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Woodlot Management Guidelines for Smallholder Farmers

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1. Introduction

Tree planting programme in Tanzania has been advocated for decades but adoption of these activities is not promising in most parts of the country. To the contrary, people in Makete district responded positively to tree planting due to unfavorable climatic conditions and poor soils that contributed to poor agricultural crop production. Also they already know the importance of trees as they contribute highly to the economy of individual households and to the District at large. Previously the income of people in Makete district depended on agricultural products such as maize, wheat, rice, round potatoes and pyrethrum but later due to climate variability and change crops production failed tremendously. This resulted in threatening food security and the wellbeing of rural people of Makete.

Responding to this situation, local people of Makete district have established tree woodlots as an alternative source of household income. Makete district is among the southern highlands areas of Tanzania reported to have successful woodlots. These areas are well afforested with trees especially of cypress, pines, eucalyptus and wattle. The woodlots range from 0.25 to 3 hectares. Much as the communities are harvesting and getting income from their woodlots, their management practices including marketing strategies are far from being sound. A study was conducted to assess management practices of smallholder woodlots and marketing of wood/timber in order to document best woodlots management practices. This was envisaged to

maximize benefits accruing from woodlots management by households in Makete district.

The best practices are documented in this publication in the form of Guidelines for Woodlots Management in Makete District. These Guidelines were developed based on farmers' own experience in managing their woodlots (Picture 1) and technical recommendations of the researchers from the Faculty of Forestry and Nature Conservation, Sokoine University of Agriculture and the Tanzania Forestry Research Institute. Forest staff and the management of Makete District Council also participated in this research. The research was funded by the government of Denmark through The UNEP/UNDP Climate Change and Development: Adapting by Reducing Vulnerability (CC DARE) programme.

Although these guidelines are meant for Makete district, they may be applied in other districts in Iringa region and Tanzania as a whole with few modifications. The guidelines have been structured into the following sub-topics, which are considered crucial for proper woodlot management by rural communities:

- Site and tree species selection;
- Source of planting material;
- Land preparation;
- Field planting and spacing;
- Woodlot tending activities;
 - Weeding
 - Thinning
 - Pruning
- Suitable harvesting time; and
- Marketing channels for timber.



Picture 1. Discussion between tree growers and the researchers

2. Site and tree species selection

Introducing new tree species to new sites normally requires small scale trials before embarking into large scale planting. This is because some sites may not be suitable for some species in terms of soil fertility, drainage, structure and climatic factors. The vegetation of Makete district is mostly grassland that is suitable for tree planting (Picture 2). However, for optimum land use, it is recommended to plant trees on hilly areas and on exhausted agricultural lands which can no longer support agricultural crops. In areas where there is no land shortage, trees can be planted anywhere.



Picture 2. Grassland vegetation of Makete

Tree species selection depends mostly on the objectives (e.g., conservation, fuelwood, fibre, or sawlog production). *Pinus patula* and Cypress (mainly *Cupressus lusitanica*) are the most preferred species for timber while *Eucalyptus* is being used for firewood and poles. However, the mentioned trees species are not suitable for planting in catchment areas and water springs due to their fast growth which results in mining water from the soil. Indigenous species should be planted in such areas. Apart from the production of timber, indigenous species are planted in water source areas for soil conservation purposes. The species include *Hagenia abyssinica* (mdobori), *Juniperus procera* (minoge) *Catha edulis* (mgambo), *Syzigium cordatas* (mvinge) and *Sylix subsilata* (Mazivizivi). Indigenous species also recommended for Makete district and other highland areas includes: *Cordia africana*, *Vitex keniensis*, *Acacia sieberiana* and *Acasia seyal*.

3. Source of planting material

There are two sources of tree planting material in Makete district. These are seedlings raised in the nursery and seedlings from natural regeneration in harvested areas. In both cases, it is insisted that the mother trees must be of superior quality in terms of:

- straightness;
- vigour;
- small balanced crown; and
- small branches perpendicular to the stem.

This is because the superior qualities are inherited by the offspring, hence, enhancing productivity and quality. Improved seeds from the Tanzania Tree Seed Agency may also be procured.

Nursery practices

In the nursery, standard nursery techniques should be followed:

- drying the seeds;
- preparing seedbed;
- sowing;
- mulching;
- potting mixture preparation (50% sand and 50% forest top soil);
- container filling;
- shading seed bed;

- watering (morning and evening up to when seedlings are 30 to 40 cm when hardening off is done by watering only in the evening);
- pricking up (i.e. putting seedlings in pots or transplant beds);
- root pruning: this is simply done by rearranging the pots once after 3 week or a month; and
- hardening off the seedlings when they are 30 to 40 cm tall by watering only in the evening.

Seedlings are planted out when they are about 30 to 40 cm tall. This takes about six months in the nursery. Since planting out is normally done from December to March, sowing seed should start in June.

Seedlings from natural regeneration after harvesting

It has been observed that more than half of current young woodlots in Makete come from natural regeneration after the mother trees have been harvested (Picture 3). Some of these seedlings are being used for the establishment of woodlots elsewhere, while some are left to grow insitu as the next woodlot. To ensure future quality crop seedlings with straight, vigorous, and non multiple stems with few balanced branches must be selected to remain in the field or for planting elsewhere.



Picture 3. Regenerants from natural regeneration in harvested areas

4. Land preparation

Field planting of seedlings requires some land preparation. Since Makete is mostly grassland, once the land is identified, thickets and small bushes are cleared. This is followed by fire line construction around the woodlots.

In principle the objectives of site preparation are to improve survival and to raise growth of seedlings. Site preparation may be manual, mechanical, chemical or burning. Use of chemicals and burning are detrimental to the environment and are therefore not recommended. Cheap land preparation techniques such as strip cultivation and spot cultivation are recommended. Those

who can afford may opt for complete site cultivation by the use of tractors/ox ploughs.

When the site has been identified and prepared, pitting is done. Depending on the soil type, two types of pits are common in Makete district:

- In areas where the soils are compact and degraded large holes measuring 30cm x 30 cm x 30 cm should be prepared before planting; and
- In areas where soils are fertile and loose, small pits made by bush knife (Panga) are made at the time of planting. These pitting techniques have shown no significant difference in survival of seedlings and have been used for decades.

5. Field planting and spacing

Field planting should be done during the start of the rain season, which is between December and March. Planting spacing is of importance because it determines the quality and volume of the wood produced per stem. There are two spacings which can be adopted:

- 2.5 m x 2.5 m; and
- 3.5 m x 3.5 m.

A spacing of 2.5 m x 2.5 m should be done if the trees will be thinned after 6 or 8 years while the spacing of 3.5 m x 3.5 m does not require thinning at all. In practice the spacing of 3.5 m translates to anything from 3 m. In most cases the small thinning are left to rot in the woodlot, as

they have no market. It is therefore recommended to adopt the wider spacing which may allow intercropping with other crops whilst avoiding the cost of thinning.

For places where it has just rained and soils are still wet, digging of holes and planting can be carried out simultaneously. If the soil is not wet, planting session can wait for the rains. During planting, seedlings should be taken with its soil intact and inserted into the hole. To cover the planting hole, the upper soils should be put first followed by the bottom soils. The soil should be gently firmed around the roots to eliminate air pockets and bring the earth into intimate contact with the roots.

Beating up should be conducted within one year after planting during the rain season. Extending the beating up period beyond one year results into uneven aged woodlot, which complicates management.

Woodlot establishment from natural regeneration requires special care. As regenerants are not growing uniformly to cover the entire site, farmers should ensure uniformity by thinning out overcrowded areas and filling in the gaps which have no regeneration. At the age of two years, it is possible to recognize saplings of good quality and remove undesirables ones to maintain the spacing of either 2.5 x 2.5 m or 3.5 x 3.5 m. However, it is difficult to have exactly square spacing of 2.5 x 2.5 m or 3.5 x 3.5 m from natural regeneration. In this case the farmer should aim to achieve such average spacing rather than exact squares.

6. Woodlot tending activities

Tending activities include fire protection, weeding, thinning and pruning.

Fire protection

Fire is the major threat, which has contributed to a significant loss of woodlots in Makete district. Fire precaution should start from the woodlot establishment phase. An effective fire line should have a minimum width of 10 m (Picture 4). In areas where woodlots of different farmers congest together in an area, instead of constructing separate fire lines for each woodlot, farmers can organize themselves and construct a single fire line to minimize land consumed by the fire line. Thickets and small bushes on the fire lines should be removed. When this is done a fire line should be constructed around the woodlots

During the crop life, the fire line should be maintained by removing grasses and other vegetative growth especially during dry season (June to October). Some farmers have hesitated to develop fire lines claiming that it occupies a significant area which could be planted with trees, but they have ended up losing the entire crop to fire. It should be clear that, the losses that may be caused by fire and the gain from the use of fire line to plant trees are not comparable.



Picture 4. Fire line around the woodlots

In addition to maintaining fire lines, the following arrangements are practical for Makete district:

- Fire protection should be participatory and co-ordinated in the village and between villages/sub-villages; and
- A farmer wishing to use fire in agricultural activities has to ask for permit from the village government and other villagers alerted in case the fire escapes.

Weeding

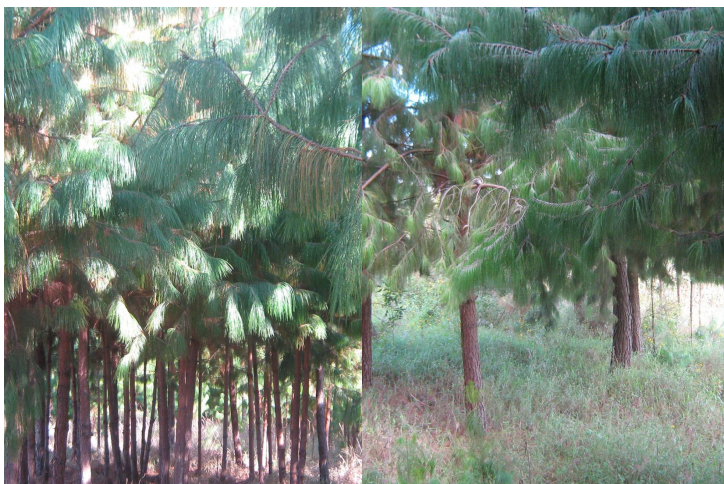
In Makete district spot weeding is usually practiced. This practice is cheap compared to total or strip weeding. Weeding is of importance to reduce competition between weeds and young trees and also minimize the risk of fire.

As trees grow, the canopy closes which helps to suppress weeds. Therefore, in later ages weeding is not necessary.

Thinning

Thinning is not of importance if the trees have been planted at a wide spacing such as 3.5 m x 3.5 m. But for trees planted at a spacing of 2.5 m x 2.5 m, thinning should be done at the age of 7 or 8 years for pines and cypress. The aim in thinning should be to remove about one third of the trees. Thinning should focus on trees with undesirable characteristics so that those with best form remain as final crop to harvest at a proposed rotation age. Trees that should be removed are therefore; crooked, small, dead and dying ones. Unproportionally large trees with poor form and large branches and crowns (wolves) should also be removed. The aim is to give the best trees more space to grow, especially diameter growth which has significant effect on volume production. Failure to carry out thinning timely will result into small diameter trees and hence low volume per tree.

For stands established from natural regeneration, extra care should be taken. Release cutting should be done when regenerants reach about 2 years of age. At this age, cutting should focus on reducing the number of stems so as to capture the spacing of square of 2.5 x 2.5 m or 3.5 x 3.5 m of a crop of trees having desirable characteristics. If release cutting is not done at two years, trees will overgrow into worthless withies and become more costly to thin out. Some naturally regenerated woodlots in Makete district were observed to have completely been spoilt due to lack of thinning (Picture 4).



(a) Unthinned stand

(b) Thinned stand

Picture 5. The contrast between unthinned and thinned stands in Makete district

Pruning

Pruning is conducted so as to obtain knot free timber, to improve access to the woodlot and to reduce the risks of crown fire. It is done 3 years after planting. The belief that pruning increases the tree bole should be discarded as some farmers tend to over-prune. The rule is that at any one time the maximum pruned height from the ground should be one third of the total tree height. Over pruning results in reduction of tree growth since the crown carries the leaves, which manufacture tree food through the process of photosynthesis. In addition, the following should be observed during pruning:

- Pruning should be conducted at the end of the rain season to reduce the risk of fungal attack on the wounds;
- Proper tools such as curved hand saws or sharp bush knife should be used for pruning;

- Using blunt bush knife may result in debarking the stem, which increases the wound size; and
- Branch should be cut flush to the stem instead of leaving stumps of the branches on the stem. The dead stumps of the branches have the same effect of inducing timber weakness as un-pruned stem.

7. When to harvest

Harvesting before the age of 15 is not recommended. Most farmers in Makete district harvest premature woodlots at the age of 8 years to solve family financial problems. For the same reason some farmers sell out their woodlots very cheaply while they are as young as 4 years. It is recommended to start tree growers SACCOS to give credits to members who need early money using the woodlots as collateral. In this context, the district authority has indicated interest and willingness to assist farmers.

8. Market channels for timbers

Figure 1 shows the identified market channels for woodlot products in Makete district. The channels are summarized as follows:

- Farmers sell immature stand to middlemen who manage woodlots to maturity and then extract timber for sale to final market destinations of Makambako, Njombe, Dar es Salaam and Mbeya;

- Alternatively, farmers sell mature stands or round logs to middlemen who convert them to sawn timber for selling to the mentioned final destination; and
- Another option is when the farmers themselves convert their mature or immature stands to lumber and sell them to middlemen or to the final destination.

9. Marketing of timber

Market for timber in Makete district is readily available. There are a lot of customers looking for timber daily. Timbers are sold in following forms:

- Standing mature;
- Standing immature;
- Round logs; and
- Sawn timber.

However, farmers should be cautious on the price they are selling their products. Tables 1 and 2 give an overview estimate of price of a given tree/timber.

E.g. for a tree having a dbh of 35 cm produces 6 pieces of lumber of 1" x 8" and 7 pieces of 2" x 6" (Table 1). At a price of TAS 2,800 and 3,500 for (1 x 8) and (2 x 6) respectively, the gross earning is TAS 41,300 if lumber are sold in the village (Table 2).

The costs associated with the production of lumber from the tree of dbh 35 cm are as follow:

Tree felling:	400
Skidding 2 logs @ 400:	800

Transfer 11 lumber @ 300:	3,900
Production cost of one 11 lumber @ 700:	7,700
Contingency (5% of the above total cost):	640
Total cost	13,460

Subtracting the cost from the gross earnings, the farmer is able to get net earning of **TAS 27,840** (41,300-13,460) from a tree of 35 cm dbh.

Field observations showed that such tree can be sold at price of **TAS 5,000 to 12,000**. The amount of money farmers lose by selling hectares of woodlot is enormous. Therefore, the information in Table 1 and 2 provides a tool for farmers to negotiate the price of the trees from the woodlots.

Table 1. Simple estimates of lumber produced to the respective size (Dbh) of the tree

DBH-RANGE (cm)	LUMBER DIMENSION (Inches)						
	1X4	1X6	1X8	1X10	2X6	2X4	2X3
10-15							1
16-20		1				3	1
21-25	1	1			3	2	
26-30		2			3	2	
31-35			4		3	2	
36-40			4		5	2	
41-45			6		7		
46-50			9		3		
		1	10		6	2	
			10		5	3	
		3	9	11	5	4	
			10	12	4	3	
		2	12	2	4		8

Source: field data

Table 2. Cost associated and price of sawn timber.

Item	Cost	Lumber selling price	
Skidding one log	200-400		
Tree felling	300-400		
Lumber transfer	200-300		
Production cost of each lumber	400-700		
Lumber dimension	Machine cost per lumber	Lumber selling price at the villages	Lumber selling price at Makambako
2x6	700	3500	4000
1x8	700	2800	3500
1x10	800	3500	5500
2x4	500	2000	3000
2x3	300	800	1500
1x6	500	1500	2500
Transportation	Cost		
Car hiring cost for transferring 400-500 lumber	300,000-400,000		
Tax per lorry	20,000-25,000		

Source: field data