 6-5 Proposed Personnel for Follow-up the Pilot Activities

A. Desirable manning for follow-up of the Pilot Activities for 2 more years

Foreign staff	volunteer 1	volunteer 2
Expertise	Rural development	Forestry/Agro-forestry
Period	2 years	2 years
Input resources	0	0

B. Proposed manning for follow-up of the Pilot Activities & policy related advisory for expansion of surrounding villages for 3 more years

Foreign staff	Advisory Expert
Expertise	Forestry/Agro-forestry
Period	3 years
Input resources	Tube pots, seed and veterinary medicines & pesticides, etc.

The expected roles of concerned ministries and character of stakeholders in this proposal are summarized in the Table6-6.

Table 6-6 Anticipated Roles and Characters of Stakeholders

A. For volunteers

Stakeholders excluding villagers	Central Level of Offices	Regional Level of Offices	PMU staffs	Foreign Volunteers
Roles in follow-up actions	Supervision and report to donors	Superintending PMU activities, Report to Central	Continue diffusion services with volunteers	Monitor and report to donor, assist PMU
Character on duty & performances	liable to follow-up actions, coordinate with the donor	liable to follow-up actions by arrainging manning and mobilizing PMU	liable to follow-up actions by extend-ing services within target villagers	no responsibility on the outcome but only spiritual support to PMU and villagers