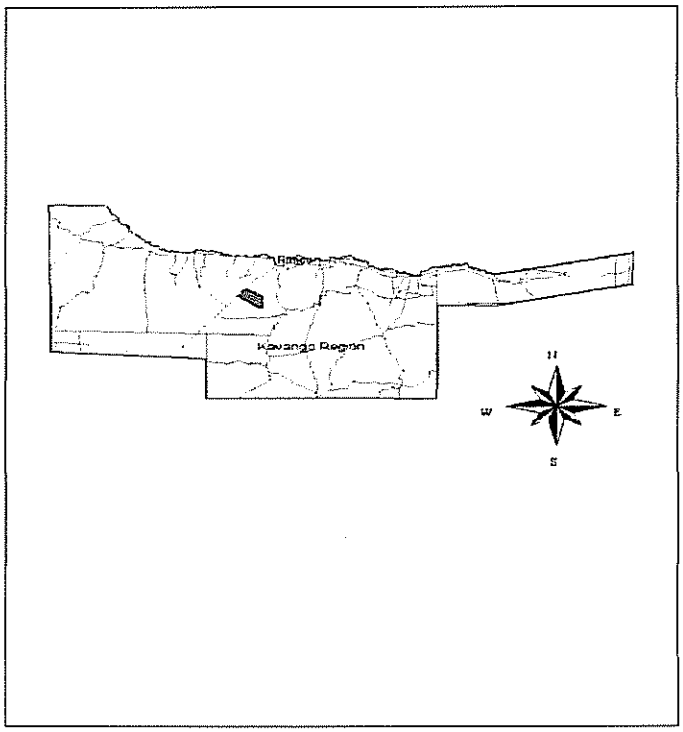
MINISTRY OF ENVIRONMENT AND TOURISM
Directorate of Forestry

Woody Resource Report of Ncamangoro Community Forest



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EXECUTIVE SUMMARY

General description of the area

Ncamangoro forest is situated in Kavango Region South of Rundu. The Ncamangoro community with the help from DED project requested the Directorate of Forestry to conduct a forest inventory to find out the amount of resources available in the area for management plan purposes.

The forest resources

The inventory concentrated on all tree species found in the area. The size of the Ncamangoro forest area inventoried is 21,872 hectares. There are 3,583,847 trees with a total volume of 699,667 m^3 of live trees in Ncamangoro forest. The mean tree volume is 32.0 m^3/ha and the mean number of trees for the whole area is 163.9 stems/ha. Dead trees were also analysed. There is a total volume of 52,700 m^3 of dead trees in Ncamangoro forest.

Majority of trees were found in the diameter class 5-25 cm. *Burkea Africana* is the most frequent tree with 49% of all stems found in the inventory.

Regeneration

There is an average of 1098 tree saplings per hectare in the area. Only *Burkea Africana* and *Ochna pulchra* are commonly found as saplings (356 and 292 per ha). *Terminalia sericea* and *Pterocarpus angolensis* saplings are found to some extent (22 per ha), while regeneration of *Guibourtia coleosperma* is very scare (19 per ha).

1. INTRODUCTION

The Directorate of Forestry (DoF) under the Ministry of Environment and Tourism in Namibia has a mission to carry out forest resource assessments in Namibia. In this task the Government of Finland has supported it since 1995. Initially the aim of the support was to build up the capacity of the Directorate to carry out regional forest inventories of large areas (National Forest Inventory component, NFI). During the years, an increasing number of local level inventories have also been carried out to fulfill specific requests by projects and forest managers. The support from the Government of Finland today through Namibia-Finland Forestry Programme Phase II aims now more at strengthening the capacity of DoF to serve the needs for local level forest management planning.

DED – DoF project community forestry in North-East Namibia (CFNEN), is directly working with the community of Ncamangoro. They deemed it necessary to find out the amount of resources available in the area in order to compile a sound management plan. With regard to community forestry, the DED is encouraging community to participate in the management of their forest and forest products. More income generating activities for sustainable development are thought of in the near future, as the community will be synthesized to the concept of community forestry.

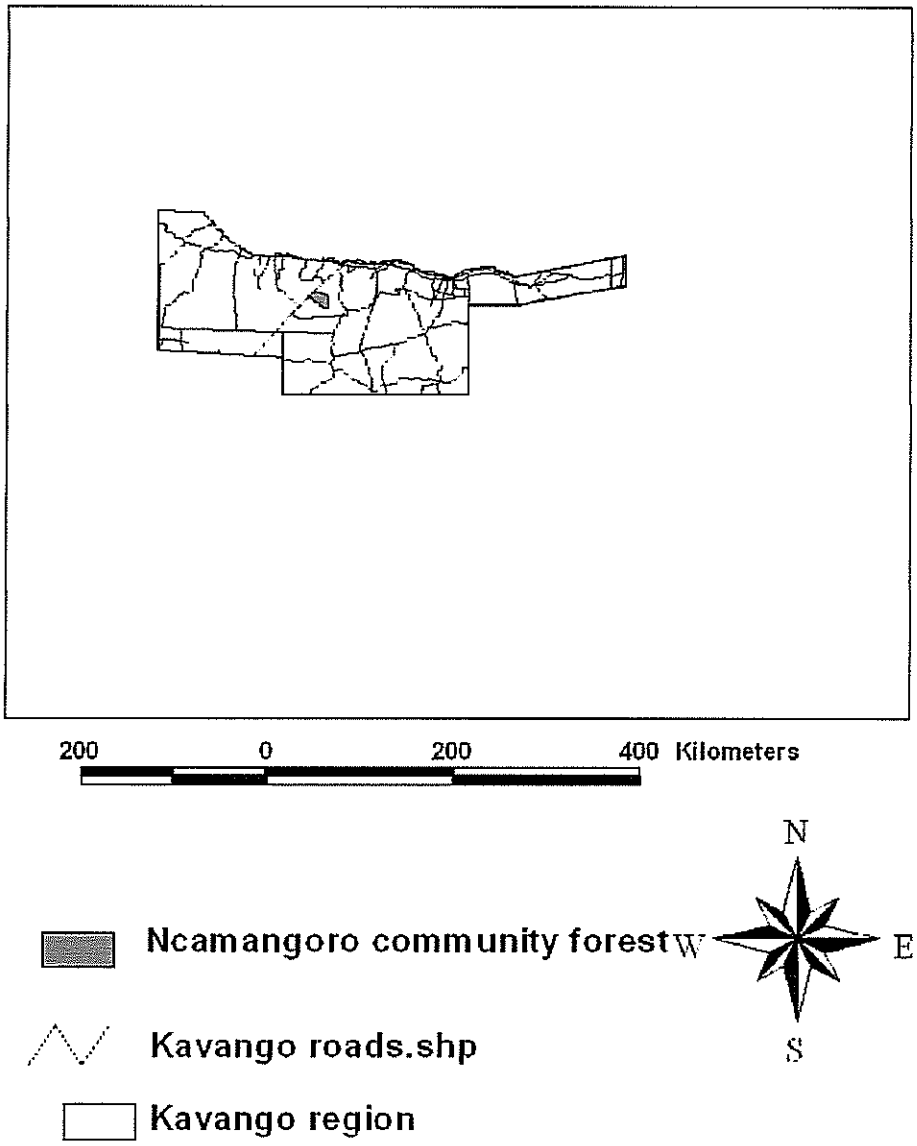
The inventory in Ncamangoro was carried out by the NFI team in August to September 2003. The inventory covered an area of 21,872 hectares.

For those readers who may be interested to know what other forest areas the Directorate of Forestry has inventoried, a list of inventory reports has been attached (Appendix 4 page 31) at the end of this report. These reports are available at the Directorate of Forestry in Windhoek.

2. DESCRIPTION OF THE AREA

The Ncamangoro Community Forest is located in the Kavango region. Common tree species found in the area are *Burkea africana*, *Pterocarpus angolensis, Dialium engleranum* and *Guibourtia coleosperma*. According to the Atlas of Namibia vegetation map, the area is classified as trees savanna vegetation and the soil is classified as sandy soils. The annual rainfall is between 500-550 mm (See Atlas of Namibia, 2002).

Map 1. Location of Ncamangoro community inventory area

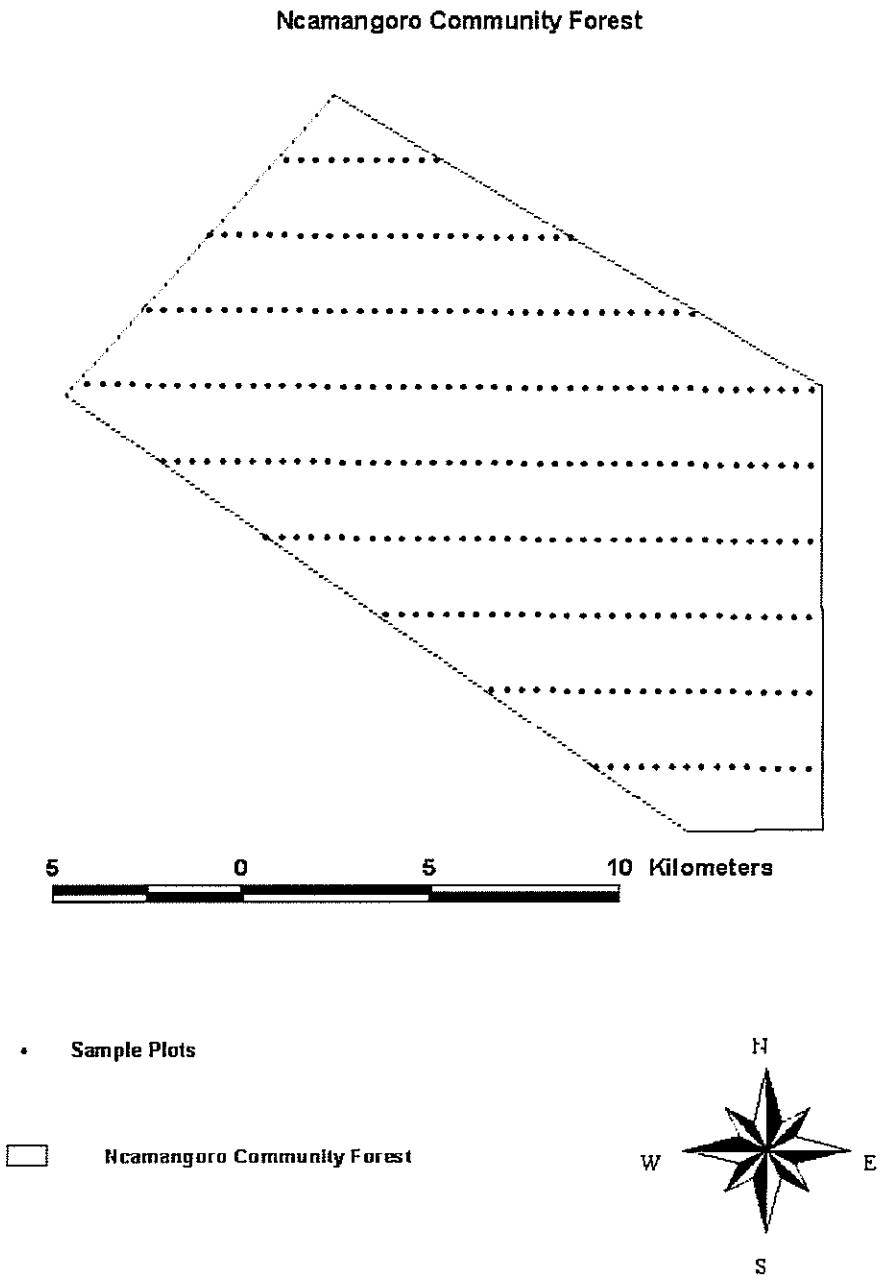


3. INVENTORY DESIGN

3.1 Sampling method

A systematic sampling design was applied. The total number of plots located in the area was 269. Each plot has its own coordinates (See Appendix 3 for the coordinates of inventoried plots). Coordinates and a GPS were used for locating the plots in the field. The plots were not marked as permanent plots. Map 2 shows the location of plots in the area.

Map 2. Location of sample plots



3.2 Field measurement

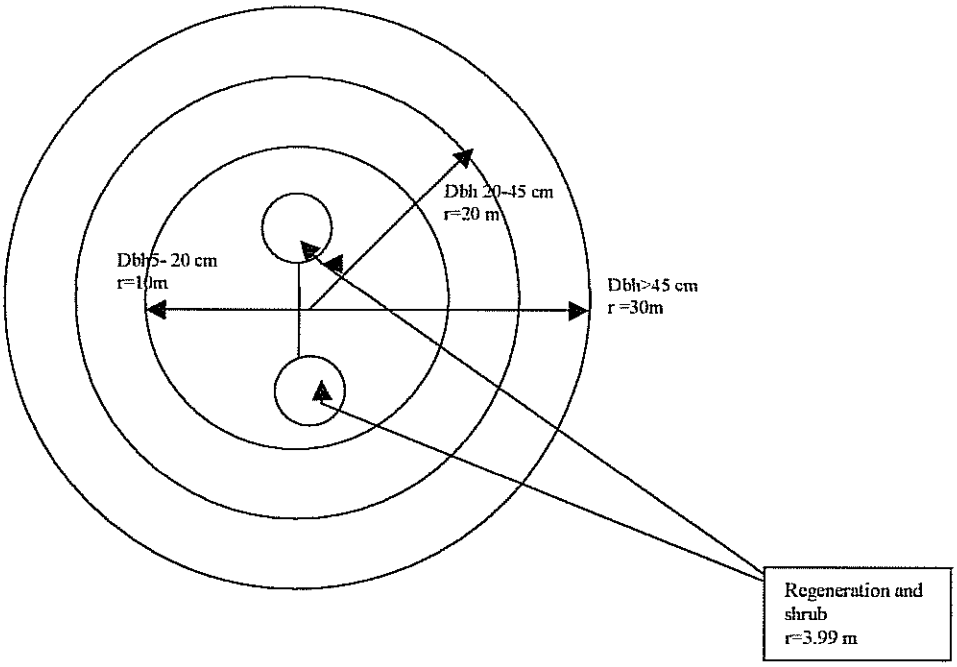
The data was collected in circular sample plots. The woody vegetation is classified into trees and shrubs. In this inventory, trees are defined as woody plants with dbh ≥ 5cm, and shrubs are woody plants with dbh <5cm.

A different radius of sample plot was applied for small trees, medium size trees and big trees. For small trees (5 cm≤dbh<20 cm) the radius is 10 m, for medium size trees (20≤dbh<45 cm) the radius is 20 m and for big trees dbh ≥ 45cm the radius is 30 m.

Diameter, location, species, crown class, quality, length and quality of possible saw log were measured for all trees in the sample plots. In addition, Height, canopy diameter and crown height were also recorded for each tree in the plot. Regeneration of all species was measured in two sub-plots (radius 3.99 m) located in each plot (see figure 1).

Information describing the environment surrounding the sample plot ("the stand") was also recorded. This description includes e.g the soil, the land types, damages to the woody vegetation and human influences. All the measurements are described in more detail in the field instructions (Manual for woody resource inventory, 2001).

Figure 1: Plot design



4. INVENTORY RESULTS

4.1 Measured data

A total of 269 sample plots were measured on an area of 21,872 hectares. A total of 2474 trees with dbh > 5cm were measured in the plots (see table 1) which is on average 9.2 trees per sample plot. Table 1 indicates that 52% of measured trees are *Burkea Africana*-trees.

Table 1. Number of measured trees by species

Species	Total No. of measured trees	% of measured trees
Baikiaea plurijuga	2	0.1
Burkea africana	1282	51.8
Combretum collinum	131	5.3
Combretum psidioides (psidioides)	18	0.7
Combretum zeyheri	25	1.0
Dialium engleranum	159	6.4
Diospyros mespiliformis	1	0.0
Diplorhynchus condylocarpon	11	0.4
Guibourtia coleosperma	262	10.6
Ochna pulchra	43	1.7
Pterocarpus angolensis	312	12.6
Schinziophyton rautanenii	30	1.2
Securidaca longepedunculata	2	0.1
Strychnos cocculoides	13	0.5
Strychnos pungens	23	0.9
Swartzia madagascariensis	6	0.2
Terminalia sericea	154	6.2
Total	2474	100.0

The three most frequent tree species in the data set were *Burkea africana* (51.8 %), *Pterocarpus angolensis* (12.6 %), *Guibourtia coleosperma* (10.6 %).

4.2 Height of measured trees

Table 2: Average and maximum height by species found

Species	Average height (m)	Maximum height (m)
Baikiaea plurijuga	7.15	14.3
Burkea africana	9.16	20.4
Combretum collinum	7.47	16.2
Combretum psidioides (psidioides)	4.32	11.6
Combretum zeyheri	7.26	12.8
Dialium engleranum	8.67	24.2
Diospyros mespiliformis	11.40	11.4
Diplorhynchus condylocarpon	5.98	10.3
Guibourtia coleosperma	5.06	21.8
Ochna pulchra	5.52	11.3
Pterocarpus angolensis	8.92	22.3
Schinziophyton rautanenii	5.39	16.9
Securidaca longepedunculata	5.80	6.9
Strychnos cocculoides	4.62	8.5
Strychnos pungens	5.58	10.4
Swartzia madagascariensis	5.78	8.6
Terminalia sericea	7.01	17.5

Table 2 above shows the average and maximum height of the trees. The height of the woody vegetation is generally low. Only *Dialium engleranum*, *Burkea Africana*, *Guibourtia coleosperma* and *Pterocarpus angolensis* trees could be found with heights from 20 meters above.

4.3 Species diversity

Simple measurement for species diversity is to express the number of species found in the area and the number of plots where each species was found. Table 3 shows the number of plots where each species was found for both trees (≥5 cm) and shrubs (<5 cm).

Table 3. Species diversity expressed by the number of plots where each species was fo

Species	No of plot Dbh < 5cm	No. of plot Dbh ≥ 5cm
Baissea wulfhorstii	47	
Baphia massaiensis	7	
Bauhinia petersiana	170	
Baikiaea plurijuga		1
Burkea africana	208	253
Combretum collinum	73	78
Combretum psidioides (psidioides)	18	13
Combretum zeyheri	59	21
Dialium engleranum	72	76
Diospyros mespiliformis		1
Diplorhynchus condylocarpon	37	10
Grewia flava	5	
Grewia retinervis	6	
Guibourtia coleosperma	30	88
Ochna cinnebarina	1	
Ochna pulchra	158	32
Ozoroa longipes	8	
Ozoroa paniculosa	16	
Pterocarpus angolensis	38	142
Rhus marlothii	1	
Salacia luebbertii	9	
Schinziophyton rautanenii	2	9
Securidaca longepedunculata	1	2
Strychnos cocculoides		9
Strychnos pungens	50	19
Swartzia madagascariensis	7	5
Terminalia sericea	82	93
Ximenia americana var americana	1	
Ximenia caffra var microphylla	4	

A total of 29 woody species were recorded in Ncamangoro Community Forest. 26 species are occurring as trees while 17 species are found in the shrub layer. 14 species occurred both as trees and in the shrub layer.

4.4 Tree volumes and number of stems

All the woody stems with a dbh > 5cm are regarded as trees. The number of stems and tree volumes by species for the whole Ncamangoro inventory area are shown in table 4 below.

Live trees

Species	Total number of stems	Stems per ha	Total tree volume, m^3	Mean volume m^3/ha
Baikiaea plurijuga	3,235	0.1	573	0.0
Burkea africana	1,764,532	80.7	361,627	16.5
Combretum collinum	250,690	11.5	28,651	1.3
Combretum psidioides (psidioides)	29,117	1.3	1,461	0.1
Combretum zeyheri	56,292	2.6	4,255	0.2
Dialium engleranum	194,398	8.9	42,644	1.9
Diospyros mespiliformis	647	0.0	145	0.0
Diplorhynchus condylocarpon	25,881	1.2	1,180	0.1
Guibourtia coleosperma	332,719	15.2	102,472	4.7
Ochna pulchra	92,526	4.2	8,362	0.4
Pterocarpus angolensis	453,067	20.7	93,880	4.3
Schinziophyton rautanenii	33,286	1.5	18,702	0.9
Securidaca longepedunculata	5,176	0.2	296	0.0
Strychnos cocculoides	33,646	1.5	2,473	0.1
Strychnos pungens	43,351	2.0	3,460	0.2
Swartzia madagascariensis	7,117	0.3	1,275	0.1
Terminalia sericea	258,166	11.8	28,211	1.3
Total	3,583,847	163.9	699,667	32.0

Table 4: Volumes and number of stems for live trees

The number of trees is 163.9 stems/ha and the mean volume is 32.0 m^3/ha as shown in table 4 above. The total number of stems is 3,583,847 and the total volume of the trees is 699,667 m^3. The biggest share of stems are of *Burkea africana, Pterocarpus angolensis* and *Guibourtia coleosperma.*

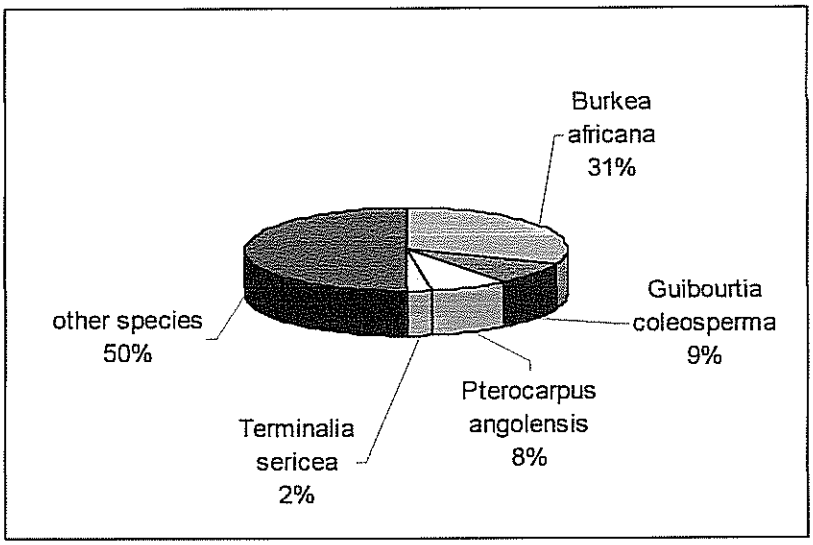


Figure 2: The volumes of the main live species expressed in % of the total volume of all species (699,667 m^3).

Dead trees

The majority of dead trees in Ncamangoro are *Burkea Africana, Guibourtia coleosperma* and *Dialium engleranum* trees. The total volume for *Burkea africana* is the highest (see table 5). The 4 most common species represent 88 % of the total volume.

Table 5: Volumes and number of stems for dead trees

Species	Total number of stems	Stems per ha	Total tree volume, m^3	Mean volume m^3/ha
Burkea africana	203,744	9.3	38,789	1.8
Combretum collinum	5,823	0.3	826	0.0
Combretum psidioides (psidioides)	10,353	0.5	246	0.0
Combretum zeyheri	2,588	0.1	165	0.0
Dialium engleranum	34,293	1.6	4,588	0.2
Diplorhynchus condylocarpon	2,588	0.1	157	0.0
Guibourtia coleosperma	28,398	1.3	5,969	0.3
Ochna pulchra	2,588	0.1	161	0.0
Pterocarpus angolensis	2,876	0.1	938	0.0
Strychnos pungens	647	0.0	170	0.0
Terminalia sericea	23,293	1.1	692	0.0
Total	317,190	14.5	52,700	2.4

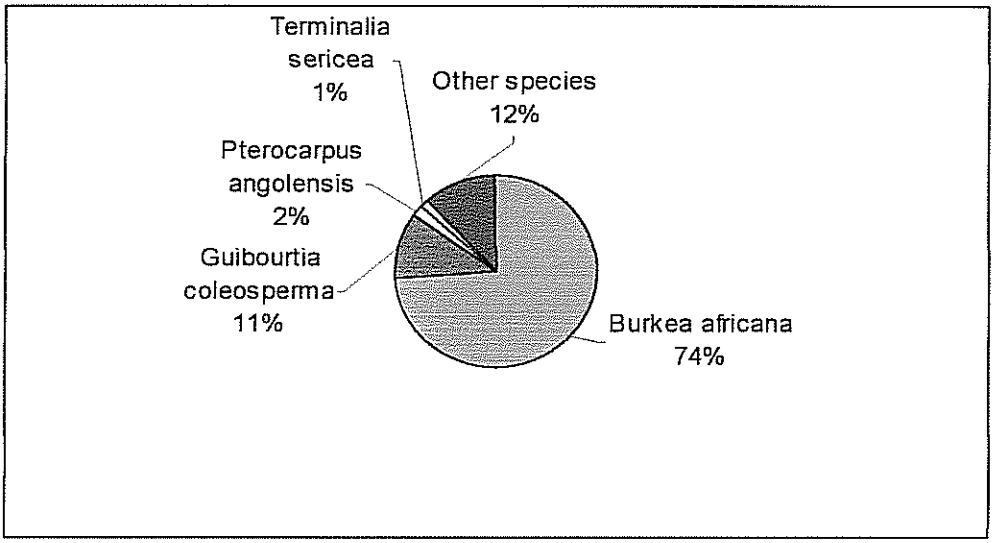


Figure 3: The volumes of the main dead species expressed in % of the total volume of all species (52,700 m^3).

4.5 Diameter distribution

Live trees

A desired diameter distribution from management point of view is one where the majority of the stems is in the lower diameter classes, and the number of stems is gradually decreasing as the diameter gets bigger. With this kind of distribution there are continuously going to be trees entering into mature stage and a continuous harvesting of timber and poles will be possible. If the actual diameter distribution deviates from the desired one, it is bound to affect short or long term management decisions.

Figure 4 below shows the diameter distribution of trees for different diameter classes in Ncamangoro inventory area. The full list of species with total number of trees in diameter classes is shown in Appendix 1 page 26).

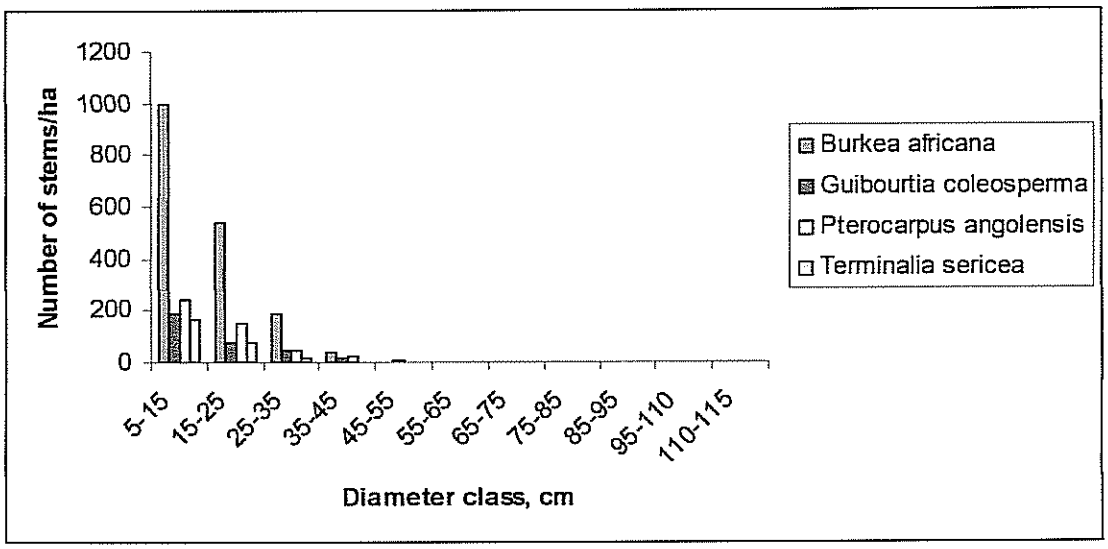


Figure 4. Live wood diameter distribution for the main species

Majority of the stems were found in small diameter classes. Appendix 1 also shows which species have a potential to grow into big trees. Species that were found in the biggest diameter classes were: *Burkea africana, Dialium engleranum, Guibourtia coleosperma, Pterocarpus angolensis and Schinziophyton rautanenii.*

Dead trees

Appendix 2 shows the number of dead trees in the Ncamangoro forest. Figure 5 below shows that the majority of the dead trees are in small diameter classes. Dead trees which was found in larger diameters is *Burkea Africana.*

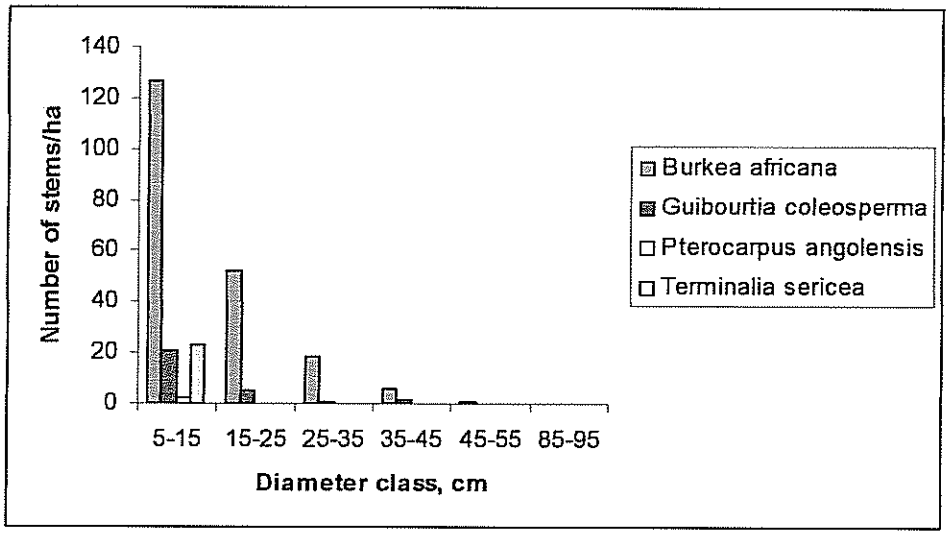


Figure 5: Dead wood diameter distribution for the main species

4.6 Regeneration and shrubs

Regeneration plays a critical role in the renewal and perpetuation of forest/woodland ecosystem. Good regeneration of trees means that there is continuously going to be a sufficient number of saplings growing into tree sizes, which in turns means later on trees entering into mature stage. Saplings are small specimen of species that are known to become trees, while shrubs are specimen that do not grow into trees.

Table 6 below shows the regeneration in terms of number of saplings per hectare by height classes and species. The table shows that there are about 1098 saplings per hectare in the area. About 32% of the saplings are *Burkea africana* – saplings. This indicates that *Burkea africana* trees are perhaps going to be even more dominating in the tree layer in the future than at present. Especially the regeneration of *Pterocarpus angolensis* is very poor (only 22 saplings/ha). The regeneration of *Pterocarpus angolensis* has to be improved in order to cut timber from this species.

Table 7 shows the number of seedlings for shrub species. There is an average of 765 shrubs per hectare in the shrub layer. *Baissea wulfhorstii* is dominating in the shrub layer with 434 shrubs per hectare, followed by *Bauhinia petersiana* with 307 shrubs per hectare.

Table 6: Number of tree seedlings per hectare by height classes

	Height class, in cm									
Species	0-25	26-50	51-100	101-150	151-200	201-250	251-300	300+	Total	% of total
Burkea africana	4	91	138	75	25	7	7	10	356	32
Combretum collinum	1	2	23	29	8	3	3	3	72	7
Combretum psidioides (psidioides)	0	0	6	2	1	0	0	0	9	1
Dialium engleranum	4	16	55	43	17	0	0	1	136	12
Combretum zeyheri	0	7	13	14	5	5	1	2	48	4
Diplorhynchus condylocarpon	0	0	7	7	9	2	1	0	26	2
Guibourtia coleosperma	0	1	9	5	2	0	2	0	19	2
Ochna pulchra	30	172	73	10	4	1	0	1	292	27
Ozoroa longipes	0	0	1	4	1	0	0	0	6	1
Ozoroa paniculosa	0	0	4	4	4	0	0	0	13	1
Pterocarpus angolensis	0	1	2	6	4	6	3	0	22	2
Schinziophyton rautanenii	0	0	0	0	0	0	0	0	1	0
Securidaca longepedunculata	0	0	0	0	0	0	0	0	0	0
Strychnos pungens	5	12	9	4	4	1	0	0	35	3
Terminalia sericea	0	13	15	18	7	4	1	4	63	6
Total	44	315	355	221	91	29	18	21	1098	100

Table 7: Number of shrubs per hectare by height classes

	Height class, in cm									
Species	0-25	26-50	51-100	101-150	151-200	201-250	251-300	300+	Total	% of total
Baissea wulfhorstii	149	281	3	0	0	0	0	0	434	57
Baphia massaiensis	0	0	0	2	3	4	0	0	10	1
Bauhinia petersiana	2	14	80	120	77	13	1	0	307	40
Grewia flava	0	3	1	1	0	0	0	0	7	1
Grewia retinervis	0	2	2	2	1	0	0	0	7	1
Total	151	300	86	125	81	17	1	0	765	100

4.7 Timber volumes and qualities

Timber volume or saw log volume means the volume of the part of the main trunk that has been regarded as sawable. In the field, the dbh and length of sawable trunk were recorded. Table 8 shows timber volumes and qualities of *Burkea africana*, *Guiboutia coleosperma* and *Pterocarpus angolensis*. It should be kept in mind that the table shows only log volumes for trees mature for harvesting, i.e. tree with a dbh more than 45 cm.

The quality classifications used in the inventory are as follows:

Good quality	There is at least 2m long straight stems without damages
Medium quality	The stem is slightly curving or sweeping or having other damages but still having at least 2 m saw-able log
Poor quality	It is possible to find only 1.2-2m long meeting the minimum timber quality requirement
Not saw able	The log is not saw-able and will probably never develop saw-able quality

The above classification was applied to all species. However, only the main species are discussed in this report. Table 8 below shows the timber quality of the main species with dbh > 45 cm. There is a considerable of 1717 stems of *Guibourtia coleosperma* and 1831 stems for *Pterocarpus angolensis* with good timber quality and 1379 stems for *Burkea africana*.

Table 8: Distribution of volume in timber quality classes (dbh ≥45 cm) for *Pterocarpus angolensis*, *Burkea Africana* and *Guibourtia coleosperma*

Pterocarpus angolensis

Quality	Stems per ha	Total number of stems	Total log volume, m^3	Average log volume, m^3/ha
Good timber quality	0.14	3163	1669	0.08
Medium timber quality	0.03	575	162	0.01
Not sawable	0.01	288	0	0.00
No code	0.01	288	0	0.00
total	0.20	4314	1831	0.08

Burkea africana

Quality	Stems per ha	Total number of stems	Total log volume, m^3	Average log volume, m^3/ha
Good timber quality	0.07	1438	1012	0.05
Medium timber quality	0.05	1150	367	0.02
Not sawable	0.09	2013	0	0.00
No code	0.03	575	0	0.00
Total	0.24	5176	1379	0.06

Guibourtia coleosperma

Quality	Stems per ha	Total number of stems	Total log volume, m^3	Average log volume, m^3/ha
Good timber quality	0.05	1150	1632	0.07
Medium timber quality	0.03	575	185	0.01
Not sawable	0.34	7477	0	0.00
No code	0.03	575	0	0.00
Total	0.45	9777	1817	0.08

4.8 Damages to the woody vegetation

Damage to the woody vegetation was recorded only at stand level. In the damage assessment the damages were classified into 5 different classes; (1) no damage, (2) mild), (3) moderate, (4) serious and (5) fatal damage.

Table 9: Damaging agent and the severity of damage at stand level, in ha

		Severity of damage				
Damage agent	No damage	Mild	Moderate	Serious	Total	% of total area
No damage	3,415				3,415	16
Forest fire		6,667	3,578	3,984	14,229	65
Mammals wild		650	407	976	2,033	9
Human		2,195			2,195	10
Total	3,415	9,513	3,984	4,960	21,872	100

The table shows that the area seems to be severely affected by fire. On 65% of the total area with woody vegetation the cause of damage is fire. No damages were observed on 3,415 hectares. The signs of cutting were few in the area. Damages related to human activities means cutting here. Only 10% of damage of the total area was caused by human activities (See table 9 above).

4.9 Sampling error and confidence limits

Sources of error

In sampling based forest inventories, the following error sources area always present: sampling error, measurement error including coding error, errors in data processing and errors in models used for e.g. volume estimation.

Training

The Ncamangoro forest was inventoried by experienced NFI field staff and the field measurement errors can be expected to be very few. Field instructions were reviewed both in the office and in the field. In this work, specific attention was paid to guarantee good quality field data. Data processing programs have been carefully designed and double checked. Several cross checkings were done to find out possible errors and inconsistencies in the data. The data processing and analysis, as well as reports were double checked.

Sampling error and confidence limits for tree volume

The estimates for the standard errors of mean volumes were calculated using the formula applicable for random sampling. The sampling in Ncamangoro was done with systematic sampling. Generally, the formula for random sampling gives an overestimate of the sampling error for systematic sampling. Therefore, it is safe to use these estimates.

The sampling error percentage for the estimate of average tree volume per hectare of all species was 3%. The true average tree volume for all species lies between 29.9 m^3/ha and 35.6 m^3/ha with a probability of 95%.

5. INVENTORY COSTS

All inventories require financial inputs which are either direct or indirect costs. The design of the inventory determines the financial implications that will be incurred during the inventory activities on the ground. The inventory in Ncamangoro was carried out from August to September 2003. Altogether 1 field trip of 20 days in the field (700 km one way) were made using 3 cars. In the field, 4 ATVs were used for moving from one plot to another. The total cost of the inventory is about N$ 20,300 which is N$ 1.1 per hectare.

Table 10. Inventory costs

Cost item	Units	Cost/unit, N$	Total cost, N$
Inventory preparation	1 week		
Inventory equipment			2,500
Inventory field work	7 people	N$70 per person, per day	9,800
Fuel		3.89	7,000
Data entry	2 weeks		
Data analysis	4 weeks		
Report writing	3 weeks		
Report printing			1,000
Total			20,300

The inventory cost per hectare in Ncamangoro Community forest is N$ 1.1. In Sikanjabuka, the cost per hectare was N$ 17.40, which is the highest cost analyzed so far (Kamwi and Laamanen, 2002).

6. CONCLUSION

This inventory provides quantitative estimates of the present state of the forest in Ncamangoro Community Forest and indicates that the resources are still remarkable in terms of volume and stems per hectare.

The majority of people depend on the forest resources for fuel wood, fruits, grass for thatching and poles for homestead construction. Other plants are also used for nutrition and medicinal purposes. Domestic animals and game also depend on the forest resources for fodder and shelter. Hence, there is need to manage and maintain the forest bio-diversity of the area. The most common tree species found in Ncamangoro Community were *Burkea africana, Pterocarpus angolensis, Guibourtia coleosperma and Schinziophyton rautanenii.*

The most common damage to the woody vegetation is fire. The stand level classification indicates that, on 65% of the area there are visible signs of damages to trees caused by fires. Although the woody vegetation on a big part of the area shows signs of fire damage, surprisingly few trees are damaged, and the damage is usually mild.

7. REFERENCES

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Lastly, thanks to DED community advisor for giving us the work

Appendix 1: Diameter distribution of the total number of stems for live trees (1000s)

Species	5-15	15-25	25-35	35-45	45-55	55-65	65-75	75-85	85-95	95-110	110-115	total	% of total
Baikiaea plurijuga	3		1									3	0.1
Burkea africana	994	541	190	35	3	1						1765	49.2
Combretum collinum	181	56	12	1	0							251	7.0
Combretum psidioides (psidioides)	28		1									29	0.8
Combretum zeyheri	44	11	1									56	1.6
Dialium engleranum	88	74	17	10	4	1		1				194	5.4
Diospyros mespiliformis		1										1	0.0
Diplorhynchus condylocarpon	26											26	0.7
Guibourtia coleosperma	184	78	44	17	4	1	1	2	1	0	0	333	9.3
Ochna pulchra	67	24	1									93	2.6
Pterocarpus angolensis	241	147	42	19	4	0						453	12.6
Schinziophyton rautanenii	16	10	3	2	0	1	1	1	0			33	0.9
Securidaca longepedunculata	5											5	0.1
Strychnos cocculoides	23	10										34	0.9
Strychnos pungens	31	12										43	1.2
Swartzia madagascariensis		6	1									7	0.2
Terminalia sericea	163	78	17	1								258	7.2
Total	2094	1048	330	85	16	5	1	3	1	0	0	3584	100.0

Appendix 2: Diameter distribution of the total number of stems for dead trees (1000s)

Species	5-15	15-25	25-35	35-45	45-55	85-95	Total	% of total
Burkea africana	127	52	19	6	1		204	64.2
Combretum collinum	3	3	1				6	1.8
Combretum psidioides (psidioides)	10						10	3.3
Combretum zeyheri	3						3	0.8
Dialium engleranum	23	5	5	1			34	10.8
Diplorhynchus condylocarpon	3						3	0.8
Guibourtia coleosperma	21	5	1	1	0	0	28	9.0
Ochna pulchra	3						3	0.8
Pterocarpus angolensis	3				0		3	0.9
Strychnos pungens		1					1	0.2
Terminalia sericea	23						23	7.3
total	217	65	25	8	1	0	317	100.0

Appendix 3: Cluster coordinates for Ncamangoro community forest

Clusters	longitude	Latitude			
1	19.45448	-18.23075	47	19.50773	-18.19503
2	19.45826	-18.23078	48	19.50789	-18.17696
3	19.46204	-18.23081	49	19.5109	-18.26734
4	19.46582	-18.23084	50	19.51106	-18.24927
5	19.46961	-18.23087	51	19.51121	-18.2312
6	19.46976	-18.2128	52	19.51136	-18.21313
7	19.47323	-18.24897	53	19.51152	-18.19506
8	19.47339	-18.2309	54	19.51167	-18.17699
9	19.47355	-18.21283	55	19.51468	-18.26737
10	19.47701	-18.249	56	19.51484	-18.2493
11	19.47717	-18.23093	57	19.51499	-18.23123
12	19.47733	-18.21286	58	19.51514	-18.21316
13	19.48079	-18.24903	59	19.5153	-18.19509
14	19.48095	-18.23096	60	19.51545	-18.17702
15	19.48111	-18.21289	61	19.51847	-18.2674
16	19.48458	-18.24906	62	19.51862	-18.24933
17	19.48473	-18.23099	63	19.51877	-18.23126
18	19.48489	-18.21292	64	19.51893	-18.21319
19	19.48505	-18.19485	65	19.51908	-18.19512
20	19.48836	-18.24909	66	19.51923	-18.17705
21	19.48852	-18.23102	67	19.52225	-18.26743
22	19.48867	-18.21295	68	19.5224	-18.24936
23	19.48883	-18.19488	69	19.52256	-18.23129
24	19.49214	-18.24912	70	19.52271	-18.21322
25	19.4923	-18.23105	71	19.52286	-18.19515
26	19.49245	-18.21298	72	19.52301	-18.17708
27	19.49261	-18.19491	73	19.52603	-18.26746
28	19.49592	-18.24915	74	19.52619	-18.24939
29	19.49608	-18.23108	75	19.52634	-18.23132
30	19.49624	-18.21301	76	19.52649	-18.21325
31	19.49639	-18.19494	77	19.52664	-18.19518
32	19.49955	-18.26725	78	19.52679	-18.17711
33	19.49971	-18.24918	79	19.52966	-18.28556
34	19.49986	-18.23111	80	19.52982	-18.26749
35	19.50002	-18.21304	81	19.52997	-18.24942
36	19.50017	-18.19497	82	19.53012	-18.23135
37	19.50334	-18.26728	83	19.53027	-18.21328
38	19.50349	-18.24921	84	19.53042	-18.19521
39	19.50364	-18.23114	85	19.53057	-18.17713
40	19.5038	-18.21307	86	19.53345	-18.28559
41	19.50395	-18.195	87	19.5336	-18.26752
42	19.50411	-18.17693	88	19.53375	-18.24945
43	19.50712	-18.26731	89	19.5339	-18.23138
44	19.50727	-18.24924	90	19.53405	-18.21331
45	19.50743	-18.23117	91	19.5342	-18.19523
46	19.50758	-18.2131	92	19.53436	-18.17716

93	19.53723	-18.28562	138	19.56067	-18.19543
94	19.53738	-18.26755	139	19.56357	-18.30389
92	19.53436	-18.17716	140	19.56371	-18.28582
93	19.53723	-18.28562	141	19.56386	-18.26775
94	19.53738	-18.26755	142	19.56401	-18.24968
95	19.53753	-18.24948	143	19.56416	-18.23161
96	19.53768	-18.23141	144	19.56431	-18.21353
97	19.53784	-18.21333	145	19.56446	-18.19546
98	19.53799	-18.19526	146	19.56735	-18.30392
99	19.53814	-18.17719	147	19.5675	-18.28585
100	19.54101	-18.28565	148	19.56765	-18.26778
101	19.54116	-18.26758	149	19.56779	-18.2497
102	19.54132	-18.2495	150	19.56794	-18.23163
103	19.54147	-18.23143	151	19.56809	-18.21356
104	19.54162	-18.21336	152	19.56824	-18.19549
105	19.54177	-18.19529	153	19.57113	-18.30395
106	19.54192	-18.17722	154	19.57128	-18.28588
107	19.5448	-18.28568	155	19.57143	-18.2678
108	19.54495	-18.2676	156	19.57158	-18.24973
109	19.5451	-18.24953	157	19.57172	-18.23166
110	19.54525	-18.23146	158	19.57187	-18.21359
111	19.5454	-18.21339	159	19.57202	-18.19552
112	19.54555	-18.19532	160	19.57492	-18.30397
113	19.54858	-18.2857	161	19.57506	-18.2859
114	19.54873	-18.26763	162	19.57521	-18.26783
115	19.54888	-18.24956	163	19.57536	-18.24976
116	19.54903	-18.23149	164	19.57551	-18.23169
117	19.54918	-18.21342	165	19.57565	-18.21362
118	19.54933	-18.19535	166	19.5758	-18.19555
119	19.55236	-18.28573	167	19.5787	-18.304
120	19.55251	-18.26766	168	19.57885	-18.28593
121	19.55266	-18.24959	169	19.579	-18.26786
122	19.55281	-18.23152	170	19.57914	-18.24979
123	19.55296	-18.21345	171	19.57929	-18.23172
124	19.55311	-18.19538	172	19.57944	-18.21365
125	19.556	-18.30383	173	19.58234	-18.3221
126	19.55615	-18.28576	174	19.58248	-18.30403
127	19.5563	-18.26769	175	19.58263	-18.28596
128	19.55645	-18.24962	176	19.58278	-18.26789
129	19.5566	-18.23155	177	19.58292	-18.24982
130	19.55674	-18.21348	178	19.58307	-18.23175
131	19.55689	-18.19541	179	19.58322	-18.21367
132	19.55978	-18.30386	180	19.58612	-18.32213
133	19.55993	-18.28579	181	19.58627	-18.30406
134	19.56008	-18.26772	182	19.58641	-18.28599
135	19.56023	-18.24965	183	19.58656	-18.26792
136	19.56038	-18.23158	184	19.58671	-18.24985
137	19.56053	-18.21351	185	19.58685	-18.23177

186	19.587	-18.2137	234	19.6164	-18.32235
187	19.58991	-18.32216	235	19.61654	-18.30428
188	19.59005	-18.30409	236	19.61668	-18.28621
189	19.5902	-18.28602	237	19.61683	-18.26814
190	19.59034	-18.26794	238	19.61697	-18.25007
191	19.59049	-18.24987	239	19.61711	-18.23199
192	19.59064	-18.2318	240	19.62018	-18.32238
193	19.59078	-18.21373	241	19.62032	-18.30431
194	19.59369	-18.32219	242	19.62047	-18.28624
195	19.59384	-18.30412	243	19.62061	-18.26817
196	19.59398	-18.28604	244	19.62075	-18.25009
197	19.59413	-18.26797	245	19.62089	-18.23202
198	19.59427	-18.2499	246	19.62396	-18.32241
199	19.59442	-18.23183	247	19.62411	-18.30434
200	19.59456	-18.21376	248	19.62425	-18.28626
201	19.59747	-18.32221	249	19.62439	-18.26819
202	19.59762	-18.30414	250	19.62453	-18.25012
203	19.59777	-18.28607	251	19.62468	-18.23205
204	19.59791	-18.268	252	19.62775	-18.32243
205	19.59806	-18.24993	253	19.62789	-18.30436
206	19.5982	-18.23186	254	19.62803	-18.28629
207	19.59835	-18.21379	255	19.62818	-18.26822
208	19.60126	-18.32224	256	19.62832	-18.25015
209	19.6014	-18.30417	257	19.62846	-18.23208
210	19.60155	-18.2861	258	19.63153	-18.32246
211	19.60169	-18.26803	259	19.63168	-18.30439
212	19.60184	-18.24996	260	19.63182	-18.28632
213	19.60198	-18.23189	261	19.63196	-18.26825
214	19.60213	-18.21381	262	19.6321	-18.25018
215	19.60504	-18.32227	263	19.63224	-18.2321
216	19.60519	-18.3042	264	19.63532	-18.32249
217	19.60533	-18.28613	265	19.63546	-18.30442
218	19.60548	-18.26806	266	19.6356	-18.28635
219	19.60562	-18.24998	267	19.63574	-18.26827
220	19.60577	-18.23191	268	19.63588	-18.2502
221	19.60591	-18.21384	269	19.63602	-18.23213
222	19.60883	-18.3223			
223	19.60897	-18.30423			
224	19.60912	-18.28615			
225	19.60926	-18.26808			
226	19.6094	-18.25001			
227	19.60955	-18.23194			
228	19.61261	-18.32232			
229	19.61276	-18.30425			
230	19.6129	-18.28618			
231	19.61304	-18.26811			
232	19.61319	-18.25004			
233	19.61333	-18.23197			

Appendix 4: List of Inventory reports by the Directorate of Forestry

Below is the list of resource reports produced by the Directorate of Forestry and the Namibia-Finland Forestry Programme. The reports are all available at the Directorate of Forestry.

Reports available are:

- Woody Resources of Western Tsumkwe (1997)
- Woody Resources of East and South Tsumkwe, Otjinene and Okakarara Districts (1997)
- Forest Inventory Report of Caprivi Region (1998)
- Forest Inventory Report on Nkurenkuru Concession Area (1998)
- Forest Inventory Report on Ongandjera Community Forest (1998)
- Forest Inventory Report on Uukwaludhi Community Forest (1999)
- Forest Inventory Report on Caprivi State Forestry (1999)
- Inventory of the Directorate of Forestry Eucalyptus Plantations in Kavango Region (1999)
- Inventory Report on the Woody Resources in the Omusati Region (2000)
- Inventory Report on the Woody Resources in the Oshana Region (2000)
- Inventory Report on the Woody Resources in the Okongo Community Forest (2000)
- Wood Resources Report of M'kata Pilot Forest Area (2001)
- Forest Inventory Report on Onankali Eucalyptus Plantation (2001)
- Woody Resources Report of Bukalo Pilot Forest Area (2001)
- Woody Resource Report of Oshikoto Region (2002)
- Forest Inventory report of Rehoboth Acacia Park (2002)
- Forest Inventory report of Otjituuo Concession Forest (2002)
- Forest Inventory report of Uukolonkadhi Community Forest (2002)
- Forest Inventory report of Ncaute Community Forest (2003)
- Forest Inventory report of Kwando Conservancy Forest (2003)
- Forest Inventory report of Sikanjambuka Community Forest (2002)
- Forest Inventory report of Hans kanyinga Community Forest (2002)
- Forest Inventory report of Ohepi, Okolola and Oshaampula community forest (2002)
- Forest Inventory report of Mashare Concession Forest (2002)