

Technical specification

System: Mixed native species woodlots

Introduction

This land use system involves planting a variety of mostly indigenous timber species on fragmented land plots near protected areas, which farmers have difficulty managing because of labour shortage, distance, theft or vermin constraints. The aim of this agroforestry system is to diversify farm production and provide multiple benefits such as timber, firewood, medicine and fodder while minimizing land management requirements.

Management objectives

This mixed native woodlot system provides an opportunity to farmers to use available land which is not optimally utilized in a profitable manner or place it under a less intensive management system. Land may be too far from farmers' compounds because of fragmentation, or crops grown may be affected by theft or vermin originating from the neighboring protected area. Farmers may not have the necessary labor to cultivate.

Species: Under this system it is expected that a large variety of species will be planted. These include the following.

Milicia excelsis

This large deciduous tree is fast growing compared to many other hardwoods. It grows 30 – 50m and has a diameter of 2-10m.

Chrysophyllum albidum / goronogosanum (Nkalati)

These large trees occur in the Eastern Highlands of Zimbabwe and Mozambique.

Albizia Spp.

Species vary between small shrubs to larger trees. Wood is suitable for a general purpose timber, and. Bark and roots are used for medicinal purposes. Some spp roots used to make soap substitute, or bark of some used for basket weaving, and leaves good for browse. Sawdust is irritable to the nose and throat.

Maesopsis emnii

Light demander and grows up to 30 m high. Prefers a wide range of soil conditions but deep moist fertile soils are preferred. The rotation is 12-15 years for timber in productive sites. Earlier harvesting at 7-10 years can yield fuelwood and pulp. Grows well at altitudes of 700 to 1500 masl and mean annual rainfall of 1200 to 3000 mm.

Table 1: Maesopsis growth in its optimum range.

Age in years	DBH in cm	Bole height in m	Tree height in m	Crown diameter in m
2	11	3	7	5.5
4	25	5.5	13	8
6	30	6.5	16	10

9	40	7	20	13
12	45	11	25	15

Source: Buchholz et al., 2003

Terminalia spp.

This is a large tree that can attain a height of 15-45m and it's a strong light demander. Grows well in well-drained loams, sandy loams, clay loams and volcanic soils. The rotation is 25-30 years for timber and 10-15 years for poles. Terminalia species can grow at altitude: 0-1200 masl and mean annual rainfall is 1250-3 000 mm.

Funtumia elastica (bastard wild rubber)

A tall tree up to 30 m.

Markamia lutea

Grows up to 10-15m tall, narrow crown and irregular taproot. It grows in well-drained heavy acidic clay soils. Rotation is between 25-30 years. Recommended altitude is between 900 and 2000 masl and mean annual rainfall ranges from 800 to 2000 mm.

Grevillea robusta (silky oak)

This tree grows up to 20m tall and is exotic in Uganda. It grows well in alluvial soils that are free from water logging. It also occurs on clay loam and sand. Altitude: 0-2300 m. Annual rainfall: 600-1700 mm. Rotation 20-30 years. Evergreen to semi deciduous straight trunk "A native of Australia; cultivated for ornament, shade, windbreaks, timber and shelter. The wood is pale yellow-brown, heavily mottled with dark rays, tough and durable, very attractive, and suitable for quality furniture." (van Wyk & van Wyk, 1997)

Cordia spp (Muzigangoma)

It grows in an altitudinal range of 550-2600 masl and mean annual rainfall of 700-2000 mm. The tree thrives in dark brown fertile forest soils. Rotation is 25-30 years. Shrub or small tree, some species have fruit which are edible (but not very tasty!). Occurs mainly in low altitude bushvelt.

Carapa procera (Mutongana)

The species grows up to 25m height. It prefers a light-textured soil. Altitude range: 0-1200 masl and mean annual rainfall: 1500 - 3200 mm. Rotation period is between 25-30 years for timber.

Entandrophragma spp. (caudatum)

This is a large deciduous tree which prefers habitats of rocky hillsides, open woodlands and low lying river valleys. It will grow up to c.1400m.

Khaya senegalensis (African mahogany)

A deciduous evergreen tree reaching 15-30m high. It can grow in altitude of 0-1800 masl and mean annual rainfall 400-1750 mm. It tolerates a wide range of soil conditions, from neutral to very strongly acidic and from very well drained, coarse sandy loam to somewhat poorly drained clay. It takes between 50-100 years to harvest for timber.

Prunus africana (Red stinkwood)

Prunus africana is an evergreen tree, 10-24 m in height. It can grow to a stem diameter of 1 m. *Prunus* is a highland forest tree, grows in the humid and semi-humid highlands

and humid midlands. The species has a high light requirement and grows best in forest gaps. It grows well in altitudes of 900 to 3,400 masl and mean annual rainfall of 890 to 1400 mm. Reddish brown wood often used in furniture.

Newtonia buchananii.

This is a tall deciduous forest tree with a flat crown (growing up to 40m high), and is a good timber tree.

SITE REQUIREMENTS

Classification of climate and site productivity

Climate in the target area is classified as bimodal. It is characterized by two two-rainfall seasons. This is suitable for the above species.

Ecology of the species

The species can survive in a wide range of ecological types (see table 2 for altitude and rainfall requirements). However, most species prefer deep well drained fertile soils.

Table 2: Site limitations for mixed woodlots

Altitude	Mean annual rainfall
900-1950 masl	750-1800 mm

Site productivity is deduced from crop yields for the area as expressed by 20 sample farmers in Kichwamba, Ryeru, Bitereko, Kiyanga subcounties, Bushenyi district. Millet and banana are the main food crops in the area. Other crops include maize, beans, cassava, coffee, groundnuts, potatoes, rice and pineapple.

Table 3: Arable outputs from land in different soil fertility scenarios

Crop type	Soil fertility levels		
	High	Medium	Low
Millet (kg/ha)	1500	750	300
Bananas (kg/ha)	10,160	6,063	2,750

Rotations

The timber species fall under 3 major rotation categories.

Table 4: rotation lengths of the tree species

Short rotation ~15 - 18 years	Medium rotation ~25 years	Long rotation 40 – 60 years
Maesopsis emnii	Funtumia elastica	Khaya senegalensis
Terminalia spp	Markhamia lutea	Entandrophragma (caudatum)
Albizia spp	Cordia spp	Milicia excelsis
	Carapa procera	Prunus africana
	Albizzia spp	Fagara macrophylla
		Newtonia (buchananii)

The objective of this system is to produce high-quality timber at the end of established rotations, as well as fuelwood obtained through woodlot management operations (thinning and pruning). Native woodlots also produce medicinal products, honey, as well as herbaceous fodder for goats growing under trees where possible. Integration of indigenous trees into rural landscapes also provides soil erosion control as well as biodiversity conservation benefits. The system can be used for producing intercrops during the two first growing seasons before competition would affect tree growth.

Potential income

Fuelwood, poles and timber provide income, although this is highly dependent on the methods used and harvesting and transport costs.

Table 5: Timber prices in U Shillings

Tree species	Timber size									
	6x1	4x2	4x3	6x2	8x2	8x1	9x1	10x1	12x2	15x1
Mahogany		11,500		16,500	23,000			23,000	33,000	
Milicia excelsis		9,000		14,000	18,000			18,000	28,000	25000 to 35000
Albizia spp		4,500		9,000	9,000			9,000	18,000	12000 to 15000
Maesopsis emnii		3,500		5,000				9,000		
Cupressus spp	6,000	5,500	7,000	12,000		9,000	15,000	25,000		
Chrysophyllum albidum		6,000	1,000	1,000	1,000	1,200		12,000	20,000	

These are expressed in USh per m³ with marketable volume of 30% and include estimate costs of harvesting and transportation

Costs of Implementation

Estimated costs per ha over the rotation can be subdivided into:

- Costs of clearing
- Planting
- Maintenance

Management operations

a) Land clearing

This involves cutting down and uprooting where possible all shrubs, herbs and climbers growing on the designated plot.

b) Establishment

Planting stock should come from seeds or wildlings of high quality mother trees selected for form, vigor, bole height in the protected areas or the agricultural landscape.

Planting holes of 30 cm diameter and depth should be made and top soil used in the rooting zone if possible.

The planting design consists in tree rows planted 5 m apart of fast growing species (especially *Maesopsis emnii*) planted at 10 m spacing between trees alternating with

rows of medium and long rotation species planted at 5 m spacing between trees in the row. Initial tree density is 310 trees/ha.

Maesopsis trees are planted at close to final density for timber. When harvested before timber size, Maesopsis does not make good construction poles but provides high quality fuelwood. In year 6+, Maesopsis crowns are expected to start closing. Medium rotation species demanding light will have conducive conditions to establish themselves and not suffer from the shade provided later by Maesopsis. Shade demanding species such as mahoganies will benefit from the shade provided.

Respective number of trees per species category is provided in Table 5. It should approximate the following: Maesopsis 32%, Medium-rotation species 48%, and Long-rotation species 20%.

Cultivation can be done in between tree rows for at least 2 growing seasons.

c) Maintenance

“Beating-up” to replace dead or poor performing seedlings for short, medium and long-rotation species is crucial.

Given the relatively low initial tree density, intensive spot weeding is needed twice a year. Initially marking trees with a stick will help to prevent tree losses when weeding. Labour requirements for weeding will need to be monitored over time.

Tree pruning should be practiced to encourage best tree form. Maesopsis eminii is self-pruned but other species require regular pruning of lower branches.

d) Harvest

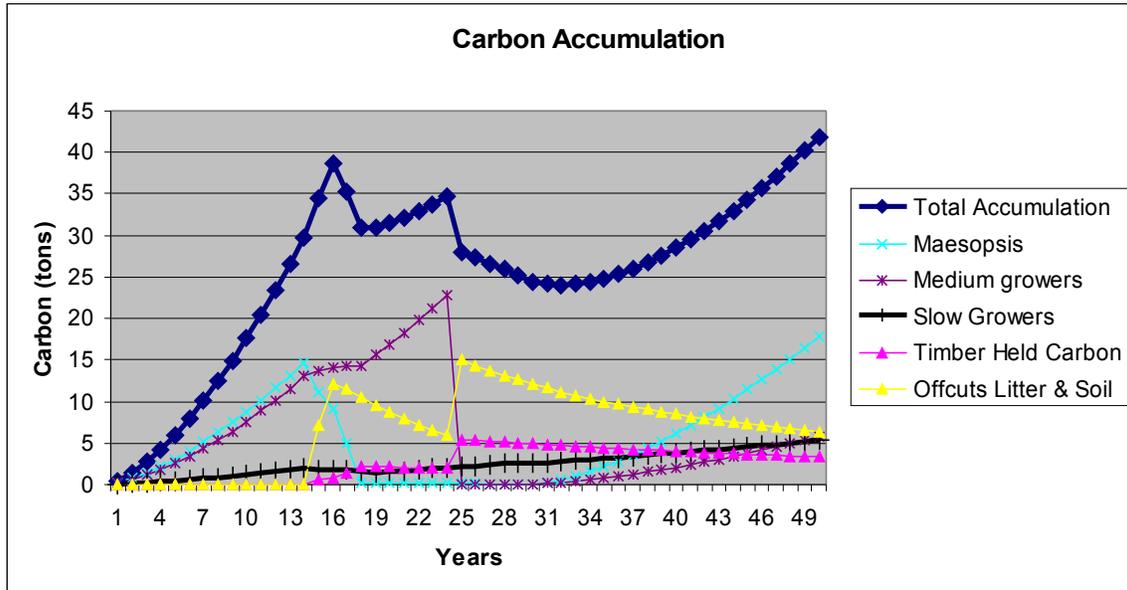
Maesopsis will be harvested at 15 to 18 years for timber. It is expected that harvesting will be done through local pitsawing. Therefore, at a rate of one log in two weeks, or about 25 logs a year, harvesting of Maesopsis is spread over 4 years.

Harvesting of medium rotation species will start at 25 years and will be spread similarly over 4 years. Damage losses are included in Table 6. Depending on the carbon market Maesopsis will be re-established then. Long rotation tree species will be harvested at 40 years or later depending on specific farm management.

Table 6: Table showing harvesting from rotations in woodlot

Species	Year 1	Year 7	Year 15	Year 16	Year 17	Year 18	Year 25	Year 26	Year 27	Year 28	Year 40+
Maesopsis	100	100	75	50	25	0	0	0	0	0	0
Medium rotation species	150	150	140	130	120	110	85	60	35	10	0
Slow growers	60	60	60	43	39	35	28	28	28	25	25
Density tree/ha	310	310	275	223	184	145	113	88	63	35	25

Carbon Sequestration potential



Graph showing carbon benefits of rotations over time.

Monitoring

Initial monitoring is based on successful establishment. The whole plot must be established by the second season with at least 85% survival of seedlings. Thereafter, targets are based on diameter at breast height and its expected annual diameter increment.

Table 7: Monitoring indicators for species

Year	Indicator
1 st season	At least 100 trees/ha established at 10 m spacing
2 nd season	Whole plot established, 310 trees/ha
3 rd season	85% survival

References

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