

TECHNICAL PAPER 60

**PARTICIPATORY FOREST INVENTORY
OF PROPOSED MFUNDIA
VILLAGE FOREST RESERVE**

**Veltheim, T., Kijazi, M. & Killenga, R.
2002**

East Usambara Conservation Area Management Programme

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Tanga 2002

**Ministry of Natural Resources and Tourism,
Tanzania
Forestry and Beekeeping Division**

**Ministry for Foreign Affairs, Finland
Metsähallitus Consulting Oy**

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Executive Summary

Mfundia forest is located in Lwengera Valley in Korogwe District, Tanga Region. It is a lowland forest area of 786 ha with altitude ranges from about 400 metres to 790 metres above sea level. The five villages surrounding Mfundia, namely Gombero, Kijango, Makangara, Makumba and Mkwajuni, requested technical assistance from EUCAMP in 2001 in order to establish village forest reserves. All villages decided that each village would own and independently manage the part of the forest falling within its boundaries, except Makangara and Mkwajuni, which decided to have a jointly managed village forest reserve.

Facilitation of the Mfundia village forest reserve –exercise was handed over to Korogwe District Council in May 2002 in line with the national policy and recommendations of the mid-term review of EUCAMP. EUCAMP still continued to have an advisory role for the exercise and it provided funding for the activities.

As there is harvesting potential in the Mfundia forest, a simple participatory forest inventory was considered important in order to establish sustainable harvesting schedules and permanent plots for monitoring purpose. The inventory was designed together with staff from EUCAMP and District Council. The inventory field work facilitators consisted of four people from Korogwe District Council and nine people from EUCAMP. Each village planning team had selected ten people with good knowledge of the forest area and tree species for the inventory.

The inventory was conducted in August 2002. Prior to the field work, there was a one-day training session, first for the facilitators, who then conducted the same training for the village planning teams. The field work took four days.

Each planning team made a participatory mapping of their respective village forest area, dividing the area into different vegetation areas or units. Then the location of 3-4 transects was agreed to a specific way so that as many different vegetation areas would be surveyed as possible. In each village forest area the inventory team laid out 3-4 transects with the width of 10 m and lengths varying from 300 m to 900 m running west – east and against the contours of the hills. In these transects, all live, cut and dead trees were identified by species and tallied into three size classes. In addition, each team established four permanent sample plots of 50 m x 20 m representing different vegetation types. On these plots all trees with a girth of 16 cm and above (at the breast height) were identified and measured. In one corner of these bigger plots a regeneration sample plot of 3 m x 3 m was measured, where the seedlings were identified.

Data analysis for the purpose of the management plans was then done in the regular planning team meetings after the inventory. The data was also analysed in the EUCAMP office. The results showed that in general, the forest in Mfundia is fairly poorly stocked, as the basal area was usually less than 10 m²/ha. The forest is very much affected by fire. In the Kijango and Makangara / Mkwajuni villages it is affected by tree cutting and grazing. In Makangara / Mkwajuni the big reason for tree cutting has been the recent encroachment. The average number of stems/ha was 1,860 for all trees, and 635/ha for timber and pole size trees (girth \geq 16 cm). In average about 20% of timber and pole size trees had been cut. Most commonly cut trees were pole size with girth 16-47 cm (diameter 5-15 cm). Regeneration was found to be poor in general. The inventory results also showed that the harvesting potential is fairly low for most of the species the villagers prefer from the forest, especially for timber size trees. Based on these findings, recommendations for activities to be included in the management plans are given.

Acknowledgements

This report is a joint effort of several people. We would like to acknowledge the management of EUCAMP, which facilitated the activity. Thanks are due to the botanist Mr. Albert Ntemi, who identified the scientific names of the tree species, to Chief Technical Advisor Dr. Veli Pohjonen and Mr. Shedrack Mashauri of EUCAMP for editorial comments, and to Ms. Debra Wapple for checking the English language. In particular, we would like to thank the following people, who participated the hard field work:

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AMANI NATURE RESERVE	Albert Ntemi
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KOROGWE DISTRICT COUNCIL

District Natural Resources Officer	Mathew Nyelo
District Forest Officer	Betty Munuo
Land Surveyor	Charles Shao
Divisional Forester Mombo	Dassa Mohamed
Divisional Forester Magoma	Cassius Mbelavintu

VILLAGE PLANNING TEAM MEMBERS

We are also grateful to the village government chairpersons and planning team members of Gombero, Kijango, Makangara, Mkwajuni and Makumba, who participated fully in training and data collection.

Abbreviations

EUCAMP	East Usambara Conservation Area Management Programme
dbh	diameter at the breast height
cm	centimetre
DFO	District Forest Officer
DNRO	District Natural Resources Officer
GPS	General Positioning System
ha	hectare (hectares)
m	metre
m ²	cubic metre

1. Introduction

Mfundia forest area is located in Tanga region, Korogwe District, Magoma Division, Magoma and Kerenge Wards. It is a fairly big area of lowland forest with altitude ranges from about 400 metres to the highest rocky peak called Mfundia of 792 metres above sea level. In the past there was a plan to gazette this forest area as a central government forest reserve and the area was surveyed in 1979 covering an area of about 670 ha. However, as there was no funding for compensation to the villages the area remained as a village land with uncontrolled use. Illegal harvesting has taken place, as there are many valuable tree species in the forest like *Brachylaena hutchinsii* (silver oak, local name Mkarambati) and *Dalbergia melanoxylon* (African blackwood, local name Mpingo). Parts of the area are also heavily used for grazing and regular forest fires have degraded big areas. Very recently about 40 ha was encroached for farming land.

After introducing the forest policy of 1998 with the new concept of village forest reserves, the Ward Development Committees of Magoma and Kerenge made a decision in 1999 to establish Mfundia as a village forest reserve. However, the idea was not introduced to the village assemblies of the surrounding villages, namely Gombero, Kijango, Makangara, Makumba and Mkwajuni until in early 2001. After that technical assistance from EUCAMP was requested and the work started effectively in late 2001.

The five villages surrounding Mfundia decided that each village would own and manage independently the part of the forest falling within its boundaries. However, Makangara and Mkwajuni villages decided that they would own and manage their forest areas jointly. Mkwajuni used to be a sub-village of Makangara and they still carry out many development activities jointly.

In line of the national policy and the recommendations of the mid-term review of EUCAMP it was decided that the facilitation of the Mfundia exercise would be handed over to Korogwe District Council. A short term consultant was hired for January – March 2002 to establish an action plan on how the village forest reserves would become self-sufficient under District Councils, and to strengthen and advise the planning process of the village forest reserves. The consultant prepared a contract in collaboration with the District Council and EUCAMP staff how the work should be conducted during 2002. The contract was signed in May 2002 and it identified the District Forest Officer under the District Natural Resources Office as a coordinator for the exercise. However, the consultant emphasised that close follow-up and technical advice would still be needed from EUCAMP.

It was evident that a resurvey would be needed for the area, as farming had taken place within the area surveyed in the past. Demarcation of the external boundaries was discussed and agreed upon with the villagers in late 2001 and followed up regularly. Originally, the villagers promised the demarcation to be ready by the end of October 2001. However, the work took much longer period than planned. Moreover, there was a strong objection from one village to do the work without payment. Between two other villages there was a serious border conflict, as the chairman of Kijango had been selling farming plots to immigrants from other parts of Tanzania and part of these plots were in the area believed to belong to the neighbouring village. Solving all these problems delayed the survey exercise considerably.

The short-term consultant proposed that the survey should be conducted by the Korogwe District Council staff. However, the management of EUCAMP felt very strongly that an experienced

forest surveyor from FBD should join the District team. This was agreed upon and the contract was made between EUCAMP and the Land Office of Korogwe District Council. The survey field work was conducted between mid April and mid June 2002. The new area of the village forest reserve was found to be 786 ha.

As there is harvesting potential in the Mfundia forest, the short-term consultant proposed to conduct a simple participatory forest inventory in order to establish sustainable harvesting schedules and permanent plots for monitoring the development of the forest.

2. Organisation of the Work

In the agreement between Korogwe District Council and EUCAMP five days in each village had been allocated for the inventory with the facilitation of four District staff. In this way the whole work would have taken about a month. As the activity was slightly lagging behind, it was felt that strong input from EUCAMP was needed. Also, at EUCAMP it was considered that the participatory forest inventory could be used as capacity building for the field station officers as the same exercise could be used later in the utilisation zones of joint forest management areas.

So, the team of facilitators comprised of four Korogwe District Council staff (District Natural Resources Officer, District Forest Officer, Divisional forester from Mombo, Land Survey Officer) and nine EUCAMP staff (Farm and Village Forestry Officer, Biodiversity Survey Officer, Botanist, four field station officers, Forestry Assistant from Makumba village, Social Forestry Adviser). With this strong input from EUCAMP the inventory could be conducted in one week simultaneously in all villages, every day each of them having two “permanent” facilitators (one from Korogwe District team and one from EUCAMP team) and one or two “rotating” facilitators. The rotating facilitators were also supervisors of the exercise and this way they got an overview of each village forest area (see appendix 3).

Each village planning team selected for the inventory 10 people, who were knowledgeable in the forest area and tree species.

3. Training of Trainers and Villagers

A “Training of trainers” -method was used where by officers from Korogwe District Council and EUCAMP field stations were trained at Korogwe District Council hall on 18 August 2002. Trainers of this training were the District Forest Officer of Korogwe, and the EUCAMP Farm and Village Forestry Officer, Biodiversity Survey Officer, plus the Botanist and Social Forestry Adviser, who were also the supervisors of the whole exercise. The trained teams together with the supervisors conducted the same training for the Mfundia village forest planning teams in their respective villages on 20 August 2002 (see appendix 1).

Objectives of the inventory were defined together by trainers and villagers as the following:

- To enhance villagers’ ability to evaluate forest resources so as to prepare sustainable participatory forest management plan for the conservation of Mfundia village forest reserve.
- To exchange knowledge and experience on forest conservation between foresters and villagers.

- To establish monitoring system that will be used to assess forest changes in future.
- To orient EUCAMP station officers in participatory forest inventory.

The training included the following topics:

A) Forest resources inventory

- Meaning of forest inventory
- Reasons of conducting forest inventory
- Forest inventory methods
- Forest inventory data collection
- Forest inventory equipment and their uses

B) Forest stratification

- How to make forest stratification based on vegetation types and forest structure
- Establishment of transect lines

C) Forest monitoring

- Meaning of forest monitoring
- Importance of making monitoring of forest changes.
- Establishment of vegetation monitoring plots.

D) Practising inventory equipment

In the end of the training day participants practised in the field the establishment of transect lines and vegetation monitoring plots, use of Global Positioning System (GPS), use of directional compass and tape measures, measuring of tree circumference and data recording.

4. Forest Inventory Field Work

The inventory field work was conducted on 21-24 August 2002. Originally the plan was to do the data collection for three days, and use the fourth day for starting the analysis of the inventory data. However the work was fairly slow in the beginning, because the planning teams were inexperienced in the inventory work. Therefore the fourth day was needed for the field work.

During the training day the village planning teams did a participatory mapping of their village forest area on the draft map of Mfundia stratifying the forest into different vegetation types. Together with the facilitators three to four transects were planned in such a way that they covered all vegetation types and gave as representative picture of the forest as possible. The tentative locations of the permanent sample plots were also planned at this stage, but finally decided in the field. Almost all four planning teams came up with four different vegetation types, namely

- Dense forest
- Fire prone area with scattered trees
- Shrubs
- Encroached area

All transects were running east-west (or west-east) as this way they were running across the contours. The starting points of the transects were identified easily with the draft map of Mfundia except in Gombero, where there were mistakes on the map and very few beacons in the field.

A GPS and altitude reading were taken at the transect starting point and by using the compass the transect was laid in the forest (appendix 4). All live, cut and dead trees were identified and tallied into three different size categories (timber size with tree girth above 47 cm at the breast height, pole size with girth 16-47 cm, and withe size with girth 6-15 cm) along a strip of 10 m (5 m either side of the transect line). The transect was sub-divided into 50 m sections and data was recorded separately for each section. Notes on other human disturbance, such as fire damage, grazing, traps for hunting etc. seen along the transect were also made. (See form number 1 in appendix 5).

Tree girth was used instead of the diameter, as this was easier for the villagers to understand, and an ordinary dressmaker's tape measure could be used.

The purpose of the transects was to get enough information on the amount and sizes of trees for making sustainable harvesting proposals, plus information on the past tree cutting and other human influences on the forest.

The vegetation plots or permanent sample plots of 50 m x 20 m were laid along the transects either to the south or to the north side of the transect. Each planning team established four vegetation plots, which were selected subjectively to represent different vegetation types. To mark the vegetation plot a piece of plastic tube was dug in the ground in the first corner of the plot along the transect and a GPS and altitude reading of this point were recorded (appendix 4). All trees with girth of 16 cm and above at the breast height were identified by vernacular name and the girth was measured. Tree number and the breast height mark were painted on all sample trees, and the plot number was painted on the tree closest to each corner of the plot. (See form number 2 in appendix 5)

The regeneration plot of 3 m x 3 m was laid in the first corner of the vegetation plot (where the plastic tube was put). The seedlings with girth less than 6 cm at the breast height, and seedlings shorter than 2 m and with girth at least 1.5 cm at the stump were identified by vernacular name. (See form number 3 in appendix 5)

The purpose of the vegetation and regeneration plots was to establish permanent monitoring plots so that the villagers could follow-up on the development of their forest.

5. Inventory Results

The results are first presented for each village separately. In the end a short summary will be made for the whole forest area. In the inventory the villagers identified the tree species and gave the vernacular name (usually a Smbaa or Swahili name, but for some trees Bondei, Pare or Zigua name). A botanist, who also participated in the inventory, identified the scientific names for the trees. In the following, the vernacular name is given in the brackets after the scientific name, or only the vernacular name is given if the scientific name could not be identified.

5.1. Gombero

5.1.1. Results from Transects

The locations of transects were selected to cover different types of forests (dense forest, area of scattered trees, degraded forest due to encroachment or fire etc.). Consequently, transects can give an overall picture of the whole area.

In Gombero, four transects were established with the lengths of 774 m, 700 m, 635 m and 350 m. Therefore, the total length of the transects was 2,459 m and as the width of the transect was 10 m, the area assessed can be considered as a sample plot of 2.46 ha. However, on the first transect only total number of trees was recorded. Therefore, when calculating the results of different tree species, data from only three transects were available from an area of 1.685 ha. The results from Gombero transects are presented in Table 1.

The average number of stems was 2,082/ha, and for timber and pole size trees ($\text{dbh} \geq 5 \text{ cm}$) 526/ha. The forest is very much dominated by one shrub species, *Combretum exalatum* (Mwekea) having over 40% of the total number of stems. Other common species were *Croton pseudopulchellus* (Mkombechi), *Spirostachys africana* (Msalaka), *Manilkara sulcata* (Msewezi), *Grewia similis* (Mkole) and *Brachylaena hutchinsii* (Mkarambati).

In average 129 trees/ha or some 20% of the timber and pole size trees had been harvested. The main harvested species were *Spirostachys africana* (Msalaka) and *Brachylaena hutchinsii* (Mkarambati). Almost all trees were cut more than a year ago as less than 1% of cut trees were recorded as being cut recently. Tree harvesting occurred on about 70% of the area assessed; only the highest hilltops had not been affected by harvesting. The forest is used for harvesting of pole size and timber size trees, but lesser extent for collection of withes. The size of trees most commonly cut was 5-15 cm dbh, which is the size of poles used in local construction.

The rate of natural dying is less than the amount of trees harvested. In protected forest reserves this ratio is usually the other way round (see e.g. Frontier Tanzania 2002a, 2002b, 2002c). Quite a few *Manilkara sulcata* (Msewezi) trees had been dying naturally.

In addition to tree harvesting almost the only disturbance recorded in the transects was fire incidents which occurred on about quarter of the area assessed. The only other disturbance noticed was animals traps, but it was recorded only twice.

Table 1. Results from transects in Gombero village

Tree species name <i>Scientific (Sambaa/Swahili)</i>	Number of stems/stumps per hectare											
	Live trees				Cut trees				Dead trees			
	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total
<i>Azelia quanzensis</i> (Mkomba)				0	1			1				0
<i>Allophylus sp.</i> (Mbombwe)	7		1	8				0	1			1
<i>Brachylaena hutchinsii</i> (Mkarambati)	17	18	30	65	15	10		25	2			2
<i>Cassia abbreviata</i> (Mzangazi)	1		4	5				0				0
<i>Combretum exalatum</i> (Mwekeka)		7	895	902	1		1	2			2	2
<i>Combretum molle</i> (Mnama)		6	9	15				0				0
<i>Combretum schumannii</i> (Mperamwitu)	6	8	5	19	1	2		3	1	1	3	5
<i>Croton pseudopulchellus</i> (Mkombechi)		10	301	311	1			1				0
<i>Dalbergia melanoxylon</i> (Mpingo)		9	5	14		4		4		2		2
<i>Dialium holtzii</i> (Mshila)	2			2				0			1	1
<i>Ficus exasperata</i> (Kishasha)	11	8	13	32	6			6				0
<i>Grewia similis</i> (Mkole)	12	34	68	114	2	1		3		3	1	4
<i>Lannea schweinfurthii</i> (Muumbu)	2	2		4			1	1		1	2	3
<i>Lecaniodiscus fraxinifolius</i> (Mbwewe)	5	3	27	35	2			2	1	1	1	3
<i>Manilkara sulcata</i> (Msewezi)	66	11	42	119	7	2		9	14	1	2	17
<i>Markhamia obtusifolia</i> (Myuyu)		12	21	33				0				0
<i>Ostryoderris stuhlmannii</i> (Mnyinga)			1	1				0				0
<i>Pteleopsis myrtifolia</i> (Mngoji)		1		1				0				0
<i>Scorodophloeus fisheri</i> (Mhande)	12	11	11	34	1	1		2	1			1
<i>Spirostachys africana</i> (Msalaka)	65	36	24	125	17	15		32	4	1	2	7
<i>Strychnos spinosa</i> (Mkwakwa)				0				0				0
<i>Terminalia sambesiaca</i> (Mkenge)	8	4	7	19	3			3	2			2
<i>Trema orientalis</i> (Mshinga)		1		1						1	1	2

ALL TREE SPECIES	225	301	1,556	2,082	51	78	25	154	21	17	20	58

5.1.2. Results from Sample Plots

In the vegetation plots, all trees with girth of 16 cm and above at the breast height ($\text{dbh} \geq 5$ cm) was measured and the tree species was identified. Tree heights were not measured as the inventory design was based on the needs of the villagers and their management plans. Tree volume is not understood by the villagers, even the tree diameter is difficult for them to understand. Circumference is easily understood, and so it was used in the measurements and when analysing the data by the planning teams, and when presenting the results in their management plans. In this paper basal area is used as the indicator for the amount of the growing stock.

In Gombero, four sample plots were established, representing dense forest, scattered large trees, degraded forest and thicket. Key results are presented in tables 2-3 and stems distribution into diameter classes in figures 1-4.

Altogether 29 different tree species were recorded in sample plots in Gombero. In addition, five trees in three sample plots could not be identified. In regeneration plots there was one species, local name Mwenga, not found in the vegetation plots. The scientific name of this species could not be identified. The number of different species varied from 6 to 16 in different plots.

In sample plot 1, which was selected to represent dense forest, the number of stems/ha (550) was slightly larger than the average from the transects (526 stems/ha, trees ≥ 5 cm dbh), but very few trees were bigger than 20 cm dbh. Consequently, the basal area is fairly modest, only 9 m²/ha. Three species were found regenerating on this plot fairly vigorously.

On plot 2, representing forest with scattered large trees, the number of stems (380) was much smaller than the average on the transects. As there were many large trees on the plot, the basal area was very high compared to any other sample plot in Mfundia forest, 22 m²/ha. The largest tree of the inventory, *Manilkara sulcata* (Msewezi) 59 cm dbh, was also found in this sample plot. This plot was characterised by big *Manilkara sulcata* (Msewezi) trees (dbh > 30 cm) and medium size *Scorodophloeus fisheri* (Mhande) trees (dbh 15-30 cm). Five species were regenerating and in general the regeneration was vigorous.

In sample plot 3, representing a degraded forest due to fire, the smallest diameter class trees (dbh 5-10 cm) were missed completely, as they obviously had died in the fire. The number of stems was very small (130/ha), but there were few medium size *Terminalia sambesiaca* (Mkenge) and *Manilkara sulcata* (Msewezi) trees. No regeneration was found in this plot, this obviously being the effect of a recent fire.

In sample plot 4 representing a thicket, the number of stems was very high (620/ha). Most trees were of small size (dbh 5-15 cm) but there were also a few medium and large sized *Spirostachys africana* (Msalaka) and Ng'anga trees. Regeneration was poor in the thicket.

When compared to the results from the transects and the overall impression of the forest, it can be concluded that the sample plots give a fairly representative picture of the forest in Gombero. There are a fairly good number of pole size (dbh 5-15 cm) and timber size (dbh > 15 cm) trees in the forest, but also some areas have been affected heavily by fire.

Table 2. Key results from vegetation sample plots in Gombero

Plot no.	Vegetation type	No. of stems/ha	Basal area, m ² /ha	No. of tree species	Most common species, % of total number of stems	Largest trees, dbh cm
1	Dense forest	550	9	16	<i>Spirostachys africana</i> (Msalaka), 29% <i>Grewia similis</i> (Mkole), 20% <i>Manilkara sulcata</i> (Msewezi), 11% <i>Ficus exasperata</i> (Kishasha), 9% <i>Brachylaena hutchinsii</i> (Mkarambati), 7% <i>Xymalos monospora</i> (Mvungawiza), 7%	<i>Spirostachys africana</i> (Msalaka), 31 cm <i>Azelia quanzensis</i> (Mkomba), 31 cm <i>Ficus exasperata</i> (Kishasha), 31 cm <i>Spirostachys africana</i> (Msalaka), 25 cm <i>Ficus exasperata</i> (Kishasha), 25 cm
2	Scattered big trees	380	22	13	<i>Manilkara sulcata</i> (Msewezi), 21% <i>Scorodophloeus fisheri</i> (Mhande), 21% <i>Croton pseudopulchellus</i> (Mkombechi), 16% <i>Combretum schumannii</i> (Mperamwitu), 16% <i>Xymalos monospora</i> (Mvungawiza), 5%	<i>Manilkara sulcata</i> (Msewezi), 59 cm <i>Manilkara sulcata</i> (Msewezi), 56 cm <i>Spirostachys africana</i> (Msalaka), 51 cm <i>Manilkara sulcata</i> (Msewezi), 51 cm <i>Manilkara sulcata</i> (Msewezi), 50 cm
3	Degraded forest (fire)	130	5	6	<i>Spirostachys africana</i> (Msalaka), 31% <i>Terminalia sambesiaca</i> (Mkenge), 23% <i>Manilkara sulcata</i> (Msewezi), 23% <i>Allophylus sp.</i> (Mbombwe), 8% <i>Brachylaena hutchinsii</i> (Mkarambati), 8%	<i>Terminalia sambesiaca</i> (Mkenge), 32 cm <i>Allophylus sp.</i> (Mbombwe), 31 cm <i>Manilkara sulcata</i> (Msewezi), 31 cm <i>Manilkara sulcata</i> (Msewezi), 27 cm <i>Terminalia sambesiaca</i> (Mkenge), 22 cm
4	Thicket	620	8	16	<i>Combretum exalatum</i> (Mwekea), 27% <i>Markhamia lutea</i> (Mtalanda), 24% <i>Grewia similis</i> (Mkole), 13% <i>Spirostachys africana</i> (Msalaka), 11%	<i>Spirostachys africana</i> (Msalaka), 36 cm (Ng'anga), 34 cm (Ng'anga), 32 cm <i>Spirostachys africana</i> (Msalaka), 28 cm <i>Spirostachys africana</i> (Msalaka), 27 cm

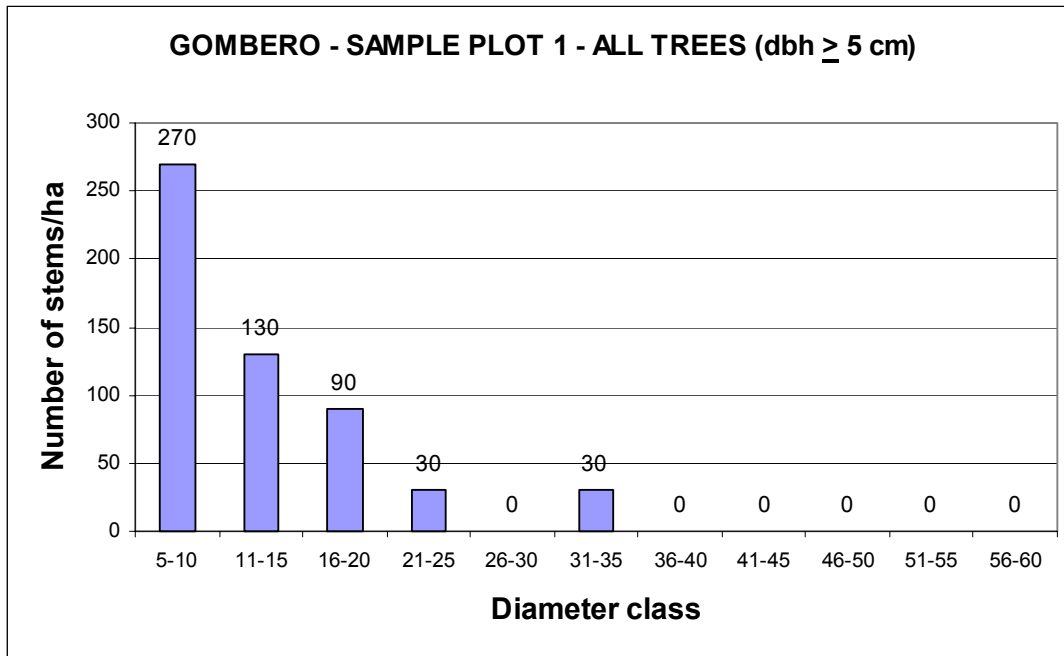


Figure 1. Distribution of trees into diameter classes in sample plot 1, Gombero

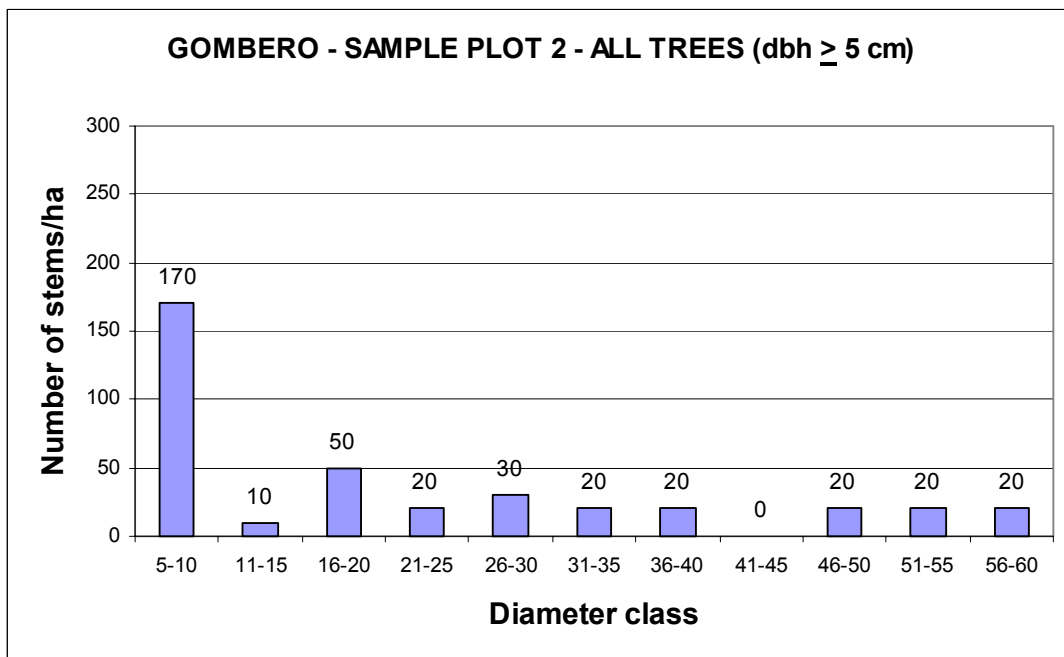


Figure 2. Distribution of trees into diameter classes in sample plot 2, Gombero

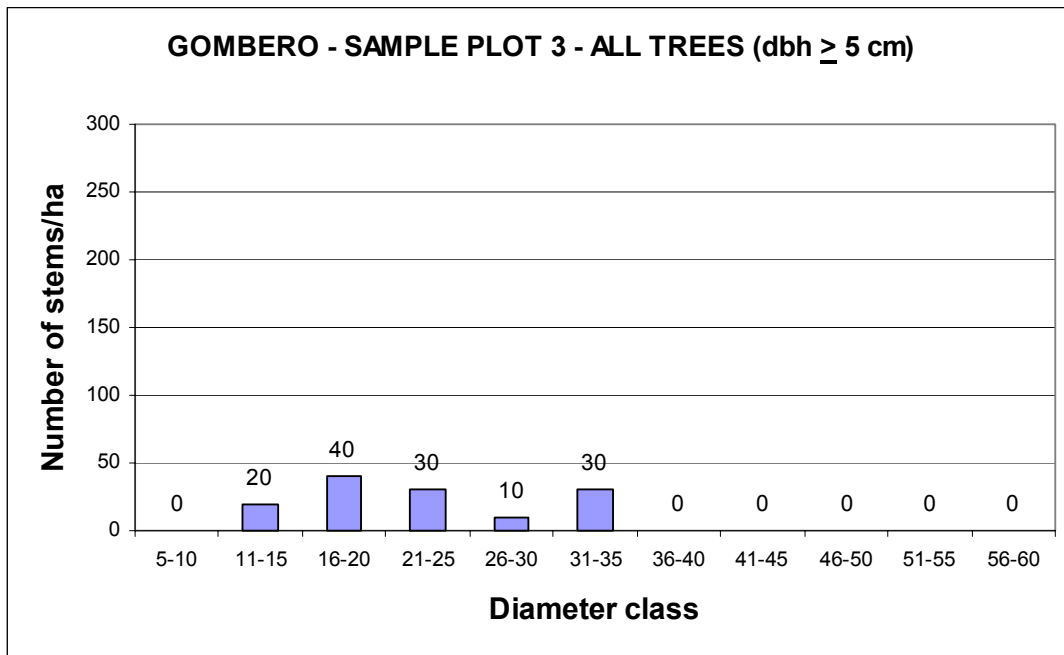


Figure 3. Distribution of trees into diameter classes in sample plot 3, Gombero

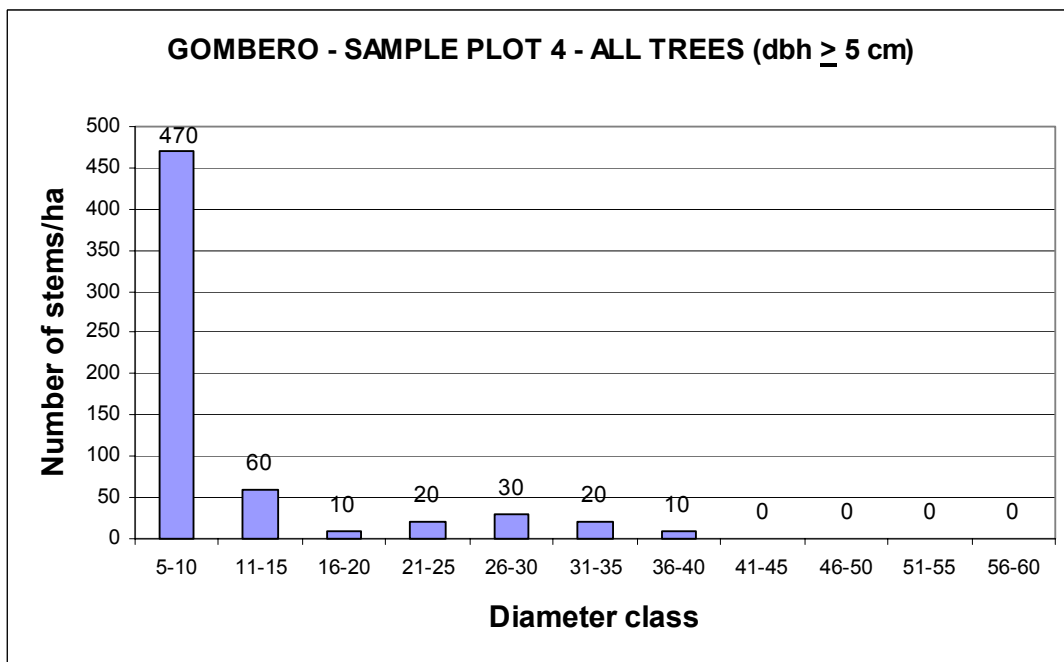


Figure 4. Distribution of trees into diameter classes in sample plot 4, Gombero

Table 3. Results from regeneration sample plots in Gombero

Plot no.	Vegetation type	Tree and shrub species name	Type of plant	No. of stems/ha
1	Dense forest	<i>Canthium hispidum</i> (Ntuavuha)	Shrub	6,670
		<i>Croton pseudopulchellus</i> (Mkombechi)	Shrub	1,110
		<i>Terminalia sambesiaca</i> (Mkenge)	Tree	1,110
		ALL SPECIES		8,890
2	Scattered big trees	<i>Croton pseudopulchellus</i> (Mkombechi)	Shrub	6,6670
		<i>Scorodophloeus fisheri</i> (Mhande)	Tree	5,5560
		<i>Canthium sp.</i> (Mlawa)	Shrub	2,220
		<i>Grewia similis</i> (Mkole)	Shrub	1,110
		(Kashuzamzitu)		1,110
		ALL SPECIES		16,670
3	Degraded forest (fire)	No regeneration		
4	Thicket	(Mwenga)		2,220
		<i>Markhamia lutea</i> (Mtalanda)	Shrub	1,110
		ALL SPECIES		3,330

5.2. Kijango

5.2.1. Results from Transects

In Kijango village three transects were established with the lengths of 800 m, 350 m and 492 m. Consequently, the total length of the transects was 1,642 m representing 1.64 ha area assessed.

The results from Kijango transects are presented in Table 4.

The average number of stems for all trees was low, 1,387 stems/ha, and 465/ha for pole and timber size trees (dbh \geq 5 cm). Most common species were *Grewia similis* (Mkole), *Markhamia obtusifolia* (Myuyu), *Combretum exalatum* (Mwekea), *Pteleopsis myrtifolia* (Mngoji) and *Combretum schumannii* (Mperamwitu).

In average 135 trees/ha or 23% of pole and timber size trees had been cut. Over 50% of the harvested stems were one species, *Spirostachys africana* (Msalaka). Also some *Pteleopsis myrtifolia* (Mngoji) and *Dalbergia melanoxylon* (Mpingo) trees had been cut. Some 85% of the area assessed had been used for harvesting of pole and timber size trees, but a lesser extent for the collection of withes. The size of trees most commonly cut was 5-15 cm dbh, which is the size of poles used in local construction. The rate of natural dying is less than the amount of trees harvested.

In Kijango, more than half of the area covered in the inventory was affected by fire and animal grazing. Animal traps and harvesting of wild honey were also recorded once.

Table 4. Results from transects in Kijango village

Tree species name <i>Scientific (Sambaa/Swahili)</i>	Number of stems/stumps per hectare											
	Live trees				Cut trees				Dead trees			
	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total
<i>Albizia versicolor</i> (Mkingu)		1		1				0				0
<i>Allophyllus sp.</i> (Mbombwe)	2	2	2	6	1			1				0
<i>Brachylaena hutchinsii</i> (Mkarambati)		4	7	11	1	4	1	6				0
<i>Combretum exalatum</i> (Mwekea)			107	107				0				0
<i>Combretum molle</i> (Mnama)	2	6	27	35		1		1		1	7	8
<i>Combretum schumannii</i> (Mperamwitu)	1	30	63	94	2	2		4	1	2		3
<i>Croton pseudopulchellus</i> (Mkombechi)		1	58	59		5	2	7				0
<i>Dalbergia melanoxylon</i> (Mpingo)	11	5	14	30	7	2		9				0
<i>Dombeya guingiesata</i> (Muati)		1	1	2				0				0
<i>Ficus exasperata</i> (Kishasha)				0				0			1	1
<i>Grewia similis</i> (Mkole)	12	43	125	180	3	3	1	7				0
<i>Lannea schweinfurthii</i> (Muumbu)	1			1				0				0
<i>Lecaniodiscus fraxinifolius</i> (Mbweve)	5	7	11	23	2	2		4				0
<i>Manilkara sulcata</i> (Msewezi)	2	1		3				0				0
<i>Markhamia obtusifolia</i> (Myuyu)	4	39	74	117	1	2		3		4		4
<i>Ostryoderris stuhlmannii</i> (Mnyinga)		1		1				0				0
<i>Pteleopsis myrtifolia</i> (Mngoji)	10	57	34	101	5	6		11			1	1
<i>Scelerocaya birrea</i> (Mng'ongo)	1			1				0				0
<i>Scorodophloeus fisheri</i> (Mhande)	7	5	4	16				0				0
<i>Spirostachys africana</i> (Msalaka)	24	37	5	56	31	45		76	2	1		3
<i>Strychnos spinosa</i> (Mkwakwa)		1	1	2				0				0
<i>Terminalia sambesiaca</i> (Mkenge)	1	1	3	5		1		1				0
<i>Trema orientalis</i> (Mshinga)		1	1	2				0				0

ALL TREE SPECIES	118	347	922	1,387	57	78	5	140	8	18	19	45

5.2.2. Results from Sample Plots

Four sample plots were established representing dense forest, degraded forest and scattered trees. Key results are presented in tables 5-6 and stems distribution into diameter classes in figures 5-8.

In Kijango sample plots, altogether 26 different tree species were recorded. In regeneration plots there was one species, *Canthium hispidum* (Ntuavuha), not found in the vegetation plots. Number of different species varied from nine to 14 in different plots. In Kijango hardly any big trees (dbh above 30 cm) were recorded in the sample plots. The basal area was less than 10 m²/ha on all sample plots.

In sample plot 1, which was selected to represent dense forest, the number of stems/ha (410) was slightly smaller than the average from the transects (465 stems/ha, trees \geq 5 cm dbh), but very few trees were bigger than 20 cm dbh. Consequently, the basal area is modest, only 8 m²/ha. This plot was characterised by small and medium size *Scorodophloeus fisheri* (Mhande) trees (dbh 5-30 cm), and small size *Grewia similis* (Mkole) and *Brachylaena hutchinsii* (Mkarambati) trees. Surprisingly there was no regeneration on the plot this most likely is the effect from grazing.

In plot 2 representing degraded forest, the number of stems (310) was much smaller than on plot 1, but as there were more medium size trees on this plot, the basal area (9 m²/ha) was slightly bigger than on plot 1. The biggest tree in Kijango, *Allophyllus sp.* (Mbombwe) 49 cm dbh, was found in this sample plot. There were quite a number of *Dalbergia melanoxylon* (Mpingo) trees on this plot. No trees were found regenerating on this plot located on a top of a hill.

In sample plot 3 also representing degraded forest almost all the trees were small in size and consequently the basal area was very low, only 3 m²/ha. Most common species were *Pteleopsis myrtifolia* (Mngoji), *Spirostachys africana* (Msalaka) and *Grewia similis* (Mkole). There were three species regenerating vigorously on this plot; two of them, *Pteleopsis myrtifolia* (Mngoji) and *Markhamia obtusifolia* (Myuyu) found also among bigger trees on the plot. Obviously the forest had started to recover from the previous degradation.

In sample plot 4 representing a forest with scattered trees the number of stems (300/ha) was the lowest of all Kijango plots and the trees were mostly small in size with some medium size trees. *Spirostachys africana* (Msalaka) and *Grewia similis* (Mkole) were the most common species. No trees were regenerating on this plot located on a top of a hill.

The sample plots give the impression of degraded forest in Kijango with low number of mostly small and some medium size trees. This was also the general impression from the field. Forest in Kijango is heavily affected by encroachment, grazing and fire. However, compared to the results from the transects the sample plots might give slightly too pessimistic a picture, as the average number of trees (dbh \geq 5 cm) on transects was bigger than on any of the sample plots.

Table 5. Key results from vegetation sample plots in Kijango

Plot no.	Vegetation type	No. of stems/ha	Basal area, m ² /ha	No. of tree species	Most common species, % of total number of stems	Largest trees, dbh cm
1	Dense forest	410	8	13	<i>Scorodophloeus fisheri</i> (Mhande), 24% <i>Grewia similis</i> (Mkole), 17% <i>Brachylaena hutchinsii</i> (Mkarambati), 10% <i>Markhamia obtusifolia</i> (Myuyu), 10% <i>Combretum schumannii</i> (Mperamwitu), 10%	<i>Scorodophloeus fisheri</i> (Mhande), 36 cm <i>Brachylaena hutchinsii</i> (Mkarambati), 31 cm <i>Lecaniodiscus fraxinifolius</i> (Mbwewe), 28cm <i>Grewia similis</i> (Mkole), 24 cm <i>Manilkara sulcata</i> (Msewezi), 23 cm
2	Degraded forest (fire, grazing)	310	9	14	<i>Dalbergia melanoxylon</i> (Mpingo), 39% <i>Grewia similis</i> (Mkole), 26% <i>Spirostachys africana</i> (Msalaka), 13% <i>Brachylaena hutchinsii</i> (Mkarambati), 10%	<i>Allophylus sp.</i> (Mbombwe), 49 cm <i>Spirostachys africana</i> (Msalaka), 29 cm <i>Dalbergia melanoxylon</i> (Mpingo), 25 cm <i>Spirostachys africana</i> (Msalaka), 25 cm
3	Degraded forest (grazing)	380	3	14	<i>Pteleopsis myrtifolia</i> (Mngoji), 32% <i>Spirostachys africana</i> (Msalaka), 13% <i>Grewia similis</i> (Mkole), 13% <i>Markhamia obtusifolia</i> (Myuyu), 11% <i>Crossopteryx febrifuga</i> (Mjikojiko), 8%	<i>Spirostachys africana</i> (Msalaka), 25 cm <i>Crossopteryx febrifuga</i> (Mjikojiko), 20 cm <i>Stereospermum kunthianum</i> (Mkande), 18 cm <i>Pteleopsis myrtifolia</i> (Mngoji), 14 cm <i>Spirostachys africana</i> (Msalaka), 13 cm
4	Scattered trees	300	5	9	<i>Spirostachys africana</i> (Msalaka), 27% <i>Grewia similis</i> (Mkole), 23% <i>Crossopteryx febrifuga</i> (Mjikojiko), 13% <i>Scorodophloeus fisheri</i> (Mhande), 10% <i>Dalbergia melanoxylon</i> (Mpingo), 10%	<i>Spirostachys africana</i> (Msalaka), 28 cm <i>Spirostachys africana</i> (Msalaka), 27 cm <i>Crossopteryx febrifuga</i> (Mjikojiko), 23 cm <i>Spirostachys africana</i> (Msalaka), 20 cm <i>Spirostachys africana</i> (Msalaka), 18 cm

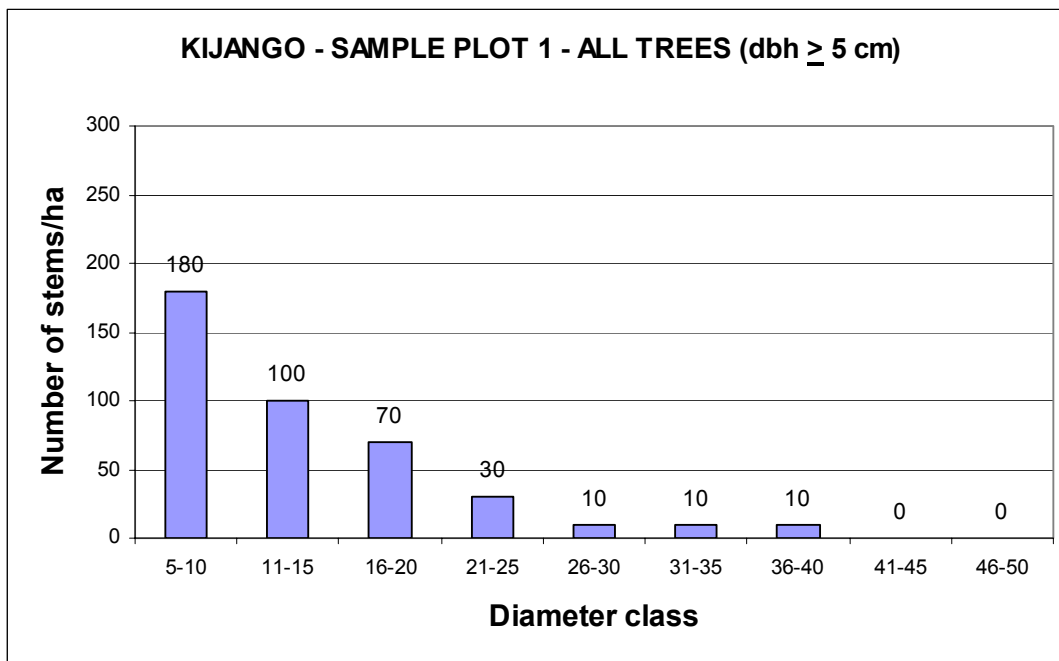


Figure 5. Distribution of trees into diameter classes in sample plot 1, Kijango

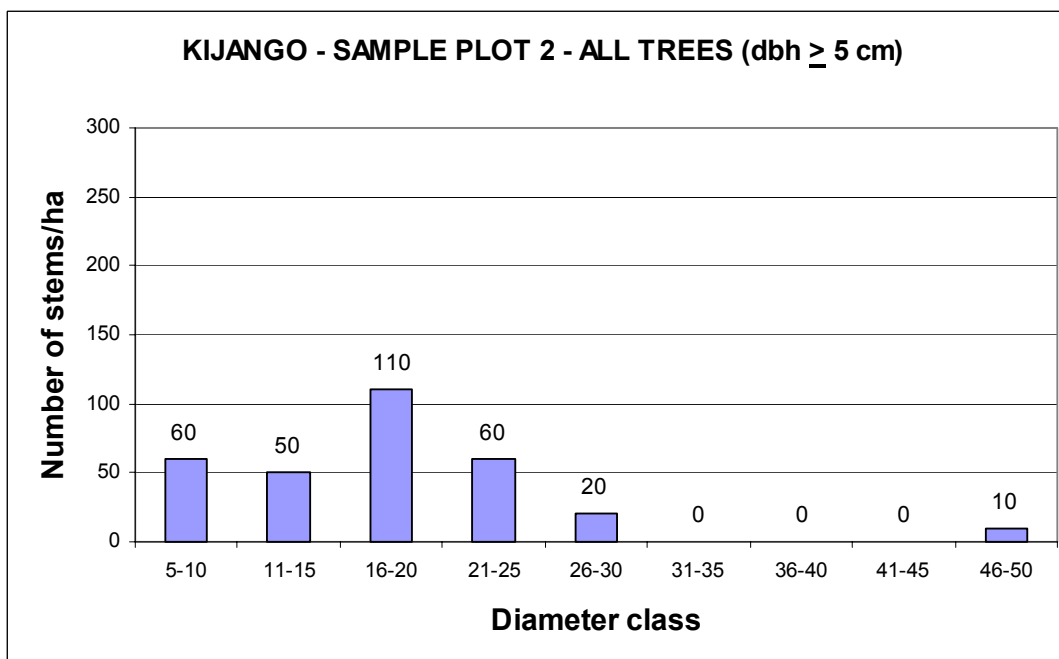


Figure 6. Distribution of trees into diameter classes in sample plot 2, Kijango

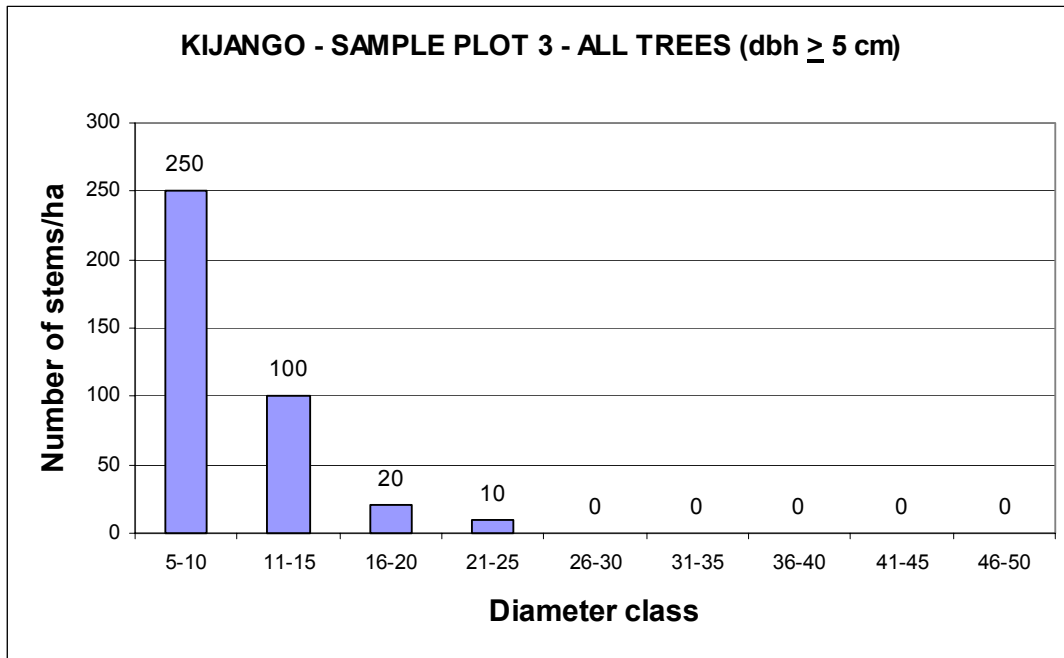


Figure 7. Distribution of trees into diameter classes in sample plot 3, Kijango

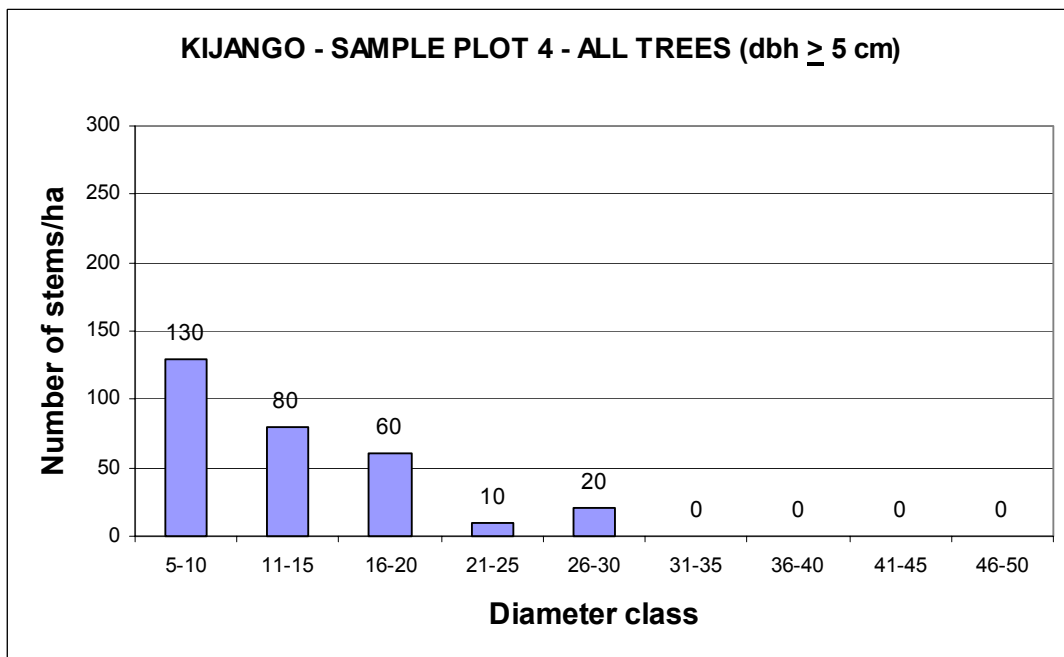


Figure 8. Distribution of trees into diameter classes in sample plot 4, Kijango

Table 6. Results from regeneration sample plots in Kijango

Plot no.	Vegetation type	Tree and shrub species name	Type of plant	No. of stems/ha
1	Dense forest	No regeneration		
2	Degraded forest (fire, grazing)	No regeneration		
3	Degraded forest (grazing)	<i>Canthium hispidum</i> (Ntuavuha)	Shrub	5,560
		<i>Pteleopsis myrtifolia</i> (Mngoji)	Tree	3,330
		<i>Markhamia obtusifolia</i> (Myuyu)	Small tree	2,220
		ALL SPECIES		11,110
4	Scattered trees	No regeneration		

5.3. Makangara / Mkwajuni

5.3.1. Results from Transects

In Makangara and Mkwajuni four transects were established. The original lengths were 650 m, 800 m, 710 m and 900 m. However, as the conflict concerning the internal border between Makangara / Mkwajuni and Kijango villages was only solved after the inventory, it was found out that two transects were continuing on Kijango's side. Consequently, in the calculations for the results in Makangara / Mkwajuni the transect lengths 650 m, 600 m, 710 m and 600 m representing the area of 2.56 ha has been used. Moreover, the field notes from transects 1 and 2 concerning data on different tree species had been lost and so data from an area of only 1.31 ha was available for species specific results. The results from the transects in Makangara / Mkwajuni are presented in table 7.

The average number of 1,278 stems/ha was the lowest in the whole inventory. For pole and timber size trees (dbh \geq 5 cm) the average number of stems was 774/ha. Three species, *Markhamia obtusifolia* (Myuyu), *Pteleopsis myrtifolia* (Mngoji) and *Grewia sp.* (Mkoe), were dominant in this forest having about 60% of all living stems.

In average 341 trees/ha or some 30% of trees of 5 cm and above had been cut. This was the highest rate in the whole forest area. Most commonly cut species was *Brachylaena hutchinsii* (Mkarambati). Other cut species included *Pteleopsis myrtifolia* (Mngoji), *Spirostachys africana* (Msalaka) and *Dalbergia melanoxylon* (Mpingo). More than half of the cut trees had been cut within the past year. Almost 80% of the area assessed had been affected by tree cutting, which was very intensive in transects 1 and 2 in the northern part of the forest. The overwhelming majority of trees cut were 5-15 cm dbh, which is the size of poles used in local construction. Timber size trees (dbh above 15 cm) and small trees were cut at about the same rate. Very few trees were recorded dying naturally in this forest area.

Transects 1 and partly transect 2 was passing through the area, which was affected by encroachment and a lot of trees had been cut on these transects. Consequently, the species specific results especially concerning cut trees give a biased impression. It is likely that much more of the following species have been cut than shown in table 7: *Dalbergia melanoxylon* (Mpingo), *Markhamia obtusifolia* (Myuyu) and *Pteleopsis myrtifolia* (Mngoji).

According to the inventory, forest in Makangara and Mkwajuni had been affected by fire and collecting of fodder (both occurred on about 8% of the area assessed), and also slightly from grazing, settlement, cultivation and charcoal making. However, it seemed that recording had not been very systematic as the general impression was that the forest was much more used for grazing as indicated in the field notes.

Table 7. Results from transects in Makangara and Mkwajuni villages

Tree species name <i>Scientific (Sambaa/Swahili)</i>	Number of stems/stumps per hectare											
	Live trees				Cut trees				Dead trees			
	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total
<i>Albizia versicolor</i> (Mkingu)	1	2		3				0				0
<i>Azelia quanzensis</i> (Mkomba)	2	2		4				0				0
<i>Allophyllus sp.</i> (Mbombwe)				0				0				0
<i>Brachylaena hutchinsii</i> (Mkarambati)		5		5	24	2		26				0
<i>Combretum molle</i> (Mnama)	11	9	13	33	2	1		3	4	3		7
<i>Combretum schumannii</i> (Mperamwitu)				0				0				0
<i>Croton pseudopulchellus</i> (Mkombechi)			53	53				0				0
<i>Dalbergia melanoxyton</i> (Mpingo)	1	4		5	8	2		10				0
<i>Ficus exasperata</i> (Kishasha)	7	8	2	17				0				0
<i>Grewia similis</i> (Mkole)	2	44	10	56				0		1		1
<i>Grewia sp.</i> (Mkoe)	7	92	81	180				0				0
<i>Lannea schweinfurthii</i> (Muumbu)	2			2				0				0
<i>Lecaniodiscus fraxinifolius</i> (Mbwewe)	2			2				0				0
<i>Manilkara sulcata</i> (Msewezi)	5	6	17	28				0				0
<i>Markhamia obtusifolia</i> (Myuyu)	7	282	50	339		8		8		4		4
<i>Ostryoderris stuhlmannii</i> (Mnyinga)	7	5		12				0				0
<i>Pteleopsis myrtifolia</i> (Mngoji)	19	232	5	256	11	2		13	6			6
<i>Scelerocaya birrea</i> (Mng'ongo)	1			1				0				0
<i>Scorodophloeus fisheri</i> (Mhande)				0				0				0
<i>Spirostachys africana</i> (Msalaka)	24	12		36	11	2		13				0
<i>Strychnos spinosa</i> (Mkwakwa)		2		2				0	1			1
<i>Terminalia sambesiaca</i> (Mkenge)				0				0				0
<i>Trema orientalis</i> (Mshinga)				0				0				0
(Ng'wekea)			6	6				0				0

ALL TREE SPECIES	93	681	504	1,278	76	265	70	411	9	9	4	22

5.3.2. Results from Sample Plots

Four sample plots were established representing dense forest, forest with scattered trees and degraded forest. Key results are presented in tables 8-9 and stems distribution into diameter classes in figures 9-12.

In Makangara / Mkwajuni sample plots, 21 different tree species were recorded. The number of different species varied from four to 11 in different plots. As in Kijango, also in Makangara / Mkwajuni hardly any large trees (dbh > 30 cm) were recorded in the sample plots and the basal areas were the lowest in the whole inventory, less than 8 m²/ha.

Sample plot 1 in Makangara was in the area where Kijango village chairman had been selling plots to outsiders. As the newcomers had started to prepare agricultural land from the forests, number of stems and basal area were very low, 200/ha and 2 m²/ha respectively. Many of the *Dalbergia melanoxylon* (Mpingo) trees had been cut down, but still this species represented almost half of the trees on the plot. Only one seedling was found on the regeneration plot.

In sample plot 2 representing a dense forest the number of stems, 680/ha, was lower than the average on the transects. The only big trees (dbh > 30 cm) in Makangara / Mkwajuni sample plots were found in this plot, but there were only two pieces of them. Otherwise the plot was characterised by small size *Markhamia obtusifolia* (Myuyu) and *Grewia sp.* (Mkoe) trees. Again, only one seedling was growing on the regeneration plot.

Sample plots 3 and 4 representing forest with scattered trees the number of stems was far lower than the average on the transects. The majority of trees were of small size and consequently the basal areas were very low, 3 m²/ha on both plots. Small size *Grewia similis* (Mkole) trees were dominating on both plots. On plot 3 three species was found regenerating but very poorly, and no regeneration was found on plot 4.

Also in Makangara / Mkwajuni the sample plots give the impression of degraded forest with a dominance of small and very few medium size trees and hardly any regeneration. This was also the general impression from the field. Forest is heavily affected by encroachment, grazing and fire. However, compared to the results from the transects the sample plots might give slightly too pessimistic picture, as the average number of pole and timber size trees (dbh ≥ 5 cm) on transects was bigger than on any of the sample plots. The high number of trees in the transects, however, was very much dominated by pole size trees of two species, *Pteleopsis myrtifolia* (Mngoji) and *Markhamia obtusifolia* (Myuyu). So, it seems that in the near future there is hardly any potential for timber harvesting in this village forest.

Table 8. Key results from vegetation sample plots in Makangara and Mkwajuni

Plot no.	Vegetation type	No. of stems/ha	Basal area, m ² /ha	No. of tree species	Most common species, % of total number of stems	Largest trees, dbh cm
1	Degraded forest (encroachment)	200	2	4	<i>Dalbergia melanoxylon</i> (Mpingo), 45% <i>Markhamia obtusifolia</i> (Myuyu), 20% <i>Pteleopsis myrtifolia</i> (Mngoji), 15% <i>Grewia sp.</i> (Mkoe), 10%	<i>Pteleopsis myrtifolia</i> (Mngoji), 24 cm <i>Pteleopsis myrtifolia</i> (Mngoji), 22 cm <i>Dalbergia melanoxylon</i> (Mpingo), 21 cm <i>Pteleopsis myrtifolia</i> (Mngoji), 16 cm <i>Dalbergia melanoxylon</i> (Mpingo), 14 cm
2	Dense forest	680	7	10	<i>Markhamia obtusifolia</i> (Myuyu), 41% <i>Grewia sp.</i> (Mkoe), 24% <i>Pteleopsis myrtifolia</i> (Mngoji), 10% <i>Dalbergia melanoxylon</i> (Mpingo), 7% <i>Diplorhynchus condylocarpon</i> (Mgoto), 6%	<i>Acacia mellifera</i> (Kikwata), 46 cm <i>Ostryoderris stuhlmannii</i> (Mnyinga), 32 cm <i>Dalbergia melanoxylon</i> (Mpingo), 22 cm <i>Dalbergia melanoxylon</i> (Mpingo), 20 cm <i>Pteleopsis myrtifolia</i> (Mngoji), 18 cm
3	Scattered trees	390	3	11	<i>Grewia similis</i> (Mkole), 44% <i>Markhamia obtusifolia</i> (Myuyu), 13% <i>Stereospermum kunthianum</i> (Mkande), 10% <i>Lonchocarpus bussei</i> (Mfumbii), 10% <i>Ficus exasperata</i> (Kishasha), 8%	<i>Ficus exasperata</i> (Kishasha), 27 cm <i>Ficus exasperata</i> (Kishasha), 25 cm <i>Ficus exasperata</i> (Kishasha), 19 cm <i>Stereospermum kunthianum</i> (Mkande), 15 cm <i>Stereospermum kunthianum</i> (Mkande), 15 cm
4	Scattered trees	450	3	7	<i>Grewia similis</i> (Mkole), 33% <i>Pteleopsis myrtifolia</i> (Mngoji), 27% <i>Markhamia obtusifolia</i> (Myuyu), 20% <i>Combretum molle</i> (Mnama), 11%	<i>Combretum molle</i> (Mnama), 26 cm <i>Pteleopsis myrtifolia</i> (Mngoji), 18 cm <i>Markhamia obtusifolia</i> (Myuyu), 17 cm <i>Pteleopsis myrtifolia</i> (Mngoji), 14 cm <i>Pteleopsis myrtifolia</i> (Mngoji), 13 cm

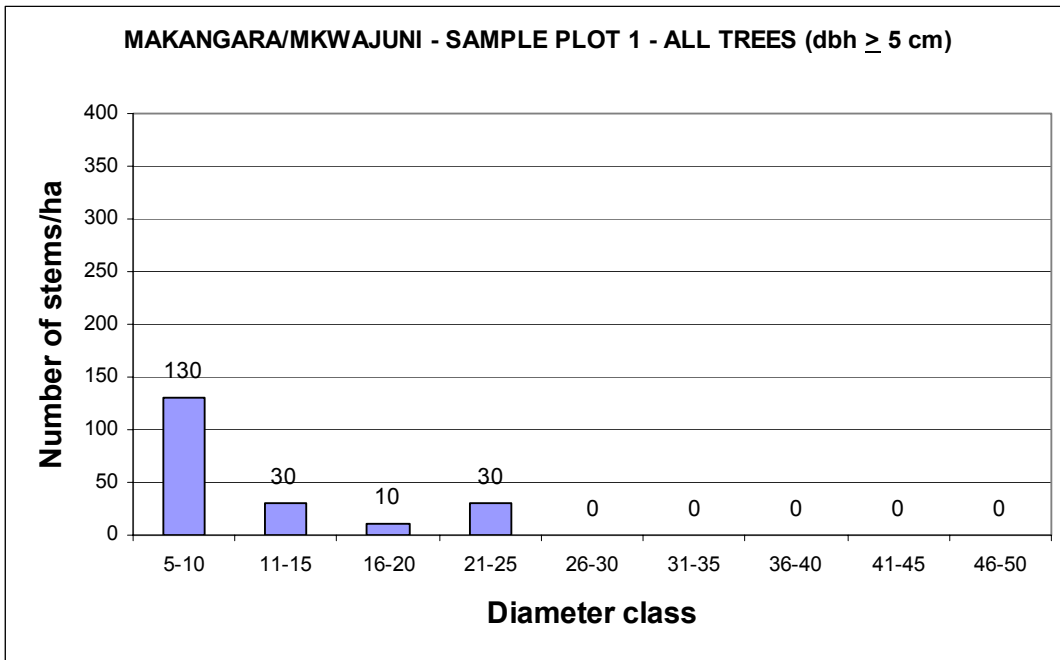


Figure 9. Distribution of trees into diameter classes in sample plot 1, Makangara / Mkwajuni

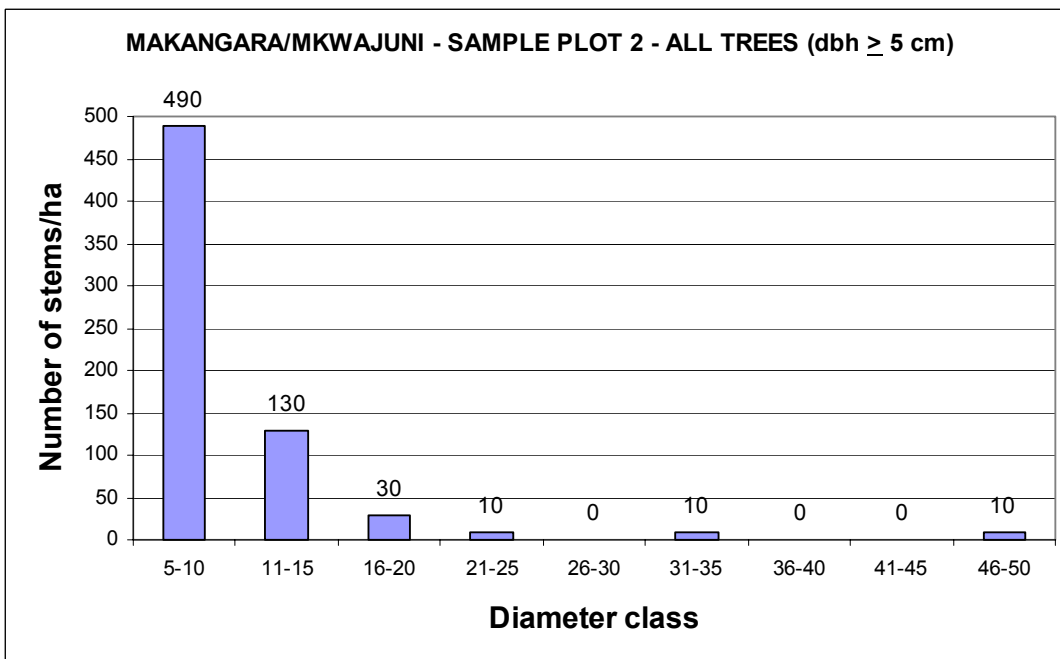


Figure 10. Distribution of trees into diameter classes in sample plot 2, Makangara / Mkwajuni

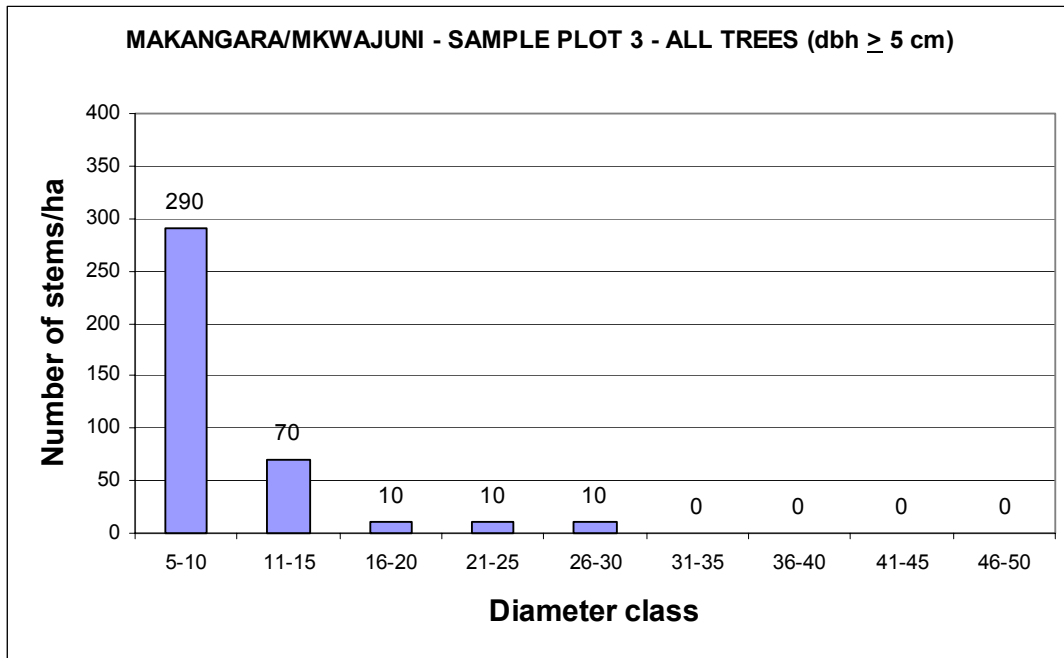


Figure 11. Distribution of trees into diameter classes in sample plot 3, Makangara / Mkwajuni

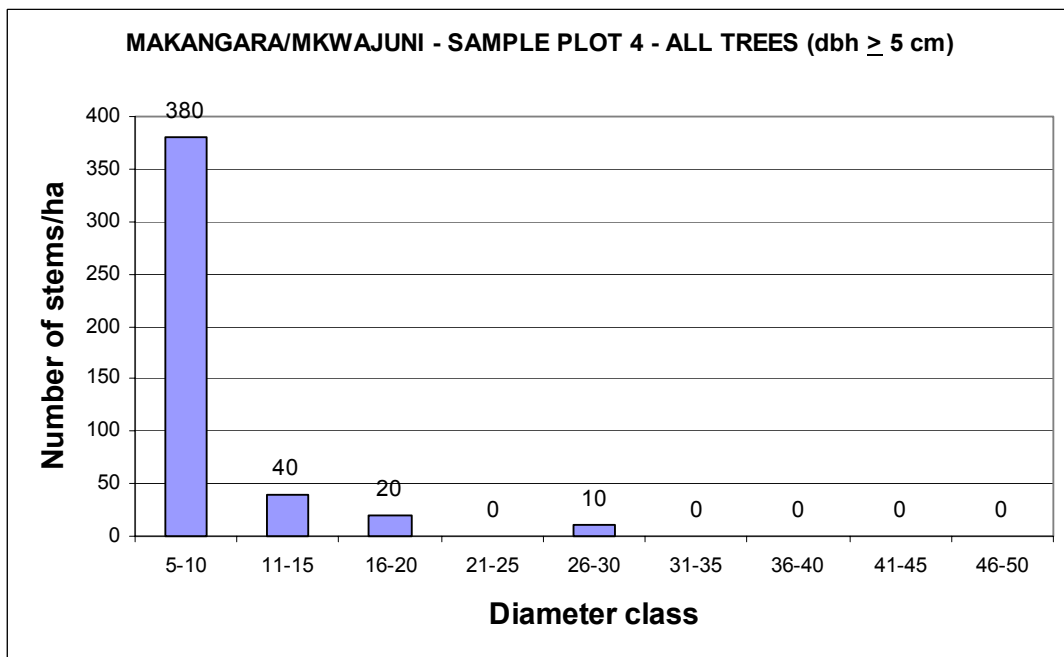


Figure 12. Distribution of trees into diameter classes in sample plot 4, Makangara / Mkwajuni

Table 9. Results from regeneration sample plots in Makangara / Mkwajuni

Plot no.	Vegetation type	Tree and shrub species name	Type of plant	No. of stems/ha
1	Degraded forest (encroachment)	<i>Pteleopsis myrtifolia</i> (Mngoji)	Tree	1,110
		ALL SPECIES		1,110
2	Dense forest	<i>Markhamia obtusifolia</i> (Myuyu)	Small tree	1,110
		ALL SPECIES		1,110
3	Scattered trees	<i>Commiphora zimmermannii</i> (Bambaa)	Tree	1,110
		<i>Stereospermum kunthianum</i> (Mkande)	Tree	1,110
		<i>Acacia mellifera</i> (Kikwata)	Tree	1,110
		ALL SPECIES		3,330
4	Scattered trees	No regeneration		0

5.4. Makumba

5.4.1. Results from Transects

In Makumba village three transects were established with the lengths of 300 m, 900 m and 650 m, giving a total length of 1,850 m. Consequently, the area covered was 1.85 ha. The results from Makumba transects are presented in Table 10.

The average number of living trees was 2,255/ha, which is the highest in the whole inventory. However, about 40% of the total living stems were one shrub species, *Combretum exalatum* (Mwekea) as in Gombero. Other common species included *Manilkara sulcata* (Msewezi), *Lecaniodiscus fraxinifolius* (Mbwewe), *Grewia similis* (Mkole), *Markhamia obtusifolia* (Myuyu) and *Brachylaena hutchinsii* (Mkarambati). For trees of 5 cm and above the average number of stems was 700/ha.

The forest is not very heavily used for timber and pole harvesting; in average 53 trees/ha or 8% of pole and timber size trees (dbh \geq 5 cm) had been cut. That was the lowest rate in the whole inventory. Most commonly cut species are *Spirostachys africana* (Msalaka) and *Brachylaena hutchinsii* (Mkarambati). Most trees were cut more than a year ago, but about 20% of the cut trees had been cut recently. About half of the area assessed was affected by timber and pole harvesting, which was concentrated mostly on the edges of the forest. The forest is used for harvesting of timber size and pole size trees, but hardly used for collection of withes. The size of trees most commonly cut was above 15 cm dbh.

More trees have died naturally, rather than been harvested in the forest. Often the trees had been dying due to forest fires. About 20% of the area assessed in the transects was affected by fire. Animal traps were recorded only once.

Compared to the results in the other villages, the forest in Makumba seems to be utilised at a much lower rate. The reason might be that the forest lies fairly far from the village, the slopes are steeper than in other villages and there is another lowland forest area with milder slopes in Makumba, that most probably is used as source forest products.

Table 10. Results from transects in Makumba village

Tree species name <i>Scientific (Sambaa/Swahili)</i>	Number of stems/stumps per hectare											
	Live trees				Cut trees				Dead trees			
	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total
<i>Albizia gummifera</i> (Mshai)		1	1	2				0				0
<i>Allophyllus sp.</i> (Mbombwe)	4			4				0	2			2
<i>Brachylaena hutchinsii</i> (Mkarambati)	4	24	45	73	4	7		11	1	2	1	4
<i>Cassia singueana</i> (Mhumba)		1	2	3				0				0
<i>Coffea sp.</i> (Mkahawa mwitu)		14	68	82								
<i>Combretum exalatum</i> (Mwekea)		51	1,133	1,184		1		1			1	1
<i>Combretum molle</i> (Mnama)	6	18	3	27				0	1	2	1	4
<i>Combretum schumannii</i> (Mperamwitu)	10	9	1	20	1			1	1		12	13
<i>Croton pseudopulchellus</i> (Mkombechi)		2	2	4				0				0
<i>Dalbergia melanoxylon</i> (Mpingo)	3	1		4				0				0
<i>Dombeya leucoderma</i> (Nkwengaa)		10	35	45			1	1		1	6	7
<i>Grewia similis</i> (Mkole)	37	48	70	155	2		1	3	1	6		7
<i>Lecaniodiscus fraxinifolius</i> (Mbwewe)	25	35	59	119	2		1	3	1	5	8	14
<i>Manilkara sulcata</i> (Msewezi)	24	50	186	260	3	4		7	11	5	5	21
<i>Markhamia obtusifolia</i> (Myuyu)	6	56	26	88		4		4				0
<i>Milicia excelsa</i> (Mvule)	1	1		2				0		1		1
<i>Pteleopsis myrtifolia</i> (Mngoji)	9	6	9	24				0				0
<i>Scorodophloeus fisheri</i> (Mhande)	2	10		12		1		1		4		4
<i>Spirostachys africana</i> (Msalaka)	46	14	2	62	17	5		22	6	3		9
<i>Strychnos spinosa</i> (Mkwakwa)	1	9	1	11				0				0
<i>Terminalia sambesiaca</i> (Mkenge)	3	1	1	5			1	1	1			1
<i>Trema orientalis</i> (Mshinga)		18	1	19				0		11	24	35

ALL TREE SPECIES	210	490	2,255	2,955	31	22	3	56	32	44	79	155

5.4.2. Results from Sample Plots

Four sample plots were established representing dense forest, scattered trees and degraded forest. Key results are presented in tables 11-12 and stems distribution into diameter classes in figures 13-16.

In Makumba sample plots, altogether 24 different tree species were recorded, and in addition one tree could not be identified. In regeneration sample plots there was one species, *Commiphora zimmermannii* (Bambaa), not found in vegetation plots. Number of different species varied from four to 12 in different plots.

Sample plot 1 was representing forest with scattered trees having the number of stems 500/ha. Basal area was fairly modest, 10 m²/ha as most trees were found from small diameter classes. This plot was characterised by small size *Grewia similis* (Mkole) and small and medium size *Spirostachys africana* (Msalaka) trees. However, the biggest tree in Makumba, *Ficus thonningii* (Mvumo) of 39 cm was found in this plot. Only two seedlings of two different species were found in the regeneration plot.

Sample plot 2 representing degraded forest was dominated by *Combretum molle* (Mnama) trees, about 2/3 of them being small size and the rest medium size. The number of stems, 340/ha was about half of the average from the transects. There was regeneration on this plot.

Sample was plot 3 representing dense forest. However, the number of stems, 590/ha was less than the average on the transects (700/ha). The basal area was slightly higher than on the other plots, 15 m²/ha and the second highest in the whole inventory, but still most trees were small and medium size with the dominance of and *Lecaniodiscus fraxinifolius* (Mbwewe) species. Again, no regeneration was found.

Sample plot 4 was just at the edge of the forest affected heavily by fire and grazing. The number of stems was only 70/ha with the basal area of 1 m²/ha. *Markhamia obtusifolia* (Myuyu) and *Combretum exalatum* (Mwekea) species were dominant on this plot. Only one seedling was recorded in the regeneration plot.

Very few large trees (dbh above 30 cm) were found in the sample plots in Makumba. As the results from transects show that the Makumba forest is not utilised at the same rate as in the other villagers, one would have expected some more large trees to be recorded. The average numbers of stems/ha in all sample plots are less than the average from the transects indicating that the sample plots were probably established on more degraded places than the average. Regeneration was generally very poor on all sample plots. This might be the outcome of the small sample, as there was not very much signs of intensive grazing in the forest. The general impression from the field was that there is quite a good forest in Makumba, but big areas have been heavily affected by fire.

Table 11. Key results from sample plots in Makumba

Plot no.	Vegetation type	No. of stems/ha	Basal area, m ² /ha	No. of tree species	Most common species, % of total number of stems	Largest trees, dbh cm
1	Scattered trees	500	10	11	<i>Spirostachys africana</i> (Msalaka), 32% <i>Grewia similis</i> (Mkole), 30% <i>Manilkara sulcata</i> (Msewezi), 16% <i>Strychnos spinosa</i> (Mkwakwa), 16% <i>Terminalia sambesiaca</i> (Mkenge), 6%	<i>Ficus thonningii</i> (Mvumo), 39 cm <i>Spirostachys africana</i> (Msalaka), 28 cm <i>Grewia similis</i> (Mkole), 27 cm <i>Grewia similis</i> (Mkole), 25 cm <i>Spirostachys africana</i> (Msalaka), 23 cm
2	Degraded forest (fire)	340	7	6	<i>Combretum molle</i> (Mnama), 44% <i>Spirostachys africana</i> (Msalaka), 18% <i>Pteleopsis myrtifolia</i> (Mngoji), 18% <i>Dalbergia melanoxylon</i> (Mpingo), 15%	<i>Spirostachys africana</i> (Msalaka), 37 cm <i>Spirostachys africana</i> (Msalaka), 31 cm <i>Combretum molle</i> (Mnama), 25 cm <i>Pteleopsis myrtifolia</i> (Mngoji), 23 cm <i>Combretum molle</i> (Mnama), 21 cm
3	Dense forest	590	15	12	<i>Lecaniodiscus fraxinifolius</i> (Mbwewe), 47% <i>Manilkara sulcata</i> (Msewezi), 12% <i>Grewia similis</i> (Mkole), 12% <i>Brachylaena hutchinsii</i> (Mkarambati), 10%	<i>Manilkara sulcata</i> (Msewezi), 35 cm <i>Brachylaena hutchinsii</i> (Mkarambati), 31 cm <i>Manilkara sulcata</i> (Msewezi), 30 cm <i>Lecaniodiscus fraxinifolius</i> (Mbwewe), 29 cm <i>Lecaniodiscus fraxinifolius</i> (Mbwewe), 27 cm
4	Degraded forest (fire, gazing)	70	1	4	<i>Markhamia obtusifolia</i> (Myuyu), 43% <i>Combretum exalatum</i> (Mwekea), 43% <i>Dombeya leucoderma</i> (Nkwengaa), 14%	<i>Markhamia obtusifolia</i> (Myuyu), 26 cm <i>Markhamia obtusifolia</i> (Myuyu), 18 cm <i>Combretum exalatum</i> (Mwekea), 11 cm <i>Combretum exalatum</i> (Mwekea), 8 cm

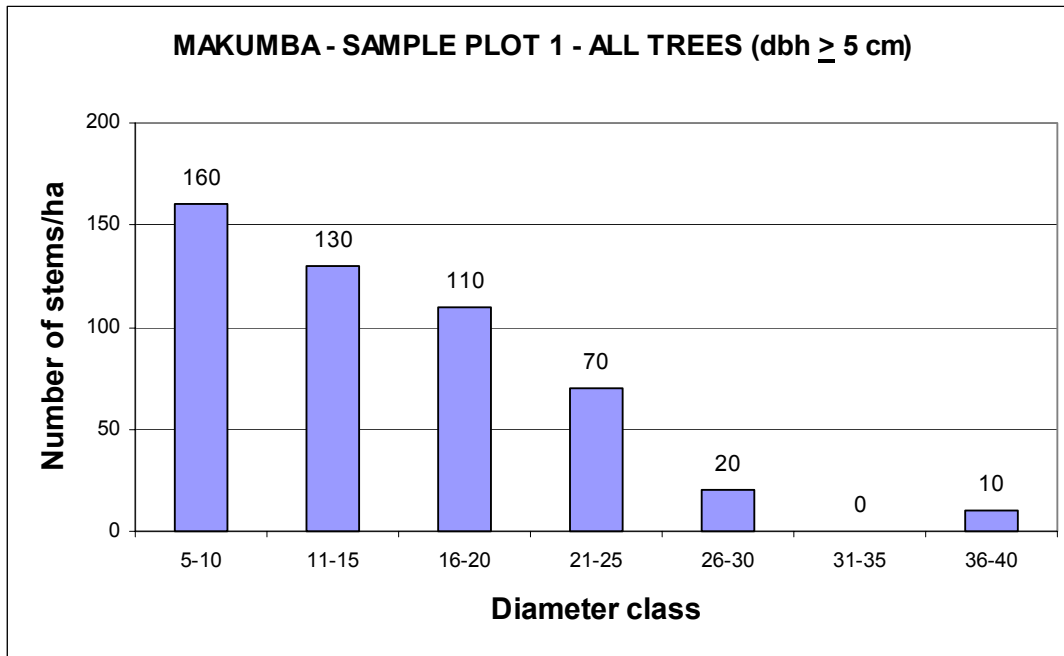


Figure 13. Distribution of trees into diameter classes in sample plot 1, Makumba

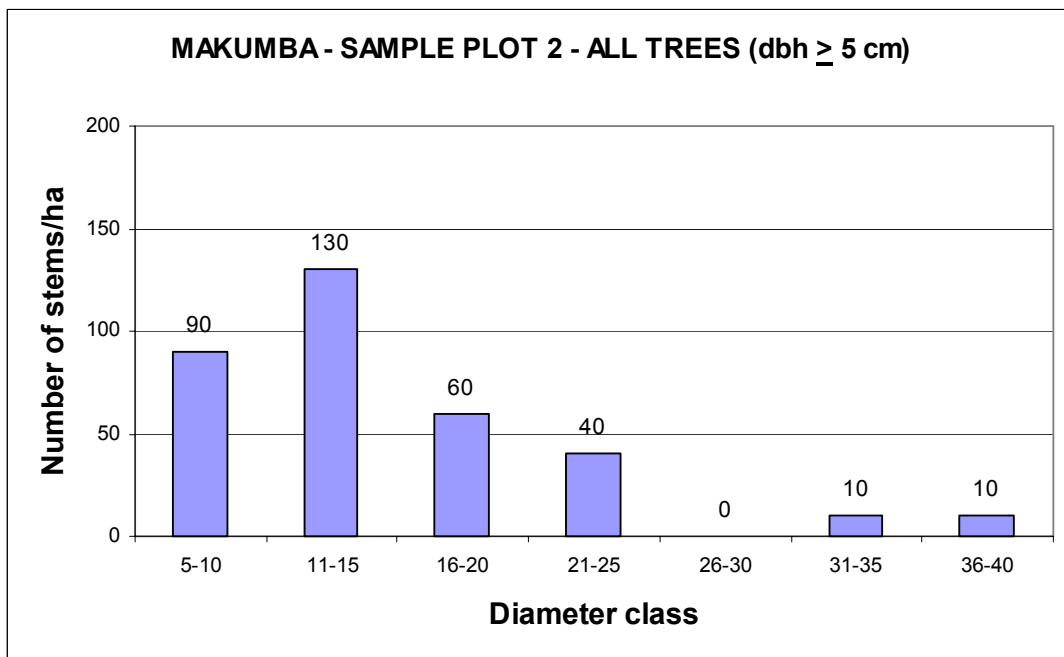


Figure 14. Distribution of trees into diameter classes in sample plot 2, Makumba

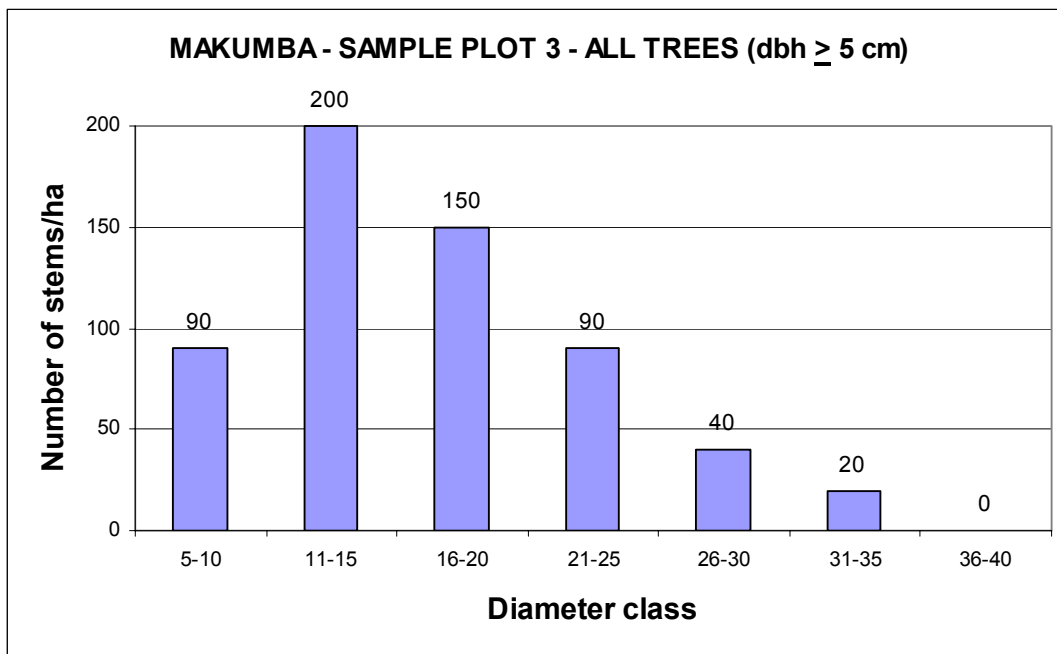


Figure 15. Distribution of trees into diameter classes in sample plot 3, Makumba

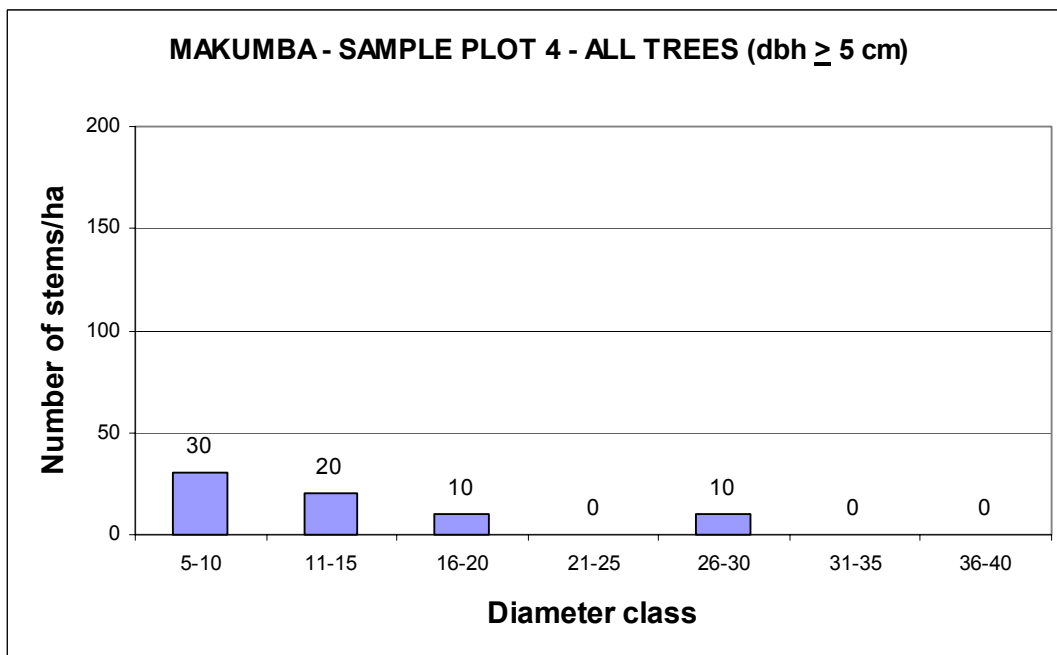


Figure 16. Distribution of trees into diameter classes in sample plot 4, Makumba

Table 12 Results from regeneration sample plots in Makumba

Plot no.	Vegetation type	Tree and shrub species name	Type of plant	No. of stems/plot
1	Scattered trees	<i>Dombeya leucoderma</i> (Nkwengaa)		1,110
		<i>Strychnos spinosa</i> (Mkwakwa)	Shrub	1,110
		ALL SPECIES		2,220
2	Degraded forest (fire)	No regeneration		0
3	Dense forest	No regeneration		0
4	Degraded forest (fire, gazing)	<i>Lantana camara</i> (Mvuti)	Shrub	1,110
		ALL SPECIES		1,110

5.5. Summary from All Villages

The total length of all transects was 9,011 m (this including also the Makangara / Mkwajuni transects in Kijango's forest). This represents an area of 9.01 ha, which is slightly more than 1% of the whole forest area. Therefore, the results for all tree species can be considered fairly representative, although it has to be remembered that the transects were not located systematically nor randomly, but subjectively, by trying to cover all different vegetation types in the forest. The data available for tree species specific results was, however, only from transects with total length of 6,787 m and so the results are not very reliable, especially concerning the amount of cut trees as discussed earlier when presenting the results from Makangara / Mkwajuni. The combined results from all villages are presented in table 13.

Altogether 184 different tree species were named by the villagers in the inventory (appendix 2). In addition there were some unknown species. Scientific names could be identified for 123 species, but 24 of them only by genus. It is likely, that some of the remaining 61 species, which could not be identified with scientific names are synonyms due to different ways of spelling. However, it can be concluded that there are well over 150 different tree species in Mfundia forest.

The average number of stems/ha was 1,860 for all trees, and for timber and pole size trees (dbh \geq 5 cm) 635/ha. Overwhelmingly the most common species was *Combretum exalatum* (Mwekea) having over 30% of all living stems. This shrub was very typical for Gombero and Makumba forests, it occurred at a lesser extent in Kijango but was not found in Makangara / Mkwajuni. Other common species were *Markhamia obtusifolia* (Myuyu), *Grewia similis* (Mkole), *Manilkara sulcata* (Msewezi) and *Croton pseudopulchellus* (Mkombechi) for all tree sizes, and *Markhamia obtusifolia* (Myuyu), *Pteleopsis myrtifolia* (Mngoji), *Spirostachys africana* (Msalaka), *Grewia similis* (Mkole) and *Manilkara sulcata* (Msewezi) for timber and pole size trees.

An average of 170 trees/ha or about 20% of timber and pole size trees had been cut. About 35% of the trees had been cut recently, that being influenced by the encroachment in Makangara / Mkwajuni, as in all other villages, the overwhelming majority of trees had been cut more than a year ago. The most common size of cut trees was 5-15 cm at dbh, which is the size of poles used in local construction. The most commonly cut species were *Spirostachys africana* (Msalaka),

about 15% of all cut trees, followed by *Brachylaena hutchinsii* (Mkarambati), *Pteleopsis myrtifolia* (Mngoji), *Dalbergia melanoxylon* (Mpingo) and *Manilkara sulcata* (Msewezi).

The results from the sample plots show that in general the forest in Mfundia is fairly poorly stocked, as the basal area was usually less than 10 m²/ha. Only in Gombero and Makumba there were sample plots having a bigger basal area.

As a conclusion it can be said that the forest in the northern part of Mfundia, that is in Kijango and Makangara / Mkwajuni villages has been very much affected by tree cutting and grazing. In Makangara / Mkwajuni one reason for tree cutting has been recent encroachment. Another reason might be that the forest is fairly close to Magoma town, which is a divisional center, and so there is a bigger pressure to the forest than compared to other villages. In Kijango, fire was also reported to be the reason for degradation. In Gombero and Makumba the biggest threat to the forest is fire; large treeless areas can be easily seen when looking at the forest from the road. The biggest number of trees/ha was found in Makumba, but the largest trees were recorded in Gombero. The forest is much less utilised for tree cutting in Makumba compared to other villages, but tree harvesting there is concentrating on bigger trees (dbh above 15 cm), while in all other villages most commonly cut trees were pole size.

Table 13. Results from transects in all villages

Tree species name <i>Scientific</i> (Sambaa/Swahili)	Number of stems/stumps per hectare											
	Live trees				Cut trees				Dead trees			
	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total	dbh >15 cm	dbh 5-15 cm	dbh 2-5 cm	Total
<i>Allophyllus sp.</i> (Mbombwe)	3		1	4				0	1			1
<i>Brachylaena hutchinsii</i> (Mkarambati)	5	14	22	41	10	6		16	1			1
<i>Coffea sp.</i> (Mkahawa mwitu)		4	20	24				0				0
<i>Combretum exalatum</i> (Mwekea)		16	558	574				0			1	1
<i>Combretum molle</i> (Mnama)	4	11	12	27				0	1	1	2	4
<i>Combretum schumannii</i> (Mperamwitu)	4	12	17	33	1	1		2	1	1	4	6
<i>Croton pseudopulchellus</i> (Mkombechi)		3	102	105		1		1				0
<i>Dalbergia melanoxylon</i> (Mpingo)	5	5	5	15	3	2		5		1		1
<i>Dombeya leucoderma</i> (Nkwengaa)		4	17	21			1	1			2	2
<i>Ficus exasperata</i> (Kishasha)	5	3	4	12	1			1				0
<i>Grewia similis</i> (Mkole)	17	40	68	125	1	1		2		3		3
<i>Grewia sp.</i> (Mkoe)	2	23	17	42				0				0
<i>Lansea schweinfurthii</i> (Muumbu)	2	1		3				0				0
<i>Lecaniodiscus fraxinifolius</i> (Mbwewe)	10	12	26	48	2			2		1	3	4
<i>Manilkara sulcata</i> (Msewezi)	25	18	64	107	3	1		4	6	2	2	10
<i>Markhamia obtusifolia</i> (Myuyu)	4	83	40	127		3		3		2		2
<i>Ostryoderris stuhlmannii</i> (Mnyinga)	1	1		2				0				0
<i>Pteleopsis myrtifolia</i> (Mngoji)	9	61	12	82	3	2		5	1			1
<i>Scorodophloeus fisheri</i> (Mhande)	5	7	4	16				0		1		1
<i>Spirostachys africana</i> (Msalaka)	44	25	8	77	20	16		36	3	1		4
<i>Strychnos spinosa</i> (Mkwakwa)		3		3				0				0
<i>Tarenna nigrescens</i> (Kishaghaati)			21	21				0				0
<i>Terminalia sambesiaca</i> (Mkenge)	3	1	3	7	1			1	1			1
<i>Trema orientalis</i> (Mshinga)		5		5						3	7	10
<i>Xymalos sp.</i> (Jamii Mvungawiza)		6	13	19				0				0

ALL TREE SPECIES	163	472	1,225	1,860	53	117	29	199	17	20	26	63

6. Compilation of Results at the Villages

Compiling the inventory results in villages with the planning teams started by identifying the most interesting tree and shrub species for the villagers. The plan was to calculate the results from transects manually for all these species following the instructions in appendix 5. Calculating results for one species usually took one meeting. As planning teams identified some 15-20 species of interest, manual calculating of results for all of them would have been very time consuming. As the planning team had practised the calculation with one species and understood the principle of the calculations, the results concerning other species were given to the planning teams based on the calculation in EUCAMP office using computer.

Calculation of results from vegetation plots and regeneration plots was done manually with the planning team using the instructions in appendix 5.

The species of interest identified by the planning teams and the occurrence of them according to the inventory is presented in tables 14-17. The occurrence was considered good, if there were more than 20 stems/ha of the size of the tree needed, average with stem number of 10-20/ha, and poor with stem number less than 10/ha (Dr. Patrick Mwangingo 2002, personal information). This information was used in the management plans for harvesting proposals.

Table 14. Species of interest in Gombero village and their occurrence in the forest

Tree species name <i>Scientific (Sambaa/Swahili)</i>	Use	Occurrence
<i>Brachylaena hutchinsii</i> (Mkarambati)	Timber, poles, fire wood	Average
<i>Manilkara sulcata</i> (Msewezi)	Timber, poles, fire wood	Good
<i>Spirostachys africana</i> (Msalaka)	Timber, poles, medicine	Good
<i>Scorodophloeus fischeri</i> (Mhande)	Timber, fire wood, home utensils	Average
<i>Combretum schumannii</i> (Mperamwitu)	Timber, poles	Poor
<i>Terminalia sambesiaca</i> (Mkenge)	Timber, medicine	Poor
<i>Azelia quanzensis</i> (Mkomba)	Timber, home utensils	None
(Mchaa)	Timber	None
<i>Dalbergia melanoxylon</i> (Mpingo)	Poles, medicine, home utensils	Poor
<i>Lecaniodiscus fraxinifolius</i> (Mbwewe)	Poles, fire wood	Poor
<i>Croton pseudopulchellus</i> (Mkombechi)	Withes, medicine	Good
<i>Grewia similis</i> (Mkole)	Fire wood, ropes, medicine, home utensils	Good
<i>Cassia abbreviata</i> (Mzangazi)	Medicine	Poor
<i>Entada rotundifolia</i> (Mkangara)	Medicine	None
<i>Dialium holtzii</i> (Mshila)	Home utensils	Poor

Although the stock in the Gombero forest was the best in Mfundia according to the inventory, the occurrence of most of the species the villagers were interested in, was poor or they did not exist in the forest at all. There is good potential for harvesting for two timber species, *Manilkara sulcata* (Msewezi) and *Spirostachys africana* (Msalaka), and for two other species used for withes, fire wood, ropes, medicine and making some home utensils, namely *Croton pseudopulchellus* (Mkombechi) and *Grewia similis* (Mkole). *Scorodophloeus fischeri* (Mhande) could also be harvested lightly. In addition there is some potential for light harvesting of *Brachylaena hutchinsii* (Mkarambati), but it has to be emphasised to the villagers that if they are harvesting this species for commercial purposes, some special regulations must be followed, as it is nationally reserved tree species.

Table 15. Species of interest in Kijango village and their occurrence in the forest

Tree species name <i>Scientific (Sambaa/Swahili)</i>	Use	Occurrence
<i>Spirostachys africana</i> (Msalaka)	Timber, medicine	Good
<i>Scelerocarya birrea</i> (Mng'ongo)	Timber, medicine	Poor
<i>Bombax rhodognaphalon</i> (Msufi mwitu)	Timber, medicine	None
<i>Terminalia sambesiaca</i> (Mkenge)	Timber, medicine	Poor
<i>Manilkara sulcata</i> (Msewezi)	Timber, fruit	Poor
<i>Brachylaena hutchinsii</i> (Mkarambati)	Timber	None
<i>Combretum schumannii</i> (Mperamwitu)	Timber	Poor
<i>Ostryoderris stuhlmannii</i> (Mnyinga)	Timber	None
<i>Lannea schweinfurthii</i> (Muumbu)	Timber	Poor
<i>Lecaniodiscus fraxinifolius</i> (Mbwewe)	Timber	Poor
<i>Ficus exasperata</i> (Kishasha)	Poles, fire wood	None
<i>Croton pseudopulchellus</i> (Mkombechi)	Withes, medicine	Good
<i>Pteleopsis myrtifolia</i> (Mngoji)	Charcoal, fire wood	Good
<i>Strychnos spinosa</i> (Mkwakwa)	Charcoal, fruit	Poor
<i>Scorodophloeus fischeri</i> (Mhande)	Charcoal	Poor
<i>Grewia similis</i> (Mkole)	Fire wood, ropes, medicine	Good
<i>Uvaria acuminata</i> (Mshofu)	Medicine, fruit	None
<i>Trema orientalis</i> (Mshinga)	Medicine, fruit	Poor
<i>Hoslundia opposita</i> (Mswewe)	Medicine, fruit	None
<i>Cassia abbreviata</i> (Mzangazi)	Medicine	None
<i>Nicroglossa oblongifolia</i> (Mshashu)	Medicine	None
<i>Dombeya guingiesata</i> (Muati)	Medicine	Poor
<i>Dalbergia melanoxylon</i> (Mpingo)	Carvings, medicine	Average

In Kijango, *Spirostachys africana* (Msalaka) has been most heavily harvested, but there still seems to be potential for harvesting of this species, for timber and medicine uses. Occurrences of other preferred timber and pole species was poor or they were not found at all in the inventory. Other species with harvesting potential are used for withes, charcoal, fire wood, ropes and medicine, namely *Croton pseudopulchellus* (Mkombechi), *Pteleopsis myrtifolia* (Mngoji) and *Grewia similis* (Mkole). Some potential for light harvesting exists for *Dalbergia melanoxylon* (Mpingo), but it has to be emphasised to the villagers that if they are harvesting this species for commercial purposes, some special regulations of this reserved species must be followed.

Table 15. Species of interest in Makangara / Mkwajuni villages and their occurrence in the forest

Tree species name <i>Scientific (Sambaa/Swahili)</i>	Use	Occurrence
<i>Brachylaena hutchinsii</i> (Mkarambati)	Timber, poles	None
<i>Spirostachys africana</i> (Msalaka)	Timber, poles	Good
<i>Bombax rhodognaphalon</i> (Msufi mwitu)	Timber, medicine	None
<i>Scelerocarya birrea</i> (Mng'ongo)	Timber	Poor
<i>Combretum schumannii</i> (Mperamwitu)	Timber	None
<i>Ostryoderris stuhlmannii</i> (Mnyinga)	Timber	Poor
<i>Lannea schweinfurthii</i> (Muumbu)	Timber	Poor
<i>Azelia quanzensis</i> (Mkomba)	Timber	Poor
<i>Albizia versicolor</i> (Mkingu)	Timber	Poor
<i>Manilkara sulcata</i> (Msewezi)	Poles, fire wood	Poor
<i>Ficus exasperata</i> (Kishasha)	Poles, fire wood	Poor
<i>Pteleopsis myrtifolia</i> (Mngoji)	Poles, fire wood	Good
<i>Scorodophloeus fischeri</i> (Mhande)	Poles, fire wood, home utensils	None
<i>Combretum molle</i> (Mnama)	Poles, fire wood	Average
<i>Markhamia obtusifolia</i> (Myuyu)	Poles, fire wood	Good
<i>Grewia similis</i> (Mkole)	Poles, ropes, medicine	Good
<i>Croton pseudopulchellus</i> (Mkombechi)	Withes, medicine	Good
(Ng'wekea)	Withes, fire wood, medicine	Poor
<i>Dalbergia melanoxylon</i> (Mpingo)	Carvings, medicine	Poor

It has to be emphasised that the species specific results for Makangara / Mkwajuni transects were available only from two transects. Therefore, one has to be cautious when making conclusions and proposals for harvesting. Anyhow, in Makangara / Mkwajuni forest there were two species of interest, which were very plentiful (both having more than 200 stems/ha), namely *Pteleopsis myrtifolia* (Mngoji) and *Markhamia obtusifolia* (Myuyu) and it seems that there is potential for sustainable harvesting of them. Two other species, *Grewia similis* (Mkole) and *Croton pseudopulchellus* (Mkombechi), used for poles, withes and fire wood have quite a good stock and could be harvested. As for preferred timber species the only one available for harvesting was *Spirostachys africana* (Msalaka).

Table 16. Species of interest in Makumba villages and their occurrence in the forest

Tree species name <i>Scientific (Sambaa/Swahili)</i>	Use	Occurrence
<i>Manilkara sulcata</i> (Msewezi)	Timber, poles, withes, fire wood	Good
<i>Brachylaena hutchinsii</i> (Mkarambati)	Timber, poles, fire wood	Poor/good
<i>Spirostachys africana</i> (Msalaka)	Timber, poles, medicine	Good
<i>Terminalia sambesiaca</i> (Mkenge)	Timber, medicine	Poor
<i>Albizia gummifera</i> (Mshai)	Timber, fire wood	Poor
<i>Milicia excelsa</i> (Mvule)	Timber	Poor
<i>Combretum schumannii</i> (Mperamwitu)	Timber	Average
<i>Azelia quanzensis</i> (Mkomba)	Timber	None
<i>Grewia similis</i> (Mkole)	Poles, medicine	Good
<i>Cassia singueana</i> (Mhumba)	Poles, medicine	Poor
<i>Lecaniodiscus fraxinifolius</i> (Mbwewe)	Poles	Good
<i>Scorodophloeus fischeri</i> (Mhande)	Poles, home utensils	Average
<i>Croton pseudopulchellus</i> (Mkombechi)	Withes, medicine	Poor
<i>Combretum exalatum</i> (Mwekea)	Withes, medicine	Good
<i>Coffea sp.</i> (Mkahawa mwitu)	Withes	Good
<i>Dombeya leucoderma</i> (Nkwengaa)	Ropes, medicine	Good
<i>Dalbergia melanoxylon</i> (Mpingo)	Carvings	Poor

In Makumba there is good harvesting potential for two preferred timber species, namely *Manilkara sulcata* (Msewezi) and *Spirostachys africana* (Msalaka). Light harvesting of timber size *Combretum schumannii* (Mperamwitu) also seems to be possible. *Manilkara sulcata* (Msewezi) is also used for poles and withes, and these sizes of trees are plentiful. Makumba was the only village in Mfundia where there were some *Milicia excelsa* (Mvule) trees recorded, but they were very few. Harvesting potential is better for species used for poles, withes and medicine, like *Grewia similis* (Mkole), *Lecaniodiscus fraxinifolius* (Mbwewe), *Coffea sp.* (Mkahawa mwitu) and *Dombeya leucoderma* (Nkwengaa). Also pole size *Brachylaena hutchinsii* (Mkarambati) could be harvested, but in timber size this species were very few. Makumba was the only village, which mentioned *Combretum exalatum* (Mwekea) as an interesting species. This shrub is very plentiful in Makumba forest. However, in the past it had hardly been harvested.

7. Lessons Learned from the Participatory Forest Inventory

Most of the problems encountered during the inventory were connected to the map, which was prepared by the Land Office of Korogwe District Council. Only a photocopy of the draft map was available in the beginning of the inventory. During the inventory field work, it was noticed that there were several discrepancies and mistakes on the map, which hampered the inventory. 88 “stations” (or turning points) had been marked and numbered on the draft map, but in the field there were only 60 numbered beacons altogether. The stations without beacons were in Gombero and Makangara, and consequently the station numbers on the map and beacon numbers in the field did not correspond in these villages causing some confusion and problems when identifying the starting points of the transects. Moreover, the internal boundary between Gombero and Makangara was wrongly marked on the map. Also the conflict concerning the internal boundary between Kijango and Makangara / Mkwajuni had not been solved, but the boundary had been marked in the field only by representatives from Makangara / Mkwajuni and the Land Surveyor. The Kijango planning team almost refused to continue the inventory before resolving the conflict. It was difficult to decide where transects should end in Makangara / Mkwajuni and Kijango, and later when the border conflict had been solved it was found out that the Makangara / Mkwajuni team had measured part of their transects in Kijango’s forest area. Unfortunately, none of these problems had been reported by the District staff before the inventory started. It is self evident, that a good and exact map is needed for forest inventory.

Some planning team members expected payment for the training and the work thus indicating a low level of awareness in the ownership of the forest. Lunch was provided for the planning teams every day but most people would have preferred cash payment. After discussion, the planning teams agreed that the work is for the villagers’ benefit and would be conducted without payment. In some villages, e.g. in Gombero the participation was quite poor.

Some facilitators felt that the inventory method was too complicated for the villagers, but others were of the opinion that after training and the field work, planning teams were conversant in using the inventory equipment and doing the work. However, the time allocated for the exercise was considerably short. Increasing the time would increase the budget as the major expense was facilitators’ allowances. If more time (and funding) would be available, more transects could be measured and they could be laid out systematically, giving a more objective picture of the forest. However, with the limited time (and budget) the method was considered to give a rough picture of forest resources for the purpose of the management plans.

During the facilitators’ training it was noticed that more information should be collected from the transects than originally planned. It was felt to be important, that all tree species should be identified to give a better overview of the forest area, instead of just the total number of timber, poles and withes. Consequently, the planned form had to be modified, and in practice the inventory teams recorded the data in their note books. It seems that some teams forgot to record systematically e.g. the disturbance category. It would be better to test the field forms before the actual inventory took place and make the modifications needed before the actual field work. In this way the inventory data would be recorded more systematically. Unfortunately, in the Mfundia inventory this was not possible due to time and budgetary constraints.

8. Recommendations to the Management Plans

Based on the results from the inventory, it was obvious that fire was a serious problem in Mfundia. It is therefore recommended that strong fire control measures should be applied. Especially cleaning the external boundary would prevent fire from crossing the forest border. It should also be considered whether the internal boundaries could be opened and cleaned to avoid fire spreading from one village forest area to another. This would also help to maintain permanent boundaries between villages and to avoid boundary conflicts in the future. Now the internal boundaries are only marked with paint, which might not be visible after some time.

Grazing has been another problem, especially in Kijango and Makangara / Mkwajuni village forest areas. It has obviously caused poor or no regeneration in many of the measured vegetation plots. According to the draft management plans, grazing would be forbidden in the village forest areas in the future. Strong awareness-raising in the villages would be needed to make the villagers understand and accept the change in the common practice.

Big areas of the forest are degraded due to fire, encroachment and grazing, and regeneration was usually poor. It is recommended that enrichment planting with fast growing tree species would be included in the work programmes.

All stations (or turning points of the boundary) without a beacon that are now marked only with a pole, should be permanently marked with some big stones and directional trenches. Clear boundaries are a prerequisite to maintain the forest area and avoidance of encroachment or other forbidden activities.

It was noticed that many villagers do not realise the benefits from the forest. A lot of awareness raising would be needed in the future. Beekeeping in the village forest areas is recommended; by protecting the bee hives from fire the villagers would also protect the forest. According to the inventory there seems to be many species in the forest to support beekeeping.

Most commonly harvested trees were pole size (dbh 5-15 cm) that indicates that the forest resources are mostly used for local construction. On the other hand the inventory revealed that there were very few large size trees in the forest. The villagers should be made aware of the advantages of building with mud bricks, thereby reducing pressure on the forest. That would also allow pole size trees to grow bigger and more valuable timber size, so that in the future possibly some monetary income would be accrued from the forest.

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Appendix 1 Training Manual

TRAINING MANUAL FOR PARTICIPATORY INVENTORY OF MFUNDIA VILLAGE FOREST RESERVE

Introduction

Mfundia forest is a lowland forest, which lies on low hills in the eastern Korogwe District, in Tanga Region. It covers an area of 800 ha. In some parts of the forest, canopy is high and closed with some valuable timber species while some areas the forest is highly disturbed by fire, timber cutting, and animal grazing.

EUCAMP has been working with villages surrounding the national catchment forest reserves in the East Usambara area. The villages surrounding Mfundia forest are interested in owning and managing village forest reserve. These villages are Makumba, Kijango, Gombero, Makangara and Mkwajuni.

In order to know the value of the forest so as to ensure sustainable use, it is important to carry out participatory inventory in the area.

Objective of the inventory

- To carry out an inventory of natural resources of the village forest reserve, which could help to implement and maintain forest management plans.
- To get an idea of how villagers use and manage their forest plus what their level of knowledge is.
- To try out some methods whereby villagers, together with foresters, can develop a monitoring system for the natural resources in that forest

Two main things will be considered during inventory

- Assessment of tree stock and forest disturbance
- Establishment of vegetation monitoring plots

Assessment of tree stock and forest disturbance

Transect lines will be established using a compass, starting from the forest boundary running towards east or west. The length of transect will be varying depending on the size of the village forest management area. Vegetation assessment will be done 5 m on either side of the transect line making a transect width of 10 m. During the establishment of the transect, one person with a compass will be leading the *panga* man who will cut the transect. The compass person will be holding one end of the 50 m string, at the same time another person holds the other end until the fifty metres portion is completed.

The following parameters will be measured 5 m each side of the transect:

- All live trees with a girth of 6 cm and above at the breast height tallied into three size categories (6-15 cm, 16-47 cm, above 47 cm) and their tree species will be identified.
- All cut trees will be identified and tallied like living trees and it will be indicated if they were cut recently (within one year) or in the past (more than one year ago).
- All dead trees will be identified and tallied the same way.
- Other forest disturbance like fire damage, grazing, traps for hunting, pit sawing, charcoal burning, collection of medicinal plants, collection of trees for carving, collection of fodder, cultivation, collection of honey, mining and settlements will be recorded.
- All recordings will be made on Form No. 1.

Establishment of vegetation monitoring plots

The vegetation monitoring plots will be established in the forest along the transect lines for monitoring vegetation changes. These plots will be established in different vegetation types like closed canopy forest, grassland, bush land, disturbed areas etc. The number of the plots depends on the size of village forest management areas and the forest strata. The size of the plot will be 50 m x 20 m. 50 m will be measured along the transect while 20 m will be measured towards south or north from the transect line. Two 50 m strings and two 20 m strings will be used in this work and a compass is used to indicate the direction. All trees with a girth of 16 cm and above will be measured, numbered, identified by the villagers and recorded on Form No 2.

Another small (3 m x3 m) plot will be established at the starting point corner of 50 m x 20 m plot for regeneration monitoring whereby all seedlings/saplings with girth of less than 6 cm at breast height and those which have a girth of more than 1.5 cm at stump base but not more than 2 m height will be identified and recorded on form No 3

The positions of vegetation plots will be recorded by using Global Positioning System (GPS), so that they can be re-located in the future. GPS readings will be taken also at the starting points of the transect lines.

The following equipment will be used in the inventory

- Tape measure for measuring width of the transect
- Tape measure (ordinary dressmaker's tape measure) for measuring the girth of trees
- 50 m and 20 m strings for establishing vegetation monitoring plots
- Compass for defining the direction
- GPS for taking positions of transect starting points and vegetation monitoring plots
- *Pangas* for opening the transect lines
- Nylon red tags for marking the transect lines
- Note books, data forms and pen
- Red paint and brushes for marking trees in the monitoring plots

Appendix 2 Tree Species List

Species found in the Mfundia inventory.

GENUS	SPECIES	VERNACULAR NAME
Acacia	Clavigera	Mtusi
Acacia	hockii	Kikwaagembe
Acacia	hockii (or polyacantha?)	Mgunga
Acacia	Mellifera	Kikwata
Acalypha	Fruticosa	Msagati-kivumba (Msaghati kizumba)
Acalypha	Paniculata	Mzindu
Acalypha	Subsessilis	Mshafu
Azelia	Quanzensis	Mkombwa (Mkokombwa)
Agathisanthemum	Boieri	Mkulagembe (Mkuagembe, Mkula gembe)
Albizia	anthelmintica	Mfueta (Mfleta, Mfuleta)
Albizia	gummifera	Mshai
Albizia	Harveyi	Msisimizi
Albizia	Versicolor	Mkingu
Allophylus	Africanus	Mbangwe mshongoo
Allophylus	Alnifolius	Mbangwe
Allophylus	sp.	Mbombwe, Bombwe
Ampelocissus	Grantii	Tongotongo
Anisohpyllea	Obtusifolia	Msala
Annona	senegalensis	Mntonkwe, Mtonkwe
Antiaris	Toxicaria	Antiaris
Bersama	Abyssinica	Mbamba
Blighia	sp.	Mzindanguuwe jamii
Blighia	Unijugata	Mzindanguuwe
Bombax	rhodognaphalon	Msufi mwitu
Boscia	Salicifolia	Mguluga (Mguluka, Mguuka)
Brachylaena	Hutchinsii	Mkarambati, Mkalambati, Mhugwe
Brachylaena	sp.	Mkarambati jamii
Bridelia	Micrantha	Ngwiza
Calodendrum	Eickii	Mhombo, Hombo Muungu
Canthium	Hispidum	Ntuavuha, Mtuavuha (Nduavuha, Ntoavuha)
Canthium	sp.	Mlawa
Capparis	Bussei	Ukombe wa mnyau (nyau)
Carrisa	Edulis	Mfumba
Cassia	Abbreviata	Mzangazi
Cassia	Singueana	Mhumba
Cassia	sp.	Mhumba jamii
Clerodendrum	Scheffleri	Mzuma

GENUS	SPECIES	VERNACULAR NAME
Clutia	Mollis	Mdagha
Clutia	sp.	Mdagha jamii
Coffea	sp.	Mkahawa mwitu, Mkahawa pori
Combretum	Exalatum	Mwekea
Combretum	Molle	Mnama
Combretum	paniculatum	Bambangoma, Mbambangoma, (Bambagoma)
Combretum	schumannii	Mperamwitu
Commiphora	Africana	Msusu
Commiphora	zimmermannii	Bambaa, Mbambala, Mbambara
Compretum	sp.	Bambangoma jamii
Crossopteryx	Febrifuga	Mjikojiko
Croton	pseudopulchellus	Mkombechi
Cussonia	Arborea	Mntindi (Mtindi)
Dalbergia	melanoxylon	Mpingo, Mhingo
Dialium	Holtzii	Mshila, Mshira, Mshia
Diplorhynchus	condylocarpon	Mgoto, Mgooto
Dobera	loranthifolia	Msiga
Dombeya	leucoderma	Nkwengaa, Mkwengaa, Kwengaa (Kwangaa)
Dombeya	guingieseta	Muati, Muwati, Mlwati (Mluwati, Muuwati)
Englerophytum	Natalense	Mduyuyu, Mduanyu, Mduaya, Mdayu
Erythrophleum	Guineense	Mkokola
Euclea	Fructuosa	Mdala, Mdaa
Euphorbia	sp.	Ndelengwe, Ndeengwe (Nderengwe)
Ficus	Exasperata	Kishasha, Mshasha
Ficus	Kirkii	Kinyandege
Ficus	sp.	Mkuyu
Ficus	sp.	Mvumo jamii
Ficus	Thonningii	Mvumo
Galinsoga	Parviflora	Msekeseke
Galinsoga	sp.	Msekeseke jamii
Garcinia	sp.	Mndee Mzize jamii
Garcinia	Volkensii	Mndee Mzize
Grewia	Forbesii	Mkandodeka, Mkongodeka
Grewia	Holstii	Mkole Mbuzi
Grewia	Similis	Mkole
Grewia	sp.	Mkoe
Grewia	Tembensis	Mnangu
Gymnospora	Serrata	Kihongolo, Kihongoro, Kinkongolo
Harungana	madagascariensis	Mkutu, Mkhutu
Lanea	schweinfurthii	Muumbu, Mumbu, Mmumbu
Lantana	Camara	Mvuti

GENUS	SPECIES	VERNACULAR NAME
Lasiosiphon	Latifolius	Mkisigizi (Mkisighizi)
Lecaniodiscus	fraxinifolius	Mbwewe, Bwembwe (Mbwembwe)
Lonchocarpus	Bussei	Mfumbii (Mfumbi, Mfumbili, Mfumbiri)
Maerua	cylindricarpa	Mdudu
Manilkara	Eickeii	Mghambo, Ngambo (Mgambo)
Manilkara	sp.	Mselewezi jamii
Manilkara	Sulcata	Msewezi, Mselewezi
Markhamia	Lutea	Mtalanda
Markhamia	Obtusifolia	Myuyu
Microglossa	oblongifolia	Mshashu
Microglossa	sp.	Mshashu jamii
Microglossa	sp.	Muuka jamii
Milicia	Excelsa	Mvule
Milletia	sp.	Milletia
Myrianthus	Holstii	Mkonde
Ostryoderris	stuhlmannii	Mnyinga
Pentas	Bussei	Mkinyampome
Premna	Chryselada	Mhaha
Pteleopsis	Myrtifolia	Mngoji
Rapanea	usambarensis	Mshizio
Rhus	Natalensis	Mhungulu, Mhunguu (Mhuhungulu)
Ricinodendron	Heudelotii	Tondolo
Rubus	sp.	Mshaa
Scelerocarya	Birrea	Mng'ongo
Scorodophloeus	Fischeri	Mhande (Mkhande)
Securinega	Virosa	Mkwamba
Spirostachys	Africana	Msalaka, Msaraka, (Msharaka)
Steganotaenia	Araliaceae	Mnyongambembe
Sterculia	appendiculata	Mgude
Sterculia	leguminosacea	Mwoza (Moza, Muoza)
Sterculia	sp.	Muoza
Stereospermum	kunthianum	Mnkande, Mkande
Strychnos	Innocua	Mtonga
Strychnos	sp.	Mkwakwa jamii
Strychnos	Spinosa	Mkwakwa
Syzygium	sp.	Mshihwi
Tarenna	Nigrescens	Mshaghasha chole, Kishaghaati
Terminalia	kilimandscharica	Mkulungo
Terminalia	sambesiaca	Mkenge
Trema	Orientalis	Mshinga, Msinga
Turraea	Robusta	Dwayu

GENUS	SPECIES	VERNACULAR NAME
Uvaria	Acuminata	Mshofu
Vitex	sp.	Mngobe
Xymalos	monospora	Mvungawiza, Vungawiza
Xymalos	sp.	Mvungawiza jamii
		Bombo
		Bwinikanguru
		Kabamba
		Kashuzamzitu (Kasuzamsitu, Kashuzamsitu)
		Kihuuzi
		Kilimbofi
		Kimodoa, Kimodora
		Kinghangala
		Kipangasasu
		Masaka
		Mbalanga
		Mbeengwa
		Mdiha
		Mfaanda
		Mfumbu
		Mgandii
		Mganga
		Mgoa
		Mgoa jamii
		Mgomozi
		Mgunda
		Mguya
		Mhifu
		Mhindi
		Mjaughai
		Mjikavuntu, Mjikavundu
		Mkingi, Mkingii
		Mkingiri, Mkingili
		Mkwangwala
		Mkwati
		Mndasha
		Mndoe Mziwa?
		Mngwaza
		Mpwanyanya
		Msakasange
		Mserehe
		Msereka

GENUS	SPECIES	VERNACULAR NAME
		Mshambo
		Mshongombangwa
		Mshumambeeko
		Mswewe
		Mtambaa kuzimu
		Mtero
		Mtundwano
		Muongunyika
		Muwenga
		Mvungunyika
		Mwenga
		Mwerekera
		Mzea
		Ng'anga (Nganga)
		Nghongolo
		Ngwangale
		Ng'wekea
		Ngwenga
		Nkatakwa
		Nkwangala
		Nkwangurala
		Ntuamba
		Shaghaati
		Twangala

Appendix 3 Facilitators' Timetable

Village	Facilitator Korogwe District team	Facilitator EUCAMP team	Rotating facilitator 1st day	Rotating facilitator 2nd day	Rotating facilitator 3rd day	Rotating facilitator 4th day	Rotating facilitator 5th day
<i>Gombero</i>	Land Surveyor	Station Officer/ Longuza	DFO Korogwe	Botanist, SFA	Biodiversity Survey Officer	FVF Officer	DFO Korogwe
<i>Kijango</i>	For. Assistant/ Makumba	Station Officer/ Maramba	Botanist	Biodiversity Survey Officer	FVF Officer	DFO Korogwe, SFA	Botanist
<i>Makangara</i>	DNRO	Forest Officer/ Maramba	FVF Officer, SFA	DFO Korogwe	Botanist	Biodiversity Survey Officer	FVF Officer, SFA
<i>Makumba</i>	Forester/Mombo	Station Officer/ Kilangangua	Biodiversity Survey Officer	FVF Officer	DFO Korogwe, SFA	Botanist	Biodiversity Survey Officer

Abbreviations:

DFO	District Forest Officer (Korogwe)
DNRO	District Natural Resources Officer (Korogwe)
For. Assistant	Forestry Assistant (EUCAMP)
FVF Officer	Farm and Village Forestry Officer (EUCAMP)
SFA	Social Forestry Adviser (EUCAMP)

Appendix 4 Location of Transects and Sample Plots

Village	Transect number	Starting point	Direction of transect	Starting point, GPS	Starting point, Altitude	Length of transect,
GOMBERO	1	From station no. 73 on draft map (no beacon)	To the east	S 04°56'12.4" E 038°34'48.4"	420 m	774 m
	2	From station no. 69 on draft map (no beacon)	To the east	S 04°56'42.8" E 038°34'50.3"	419 m	700 m
	3	50 m northeast from beacon no. 47	To the east	(Information missing)	(Information missing)	635 m
	4	From beacon no. 40	To the east	S 04°57'55.3" E 038°34'18.3"	470 m	350 m
KIJANGO	1	From beacon no. 8	To the west	S 04°55'22.9" E 038°35'58.7"	526 m	800 m
	2	From beacon no. 2	To the west	S 04°55'05.0" E 038°35'49.0"	466 m	350 m
	3	From beacon no. 21	To the west	S 04°55'57.7" E 038°35'27.0"	453 m	492 m
MAKANGARA	1	From beacon no. 60	To the west	S 04°54'41.4" E 038°35'49.7"	457 m	650 m
	2	85 m north from beacon no. 54	To the east	S 04°55'08.4" E 038°35'16.4"	411 m	600 m
	3	From beacon no 51	To the east	(Information missing)	(Information missing)	900 m
	4	300 m northeast from beacon no. 53	To the east	S 04°55'20.6" E 038°35'07.6"	411 m	600 m
MAKUMBA	1	From beacon no. 26	To the west	S 04°56'22.7" E 038°35'28.9"	504 m	Less than 300 m
	2	From beacon no. 30	To the west	S 04°57'11.3" E 038°35'33.5"	500 m	900 m
	3	61.5 m west from beacon no. 36	To the west	S 04°57'40.2" E 038°34'48.4"	570 m	Less than 650 m

Village	Sample plot no.	Transect number	Location of sample plot	Location of sample plot, GPS	Altitude of sample plot	Direction of sample plot	Vegetation type of sample plot
GOMBERO	1	1	At 350-400 m from start	S 04°56'11.2" E 038° 35'01.9"	453 m	To the north	Dense forest
	2	2	At 100-150 m from start	S 04°56'43.1" E 038°34'55.3"	468 m	To the south	Scattered big trees
	3	3	At 350-400 m from start	S 04°57'34.8" E 038°34'37.3"	579 m	To the south	Degraded forest (fire)
	4	4	At 300-350 m from start	S 04°57'55.1" E 038°31'32.3"	524 m	To the south	Thicket
KIJANGO	1	1	At 350-400 m from start	S 04°55'23.7" E 038°35'47.7"	514 m	To the north	Dense forest
	2	1	At 700-750 m from start	S 04°55'25.2" E 038°35'0"	539 m	To the north	Degraded forest (fire, grazing)
	3	2	At 200-250 m from start	S 04°55'04.8" E 038°35'42.5"	489 m	To the north	Degraded forest (fire, grazing)
	4	3	At 350-400 m from start	S 04°55'58.2" E 038°35'15.9"	525 m	To the north	Scattered big trees
MAKANGARA	1	1	At 350-400 m from start	S 04°54'41" E 038°35'41"	458 m	To the south	Degraded forest (encroachment)
	2	2	(Information missing)	S 04°55'08" E 038°35'19"	423 m	To the south	Dense forest
	3	3	At 450-500 m from start	S 04°55'46.7" E 038°35'08.0"	450 m	To the south	Scattered trees
	4	4	At 400-450 m from start	S 04°55'20.6" E 038°35'21.0"	449 m	To the south	Scattered trees
MAKUMBA	1	1	At 150-200 m from start	S 04°56'24.2" E 038°35'24.2"	542 m	To the north	Scattered trees
	2	1	At 300-350 m from start	S 04°56'22.1" E 038°35'21.1"	583 m	To the north	Degraded forest (fire)
	3	2	At 650-700 m from start	S 04°57'12.9" E 038°35'13.2"	730 m	To the south	Dense forest
	4	3	At 100-150 m from start	S 04°57'39.4" E 038°35'05.8"	461 m	To the north	Degraded forest (fire, grazing)

Appendix 5 Instructions for Compilation of Inventory Data

Compiling data from transects

- 1) The data from transects was recorded in the format as in Form No. 1.
- 2) Discuss with the planning team, which are the most interesting tree species for the villagers and for the management plan. List the tree species and their uses.
- 3) For compiling information concerning living, cut and dead trees from each transect, use Form No. 4. This form is filled in for each tree species of interest. It can also be used for all tree species, if the planning team wants that information.
- 4) For compiling information from different transects for a specific tree species, use Form No. 5. The totals on the bottom line of Form No. 4 are transferred on Form No. 5 for each transect. Again this form can be used for all tree species if necessary.
- 5) The totals in the bottom line of Form No. 5 give the total numbers of living, cut and dead trees in the area which was assessed in the transects. All transects can be considered as a big sample plot, which size is 10 m * the total length of the transects. With this information the numbers of trees can be calculated per hectare using the following formula:

$$\frac{10,000 * \text{total number of trees}}{\text{total length of transects} * 10}$$

However, information per hectare might not be relevant or difficult for the villagers to understand. For their uses it might be more interesting to make e.g. following conclusions based on the compiled information:

- Which valuable tree species is most common in the forest, and in which sizes (timber, poles, withes) it is available
 - Which valuable tree species is rarest in the forest
 - Which valuable tree species is most utilised in the forest
 - Which valuable tree species is dying naturally at a high rate.
- 6) The compiled information from transects can be used for making harvesting proposals for different tree species that can be included in the management plan. It could be considered that there is sustainable harvesting potential for a specific size of a specific tree species, if there are more than 30 stems/ha in average of that tree and size, light harvesting potential if the average number of stems/ha is 10-30, and no harvesting potential, if there are less than 10 stems/ha in average.
 - 7) For compiling information on different uses and disturbance of the forest, use Form No. 6. Copy the codes of different uses/disturbances from the field notes in the relevant cell of the upper table according to the transect number and the distance from the border. When all field data has been copied in the table, count how many times each disturbance occurs in each transect and write this information on the lower table.

With the compiled information you can e.g. conclude, which use or disturbance is most common in the forest, and how large the affected area is (e.g. half of the area, one third, one quarter etc.). For example, if the total length of all transects was 1,600 metres, there were altogether 32 pieces of 10 m * 50 m “recording units”. If fire damage was recorded 15 times (“Total” of “FIRE DAMAGE” in the lower table on Form No. 6 is 15), it can be concluded that almost half of the area was affected by fire.

Compiling data from vegetation plots

- 1) For compiling the data from a vegetation plot (50 m * 20 m) use Form No. 7. Write the tree species names e.g. in the order of importance to the villagers in column “Vernacular name”. Tally (using IIII 111 –technique) each sample tree in the relevant “Tally” -column. E.g. If there is a sample tree of Mpingo (*Dalbergia melanoxylon*) of 37 cm, tally under “Pole size Girth 16 – 47 cm, Tally”, and another sample tree of 99 cm tally under “Timber size Girth 48 – 150 cm, Tally” –column etc. When all sample trees have been tallied on the form, mark the totals for each species and each tree size in the column “Total”. The far right and the bottom “**Total**” -columns give the sub-totals for each species and each tree size, and the grand total is in the far right bottom cell.
- 2) With this information, the numbers of trees on a vegetation plot can be calculated per hectare using the following formula:

$$\frac{10,000 * \text{total number of sample trees}}{50 * 20}$$

Compiling data from regeneration plots

- 1) For compiling the data from regeneration plots (3 m * 3 m) use Form No. 8. Write the tree species names e.g. in the order of importance to the villagers in column “Vernacular name”. Tally (using IIII 111 –technique) each sample tree in the relevant “Tally” column under respective sample plot number. When all sample trees have been tallied on the form, mark the totals for each species in each sample plot in the column “Total”. The far right and the bottom “**Total**” -columns give the sub-totals for each species and each sample plot, and the grand total is in the far right bottom cell.
- 3) With this information the numbers of trees can be calculated per hectare using the following formula:

$$\frac{10,000 * \text{total number of sample trees}}{\text{Number of sample plots} * 3 * 3}$$

Again, this information per hectare might not be relevant. For their uses it might be more interesting to make e.g. following conclusions based on the compiled information:

- Which valuable tree species are regenerating in the forest, and which are not
- Which tree species were most common in regeneration plots.

Name of forest Village

Transect No. Plot No.

Distance from the beginning (m)

Altitude (m) GPS

Group

Date

Vegetation type

Lowland forest	<input type="checkbox"/>
Submontane forest	<input type="checkbox"/>
Montane forest	<input type="checkbox"/>
Woodland	<input type="checkbox"/>
Grassland	<input type="checkbox"/>

Signs of past use

Cultivation

Settlement

TREES WITH GIRTH (AT THE BREAST HEIGHT) \geq 16 cm

Tree No.	Girth, cm	Vernacular name	Scientific name	Family
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

Form No. 3

REGENERATION SUBPLOT (3 m x 3 m)Name of forest Village Transect No. Plot No. Group Date

**TREES WITH GIRTH < 6 cm (AT THE BREAST HEIGHT) AND
TREES WITH GIRTH \geq 1.5 cm AT STUMP BUT WITH HEIGHT < 2 m**

Tree No.	Vernacular name	Scientific name	Family
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

Form No. 4

COMPILATION OF DATA FROM A TRANSECT

Name of forest Village

Transect No. Date

Group

Tree name

DISTANCE (m)	LIVE TREES			CUT TREES						DEAD TREES		
	TIMBER SIZE	POLE SIZE	WITHE SIZE	FRESH	OLD	FRESH	OLD	FRESH	OLD	TIMBER SIZE	POLE SIZE	WITHE SIZE
				TIMBER SIZE		POLE SIZE		WITHE SIZE				
0 - 50												
50-100												
100-150												
150-200												
200-250												
250-300												
300-350												
350-400												
400-450												
450-500												
500-550												
550-600												
600-650												
650-700												
700-750												
750-800												
800-850												
850-900												
900-950												
950-1000												
1000-1050												
1050-1100												
1100-1150												
1150-1200												
Total												

Form No. 5

COMPILATION OF DATA FROM ALL TRANSECTS

Name of forest Village

Group

Date

Tree name

TRANSECT NUMBER	LENGTH OF TRANSECT (m)	LIVE TREES			CUT TREES						DEAD TREES		
		TIMBER SIZE	POLE SIZE	WITHE SIZE	FRESH	OLD	FRESH	OLD	FRESH	OLD	TIMBER SIZE	POLE SIZE	WITHE SIZE
					TIMBER SIZE	POLE SIZE	WITHE SIZE						
1													
2													
3													
4													
5													
6													
Total													

Tree name

TRANSECT NUMBER	LENGTH OF TRANSECT (m)	LIVE TREES			CUT TREES						DEAD TREES		
		TIMBER SIZE	POLE SIZE	WITHE SIZE	FRESH	OLD	FRESH	OLD	FRESH	OLD	TIMBER SIZE	POLE SIZE	WITHE SIZE
					TIMBER SIZE	POLE SIZE	WITHE SIZE						
1													
2													
3													
4													
5													
6													
Total													

Form No. 7 COMPILATION OF DATA FROM A VEGETATION PLOT (50 m x 20 m)

Name of forest Village

Transect No. Plot No.

Distance from the beginning (m)

Altitude (m) GPS

Group

Date

Vegetation type

Lowland forest	<input type="checkbox"/>
Submontane forest	<input type="checkbox"/>
Montane forest	<input type="checkbox"/>
Woodland	<input type="checkbox"/>
Grassland	<input type="checkbox"/>

Signs of past use

Cultivation

Settlement

Vernacular name	Pole size trees Girth 16 - 47 cm		Timber size trees Girth 48 - 150 cm		Timber size trees Girth > 150 cm		Total
	Tally	Total	Tally	Total	Tally	Total	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
Total							

