

Nyae FOREST INVENTORY OF NYAENYAE

NTAK NTAK NORTH + SOUTH

1. INTRODUCTION

The Namibia Forestry Strategic Plan (NFSP) was prepared by the Directorate of Forestry (DoF), under the Ministry of Environment and Tourism in 1996 as the principal document for the organization and development efforts in the forestry sector. Namibia-Finland Forestry Program (NFFP) was subsequently prepared by the Ministry as the main entry and action plan in launching of the NFSP. Government of Namibia and Government of Finland committed themselves to contribute significant amount of monies to the implementation of NFFP, which aims at strengthening the capacity of DoF to serve the needs for forest management planning. National Forest Inventory (NFI) is the sub-component of the Public Sector Forestry Capacity Building Program, which is one of the priority programs under NFFP. National Forest Inventory component is responsible for conducting forest resource inventories on the regional and local levels.

Local level inventory was conducted in NyaeNyae South and North, on the request by the community and the stakeholders in Tsumkwe district in 199??? to provide information on the quantity and quality of the woody resources in the area. The information provided by the inventory is to be used in the forestry planning and decision making by the stakeholders.

2. GENENERAL DESCRIPTION OF THE AREAS

NyaeNyae South and North belongs to the Forest Savanna and Woodland and Camelthorn Savanna vegetation zones in the classification of Gies (National Atlas of South West Africa). Soil is always sandy. The following landforms are present: dunes, dune valleys, dry riverbeds and sandy substrates. Annual rainfall is 300 – 400 mm. Elevation is 1100 – 1300 m over sea level.

Map 1. Location of NyaeNyae South and North inventory areas

3. INVENTORY DESIGN

3.1.a Method description

The woody resources were estimated using systematic plot sampling. Total of 101 (NyaeNyae South) and 146 (NyaeNyae North) sample plots were distributed systematically over the areas and measured. Total number of plots, are determined by the size and the vegetation of a particular area.

Map2. Location of sample plots for NyaeNyae South and North

All trees, at least 5 cm breast height (DBH) inside the circular plots were measured. The plot consisted of three circles, on which the total size of the plot depended so that the radius of the plot is 30 m for trees with DBH more than 45 cm; 20 m for trees with $20 \leq \text{DBH} < 45$ cm; and 10 m for trees with $5 \leq \text{DBH} < 20$ cm. Diameter, location, species, crown class, quality, length and possible saw log were measured. Height, canopy diameter, crown height, damages and phenology were recorded for each tree in the plot.

Additionally, shrubs and regeneration were measured using two 3.99 m radius circular plots. Woody plants with diameter at breast height less than 5 cm were recorded on the shrub and

regeneration field form and bigger woody plants on the sample tree field forms. Several variable describing the site, soil and tree cover were observed for each plot. All measurements are described in more detail in the field instructions (Field Instructions for National Forest Inventory 2001).

Figure 1. Plot design

SECTION A

4.a INVENTORY RESULTS FOR NYAENYAE SOUTH

4.1.a Measured data

A total of 101 sample plots were measured in the inventory on an area of 1397.63 hectares.

A total of 346 trees with diameter at least 5 cm were measured on the plots. The number of measured trees by species is shown in Table 1.a

Species	Total No. of measured trees	% of measured trees
Acacia ataxacantha	1	0.3
Acacia erioloba	19	5.5
Acacia fleckii	9	2.6
Boscia albitrunca	1	0.3
Burkea Africana	53	15.3
Combretum collinum	87	25.1
Combretum psidioides (psidioides)	7	2.0
Combretum zeyheri	3	0.9
Lonchocarpus nelsii	20	5.8
Ochna pulchra	11	3.2
Pterocarpus angolensis	9	2.6
Schinziophyton rautanenii	3	0.9
Terminalia sericea	123	35.6
Total	346	100

Table 1.a. Number of measured trees by species (NyaeNyae South)

Terminalia sericea (35.5 %), *Burkea Africana* (15.3%) and *Combretum collinum* (25.1 %) are the most common tree species found in the NyaeNyae South as shown in Table 1.a above. More than 75% of the measured trees consist from this three species alone.

4.2.a Average and maximum height by species

Table 2.a below shows the average and maximum height by species in the area. The height of the tree layer is one criteria for Edward's vegetation type classification.

Species	Average height, (m)	Maximum height, (m)
Acacia ataxacantha	10.10	10.1
Acacia erioloba	5.53	10.6
Acacia fleckii	6.10	8.4
Boscia albitrunca	9.70	9.7
Burkea Africana	7.75	15.4
Combretum collinum	5.40	12.5
Combretum psidioides (psidioides)	4.7	6.1
Combretum zeyheri	6.0	6
Lonchocarpus nelsii	5.6	8.2
Ochna pulchra	4.3	8
Pterocarpus angolensis	10.7	16.6
Schinziophyton rautanenii	12.9	12.9
Terminalia sericea	4.3	7.1

Table 2.a. Average and maximum height by species in the area (NyaeNyae South)

Four species, namely *Combretum collinum*, *Pterocarpus angolensi*, *Burkea africana* and *Schinziophyton rautanenii* have an average height of more than 10.0 m. The highest tree in the NyaeNyae South is *Pterocarpus angolensis* with 16.6 m as shown in Table 3.

4.3.a Species diversity

There are different measures of species diversity that can be applied in an inventory data such as Simpson's dominance and Shannon's species diversity index. Simpler measure applied in NyaeNyae South/North inventory data is that the number of plots where each species was found for both trees (DBH \geq 5 cm) and shrubs (DBH < 5 cm).

Species	No. of plots dbh < 5 cm	No. of plots dbh > 5 cm
Acacia ataxacantha	22	1
Acacia erioloba	9	8
Acacia fleckii	11	1
Baissea wulfhorstii	5	
Baphia massaiensis	6	
Bauhia petersiana	53	
Boscia albitrunca	6	
Burkea Africana	32	18
Combretum collinum	49	32
Combretum engleri	3	
Combretum psidioides (psidioides)	27	3

Combretum zeyheri	3	1
Commiphora angolensis	42	
Croton gratissimus	3	
Dialium engleranum	1	
Dichrostachys cinerea (Setulosa)	25	
Diospyros mespiliformis	15	
Grewia bicolor	16	
Grewia flava	3	
Grewia retinervis	41	
Lonchocarpus nelsii	34	9
Mundulea sericea	4	
Ochna pulchra	39	7
Ozoroa insignis	1	
Ozoroa paniculosa	1	
Ozoroa schinzii	3	
Pterocarpus angolensis	11	7
Rhigoszum brevispinosum	5	
Strychnos pungens	3	
Terminalia sericea	74	
Ximenia americana var americana	2	32
Total	549	119

Table 3.a. Species diversity shown in relation to the number of plots were each species was found (NyaeNyae South).

A total of 31 different woody species were recorded in NyaeNyae South (Table 4.a). 31 shrub species and 11 tree species are found in the area. Hence, the species diversity in the shrub layer is bigger than in the tree layer. 11 species occurred both as trees and shrub layer. *Terminalia sericea* shrub species were found on 74 of the measured plots, while *Combretum collinum* shrubs are found in 32 of measured plots.

4.4.a Tree volumes and number of stems

85% of total trees (live and dead) measured in the whole area are live trees and 15% are dead trees.

Live trees

There are total of 1111,6 stems, which is 79 stems/ha. Average volume for all live tree species is 6.2 m³ per ha as shown in Table 4.a below.

Species	Total no. of stems	Stems per ha	Total tree volume, m ³	Average volume m ³ /ha
Acacia ataxacantha	4.5	0.0	5.4	0.0
Acacia erioloba	64.5	5.0	38.6	0.3
Acacia fleckii	40.0	3.0	19.5	0.1
Boscia albitrunca	1.1	0.0	2.7	0.0
Burkea Africana	98.4	7.0	157.1	1.1

Combretum collinum	276.3	20.0	213.2	1.5
Combretum psidioides (psidioides)	31.1	2.0	5.9	0.0
Combretum zeyheri	3.3		6.3	0.0
Lonchocarpus nelsii	82.3	6.0	67.0	0.5
Ochna pulchra	44.5	3.0	29.7	0.2
Pterocarpus angolensis	14.2	1.0	86.5	0.6
Schinziophyton rautanenii	1.5	0.0	49.5	0.4
Terminalia sericea	449.8	32.0	191.7	1.4
Total	1111.6	79.0	873.1	6.2

Table 4.a. Number of stems and volumes for live tree species (NyaeNyae South).

The most common species is *Terminalia sericea* with an average of 32 (40.5%) trees per ha followed by *Combretum collinum* with an average of 20 (25.3%) trees per ha. *Combretum collinum* has the highest average tree volume of 1.51 m³ (24.4%) per ha followed by *Terminalia sericea* with the average tree volume of 1.36 m³ (18.7%) per ha. Because of its big size trees, *Combretum collinum* has higher volume per ha compared to the *Terminalia sericea*, which has more trees per ha as shown in Table 4. a.

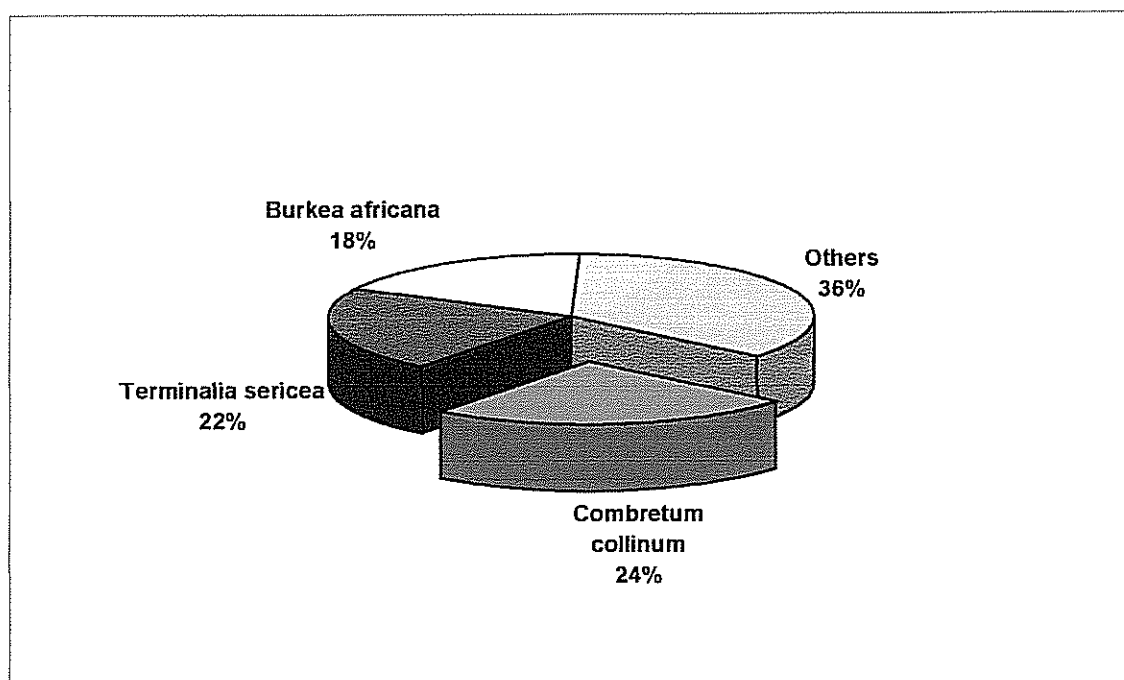


Figure 2.a. Volumes of the common live species expressed in % of the total volume of all species (NyaeNyae South)

The total volume for all live trees is 873.1 m³. *Combretum collinum* with 213.2 m³ (24%) has the highest volume as individual tree species followed by *Terminalia sericea* with 191.7 m³ (22%), which is expressed as % of total volume found in the area shown in Figure 2. a.

Dead trees

Table 5.a shows the dead tree species found in the area. There are a total number of 192.4 dead trees, which give 13.6 stems per ha. Average volume for all dead tree species is 0.9 m³ per ha.

Species	Total no. of stems	Stems per ha	Total tree volume, m ³	Average volume m ³ /ha
Acacia erioloba	2.2	0.2	12.9	0.1
Burkea Africana	55.6	3.9	47.3	0.3
Combretum collinum	36.7	2.6	33.9	0.2
Ochna pulchra	4.5	0.3	1.7	0.0
Terminalia sericea	93.4	6.6	37.0	0.3
Total	192.4	13.6	132.7	0.9

Table 5.a. Number of stems and volumes for dead trees (NyaeNyae South)

Majority of the dead trees in NyaeNyae South are from *Terminalia sericea* species with 6.62 (48.5%) stems per ha followed by *Burkea africana* with 3.94 (28.9%) stems per ha. See Table 5.a above.

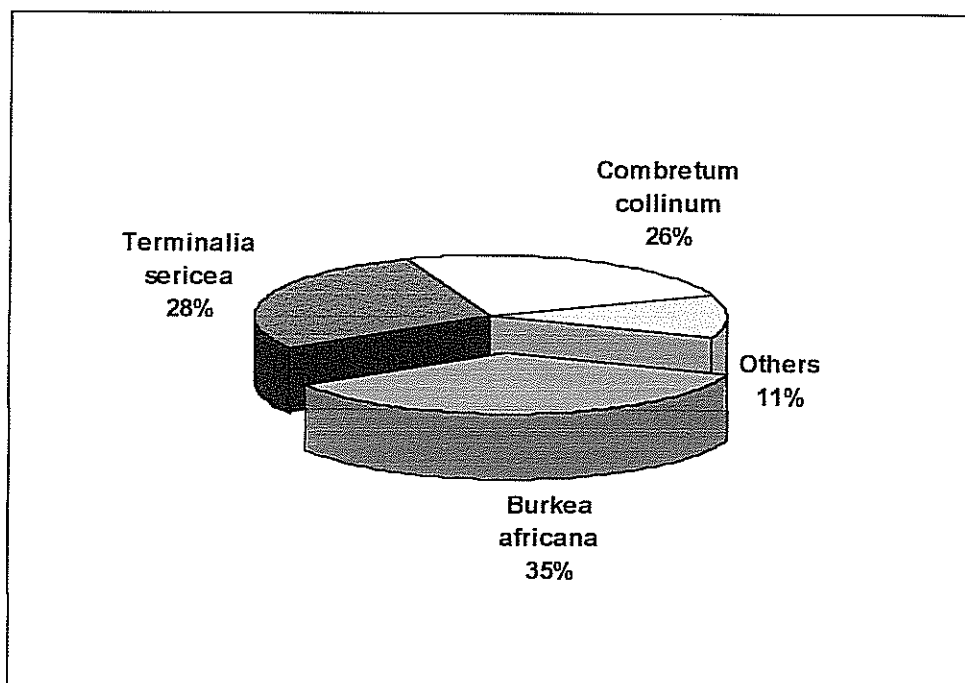


Figure 3.a. The volumes of the most common dead species expressed in % of the total volume of all species (NyaeNyae South).

Total tree volume of dead trees in the area is 132.7 m³. *Burkea Africana* with 47.3 m³ (35%) has the highest volume followed by *Terminalia sericea* with 36.99 m³ (28%), which is expressed as % of total volume from dead trees in the area as shown in Figure 3.a.

4.5.a Diameter distribution

Diameter distribution for the five common live trees (Figure 4) and dead trees (Figure 5) are shown below. See also Appendix 1 (live trees) and Appendix 2 (dead trees).

Live trees

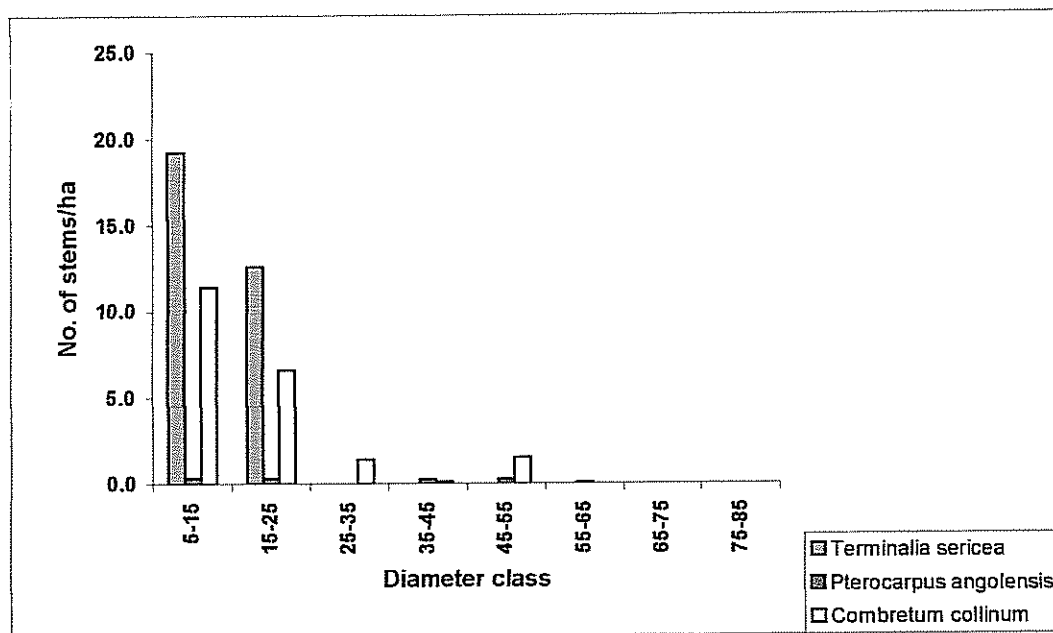


Figure 4.a. Diameter distribution of the three common live tree species found in the area (NyaeNyae South).

Diameter distribution of live stems per ha for three common species are shown in the Figure 4. Bulk of the species, which occurred between the diameter classes of 5 and 25 cm are from *Terminalia sericea* followed by *Combretum collinums*. Biggest trees found in the diameter classes of ≥ 35 cm are from *Combretum collinum* and *Pterocarpus angolensis* tree species.

Dead trees

Only five species were found dead in the area as shown in Appendix 2 and figure 5.

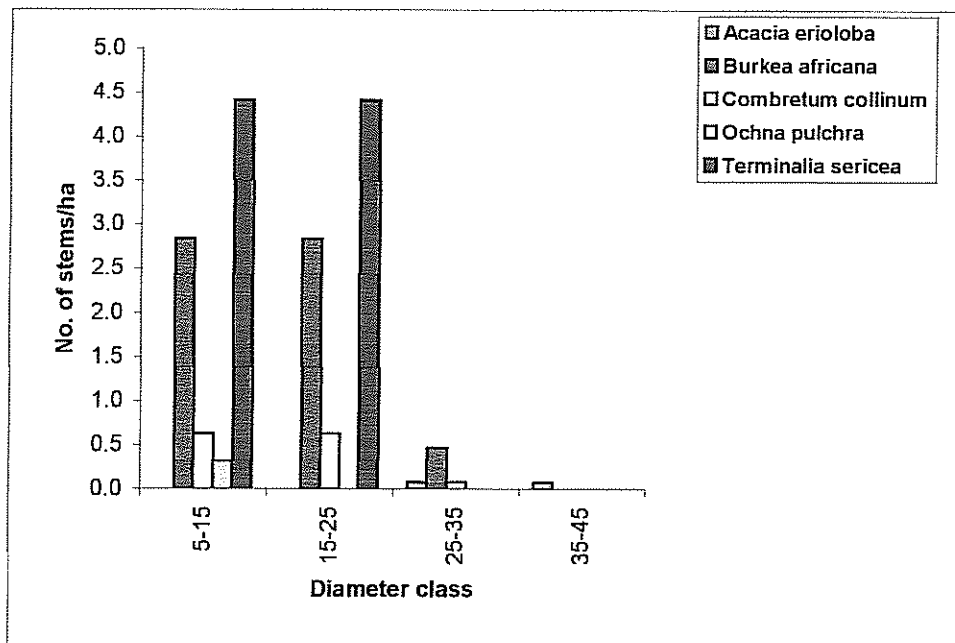


Figure 5.a. Diameter distribution by stems per ha of the five dead tree species found in the area (NyaeNyae South).

Most of the dead trees found in the diameter classes of 5 – 25 cm as shown in the Figure 5 are from *Terminalia sericea* and *Burkea africana* species. Figure 5.a indicate that most of the trees died while they are matured.

4.6.a Regeneration and shrubs

Table 7.a shows total number of tree seedlings per ha by height classes and species found in NyaeNyae South.

Species	Height class, cm								Total
	0-25	26-50	51-100	101-150	151-200	201-250	251-300	300+	
Acacia ataxacantha			6	10	36	2	4	2	59
Acacia erioloba		31	14	2	7			2	55
Acacia fleckii			7	7	7	2	2		25
Baphia massaiensis		2	6	17	23	14			61
Bauhia petersiana	12	63	107	80	62	5	3		333
Boscia albitrunca				4	2				6
Burkea Africana	4	52	78	45	13	5			197
Combretum collinum	1	21	50	54	21	14	3	9	172
Combretum engleri	1		1	5	4				11
Combretum psidioides (psidioides)		3	18	18	17	3	1	4	63
Combretum zeyheri	2	1	1	2	6				12
Commiphora angolensis		16	87	75	17	2		1	198
Croton gratissimus				2	2		1		5
Dichrostachys cinerea (Setulosa)	5	5	49	30	20	16		1	125

Lonchocarpus nelsii		6	63	37	49	15	2		171
Ochna pulchra	7	31	64	49	22	4	1		177
Strychnos pungens			4	1	1				6
Terminalia sericea	1	10	64	131	159	120	19	82	586
Ximenia americana	1		2						3
Total	34	241	621	567	466	201	36	101	2266

Table 7.a. Number of tree seedlings per ha by height classes and species (NyaeNyae South).

Regeneration of *Terminalia sericea* species is the highest in the area, which accounted for more than 25% of the total seedlings. Bulk of the seedlings are found in the height classes between 51 and 150 cm.

Species	Height class, cm								Total
	0-25	26-50	51-100	101-150	151-200	201-250	251-300	300+	
Baissea wulfhorstii	6	25	16						47
Diospyros mespiliformis	8	104	24			1			137
Grewia bicolor		7	34	9	9	3			61
Grewia flava			7						7
Grewia retinervis		11	70	45	36	12		1	174
Mundulea sericea				1	6	7			14
Ozoroa paniculosa			1						1
Ozoroa schinzii			2	2					4
Rhigoszum brevispinosum	4	7	5	3	10				29
Total	18	153	158	59	60	23	0	1	473

Table 8.a Number of shrubs species per ha by height classes (NyaeNyae South).

Table 8.a above shows that more than 36% of the shrubs/ha are from the *Grewia retinervis* species followed by *Diospyros mespiliformis*.

SECTION B

4. INVENTORY RESULTS FOR NYAENYAE NORTH

4.1.b Measured data

A total of 164?? sample plots were measured in the inventory on an area of 34848.985 hectares.

Baphia massaiensis	89	1
Bauhia petersiana	49	
Boscia albitrunca	3	3
Burkea Africana	77	68
Combretum collinum	93	57
Combretum engleri	8	1
Combretum hereroense	3	2
Combretum imberbe	1	1
Combretum psidioides (psidioides)	8	4
Combretum zeyheri	39	17
Commiphora africana	1	1
Commiphora angolensis	7	4
Commiphora glandulosa	1	
Croton gratissimus	10	
Dichrostachys cinerea (Africana)	4	
Dichrostachys cinerea (Setulosa)	3	
Grewia flava	3	
Grewia retinervis	15	
Guibourtia coleosperma	7	13
Lonchocarpus capassa	3	2
Lonchocarpus nelsii	6	11
Ochna pulchra	71	10
Ozoroa paniculosa	8	
Ozoroa schinzii	1	
Peltophorum africanum	1	
Pterocarpus angolensis	16	26
Rhus marlothii	1	
Schinziophyton rautanenii	13	25
Securidaca longepedunculata	3	
Strychnos pungens	8	3
Terminalia sericea	85	32
Ximenia Americana var americana	5	
Ximenia caffra var microphylla	2	

Table 3.b Species diversity shown in relation to the number of plots were each species was found (NyaeNyae North).

A total of 42 different woody species were recorded in NyaeNyae North. 42 shrub species and 23 tree species are found in the area. Hence, the species diversity in the shrub layer is bigger than in the tree layer. *Combretum collinum* is the most common shrub species found on 93 (12.8%) of the measured plots, while trees from the same species were found on 57 (18.3%) of the measured plots. *Burkea africana* tree species was found on most of the measured plots. This tree species was found in 68 (21.93%) of the measured plots indicated in Table 3.b above.

4.4.b Tree volumes and number of stems

85.2% of total trees measured in the whole area are live trees and 14.8% are dead trees.

Live trees

There are total of 333.40 stems, which is 95.67 stems/ha. Average volume for all live tree species is 19.85 m³ per ha as shown in Table 4.b below.

Species	Total no. of stems	Stems per ha	Total tree volume, m ³	Average volume m ³ /ha
<i>Acacia erioloba</i>	2.0	0.6	3.1	0.1
<i>Acacia fleckii</i>	2.5	0.7	3.9	0.1
<i>Acacia karroo</i>	0.2	0.1	0.5	0.0
<i>Acacia mellifera</i>	12.7	3.6	4.5	0.1
<i>Baikiaea plurijuga</i>	27.8	8.0	92.5	2.7
<i>Baphia massaiensis</i>	0.8	0.2	0.1	0.0
<i>Burkea africana</i>	5.2	1.5	4.3	0.1
<i>Commiphora africana</i>	97.5	28.0	122.5	3.5
<i>Commiphora angolensis</i>	1.6	0.5	0.3	0.0
<i>Combretum collinum</i>	5.9	1.7	4.1	0.1
<i>Combretum engleri</i>	59.2	17.0	75.1	2.2
<i>Combretum hereroense</i>	0.8	0.2	1.2	0.0
<i>Combretum imberbe</i>	2.4	0.7	1.4	0.0
<i>Combretum psidioides (psidioides)</i>	1.6	0.5	0.3	0.0
<i>Combretum zeyheri</i>	4.4	1.3	3.9	0.1
<i>Guibourtia coleosperma</i>	21.9	6.3	17.5	0.5
<i>Lonchocarpus capassa</i>	9.5	2.7	42.8	1.2
<i>Lonchocarpus nelsii</i>	8.7	2.5	8.5	0.2
<i>Ochna pulchra</i>	14.9	4.3	10.3	0.3

Pterocarpus angolensis	11.1	3.2	8.2	0.2
Schinziophyton rautanenii	19.5	5.6	43.3	1.2
Strychnos pungens	20.2	5.8	242.8	7.0
Terminalia sericea	3.2	0.9	0.8	0.0
Total	333.4	95.7	691.7	19.9

Table 4.b Number of stems and volumes for live tree species (NyaeNyae North).

The most common species is *Commiphora africana* with 28.0 stems/ha (29.2%) followed by *Combretum engleri* with range of 20 (17.8%) trees per ha. *Strychnos pungens* has the highest tree volume of 7.0 m³/ha followed by *Commiphora africana* with the 3.5 m³/ha. Because of its big size trees, *Strychnos pungens* has higher volume per ha compared to the *Commiphora africana*, which has more trees per ha as shown in Table 4.b.

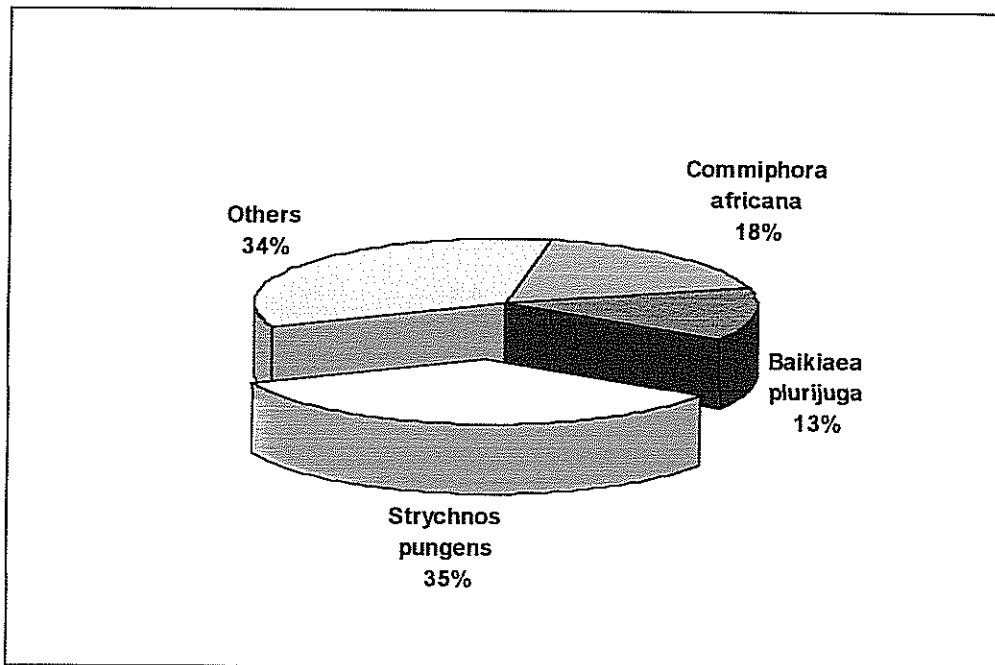


Figure 1.b. Volumes of the common live species expressed in % of the total volume of all species (NyaeNyae North).

The total volume for all live trees is 691.7 m³. *Strychnos pungens* with 213.2 m³ has the highest total tree volume as individual tree specie followed by *Commiphora angolensis* with 122.5 m³ which is express as % of total volume found in the area as shown in Figure 1.b.

Dead trees

Only five tree species make up the total number of 192.4 dead trees found in the area, which give 13.6 stems per ha. Average volume for all dead tree species is 0.9 m³ per ha as shown in table below.

Species	Total no. of stems	Stems per ha	Total tree volume, m ³ /ha	Average volume, m ³ /ha
Acacia erioloba	0.5	0.1	2.7	0.1
Acacia karroo	1.6	0.5	0.4	0.0
Baikiaea plurijuga	10.7	3.1	13.1	0.4
Burkea Africana	21.6	6.2	34.2	1.0
Combretum collinum	4.0	1.1	3.6	0.1
Combretum zeyheri	2.4	0.7	0.6	0.0
Guibourtia coleosperma	0.4	0.1	4.4	0.1
Lonchocarpus nelsii	1.6	0.5	0.4	0.0
Ochna pulchra	0.8	0.2	0.3	0.0
Pterocarpus angolensis	4.0	1.1	8.6	0.3
Terminalia sericea	6.3	1.8	1.2	0.0
Total	53.7	15.4	69.5	2.0

Table 5.b. Number of stems and volumes for dead trees (NyaeNyae North).

Majority of the dead trees in NyaeNyae North are from *Burkea Africana* with 6.2 trees per ha followed by *Baikiaea plurijuga* with 3.1 stems per ha. See Table 5.b above.

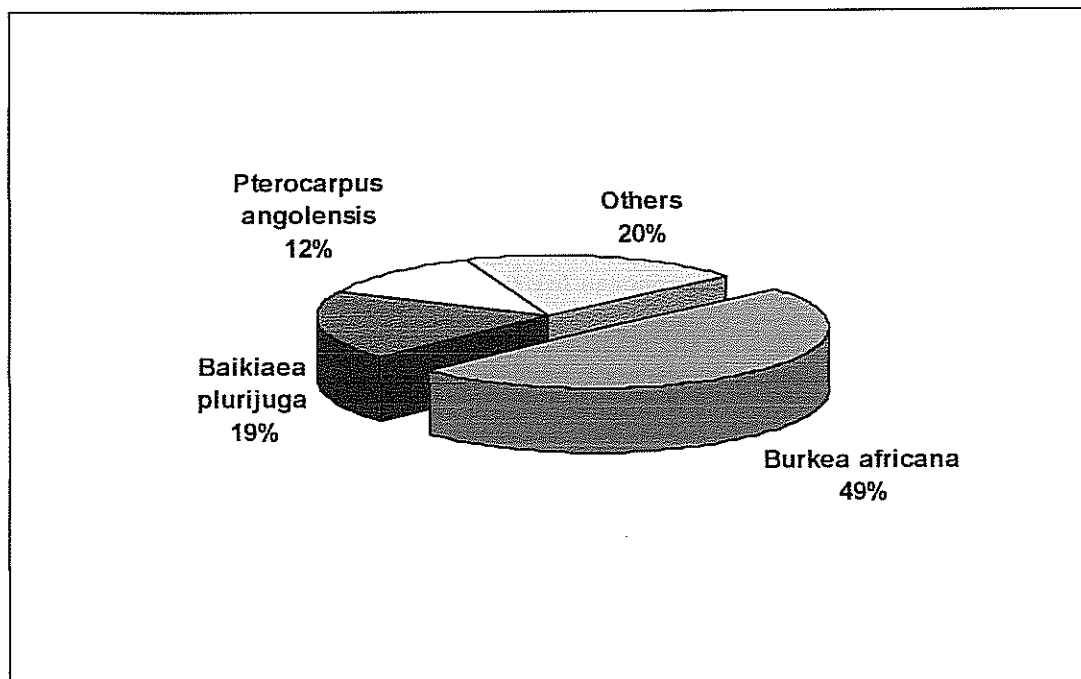


Figure 2.b. The volumes of the most common dead species expressed in % of the total volume of all species (NyaeNyae North).

Total tree volume of dead trees in the area is 69.5 m³. *Burkea Africana* with 34.2 m³ has the highest total tree volume followed by *Baikiea plurijuga* with 13.1 m³ which expressed as % of total volume from dead trees in the area as shown in Figure 2.b above.

4.5.b Diameter distribution

Diameter distribution for the five common live trees (Figure 4) and dead trees (Figure 5) are shown below.

Live trees

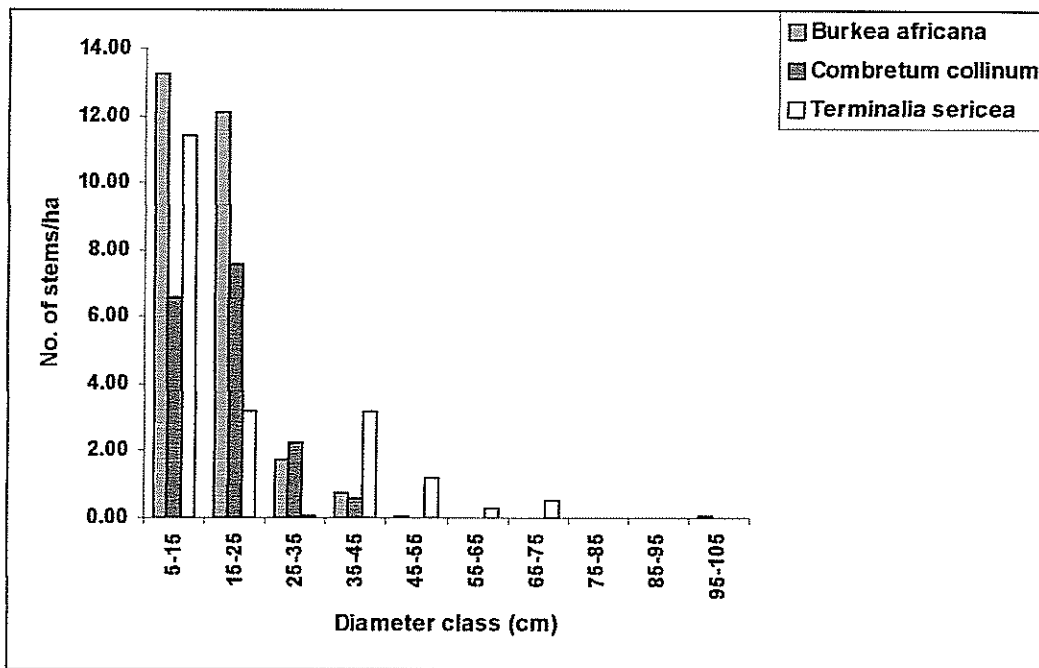


Figure 3.b Diameter distribution of the three common live tree species found in the area (NyaeNyae North).

Above figure indicate that bulk of the species occurred between the small diameter classes of 5 and 25 cm. Biggest trees found in the diameter classes of ≥ 45 cm are from *Terminalia sericea*.

Dead trees

Only five species were found dead in the area as shown in Appendix 2 and figure 5.

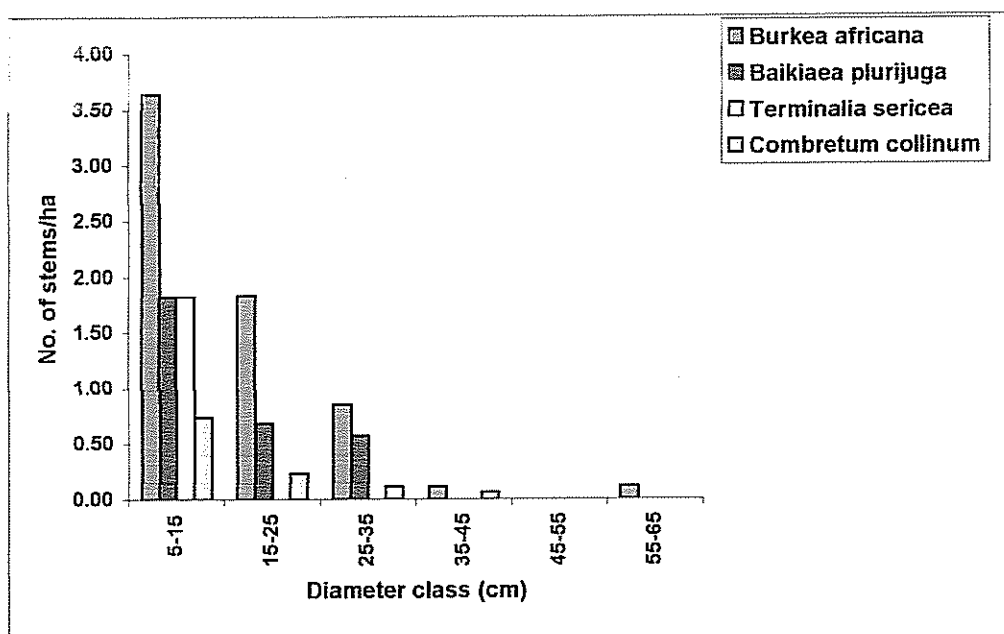


Figure 4.b Diameter distribution by stems per ha of the common dead tree species found in the area (NyaeNyae North).

Most of the common dead trees shown in the Figure 5.b above are in the diameter classes of 5 – 25 cm. Trees with the biggest diameters are from *Combretum collinum* species.

4.6.b Regeneration and shrubs

Table 6.b below shows the total number of tree seedlings per ha by height classes and species found in NyaeNyae North.

Species	Height class, cm							Total
	0-25	26-50	51-100	101-150	151-200	201-250	251-300	
Acacia ataxacantha			2.9	6.5	6.5	4.3	0.7	20.9
Acacia erioloba	1.4	4.3	7.2	11.5	0.0	0.7		25.2
Acacia fleckii			0.7	2.2	4.3	1.4		9.4
Acacia mellifera			0.7			0.7		2.9
Albizia anthelmintica						0.7	1.4	2.2
Baikiaea plurijuga		7.2	37.4	23.0	11.5	4.3	1.4	97.8
Baphia massaiensis	1.4	48.9	155.4	78.4	83.5	15.1	1.4	392.8
Bauhia petersiana		37.4	71.9	33.1	10.1	5.8	7.9	166.9
Boscia albitrunca			0.7	2.2				2.9

Burkea Africana	46.0	92.1	218.7	49.6	28.8	6.5	0.0	0.7	442.5
Combretum collinum	7.9	63.3	157.6	59.7	46.8	22.3	10.8	14.4	382.7
Combretum engleri	0.7	4.3	5.8	13.0	2.2	1.4			27.3
Combretum psidioides (psidioides)		2.9	2.2	6.5	0.0	0.7			12.2
Combretum zeyheri	13.7	13.0	39.6	21.6	33.1	17.3	2.2	0.7	141.0
Commiphora Africana					0.7				0.7
Commiphora angolensis			1.4	1.4	0.7	1.4		0.7	5.8
Croton gratissimus			4.3	3.6	3.6	10.1		5.0	26.6
Dichrostachys cinerea (africana)				3.6	1.4	0.7	0.7		6.5
Dichrostachys cinerea (Setulosa)		1.4	2.2	2.9	4.3	3.6			14.4
Lonchocarpus nelsii	0.7	0.7	2.9	1.4	2.9	1.4	0.7	0.7	11.5
Ochna pulchra	66.2	102.9	102.9	25.9	6.5	10.1	1.4		315.8
Peltophorum africanum				4.3					4.3
Strychnos pungens		7.2	4.3	2.2	2.2	0.7			16.6
Terminalia sericea	0.7	13.0	68.4	38.1	66.9	27.3	2.2	20.9	237.4
Ximania americana var Americana			1.4	7.9	0.7				10.1
Ximania caffra var microphylla			0.7			0.7			1.4
Total	138.9	398.6	889.2	398.6	316.6	137.4	30.9	67.6	2377.7

Table 6.b. Number of tree seedlings per ha by height classes and species (NyaeNyae North).

Regeneration of the *Burkiea africana* species is the highest in the area, which accounted for more than 18% of the total seedlings. Bulk of the seedlings are found in the height classes between 51 and 150 cm

Shrubs table

Total number of shrub species per ha by height classes area shown in the table above Table 7.b below.

Species	Height class, cm								
	0-25	26-50	51-100	101-150	151-200	201-250	251-300	300+	Total
<i>Baissea wulfhorstii</i>	126.6	243.2	2.2						371.9
<i>Grewia flava</i>			2.9	1.4	0.0	1.4			5.8
<i>Grewia retinervis</i>		0.7	2.9	10.1	6.5	4.3		0.7	25.2
<i>Guibourtia coleosperma</i>				4.3	0.7	6.5		0.0	11.5
<i>Ozoroa paniculosa</i>		0.0	8.6	8.6		1.4		0.7	19.4
<i>Ozoroa schinzii</i>		0.0	2.2						2.2
<i>Rhus marlothii</i>		0.7							0.7
Total	126.6	244.6	18.7	24.5	7.2	13.7	0.0	1.4	436.7

Table 7.b. Number of shrubs species per ha by height classes (NyaeNyae North).

More than 85% of the total shrubs species found in the area are from *Baissea wulfhorstii* followed by the followed by *Grewia retinervis* with only more than 5%.

COMBINED RESULTS to be included here?

5 Reliability of the results

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

Measurement error:

Field personnel were continuously trained on –the-job in forest measurements, use of instruments and plant identification to guarantee good quality and accurate field measurements and data input on the field forms. Several cross checkings were done to find out possible errors and inconsistencies in the data.

Volume functions:

This might be the main source of error. The size of the material collected for constructing the functions was moderate. 252 trees were felled in West Tsumkwe, Caprivi, Omusati and Oshikoto regions and these were used for modeling.

Sampling error estimator:

The sampling error was estimated using the formula for random sampling. The standing error for the main volume (52 m³/ha) was 2.8 m³/ha, which is 5.3% of the average volume. The true volume with 95% probability is between 46.4 m³/ha and 57.6 m³/ha.

6. INVENTORY COST

Large sum of money is spent to determine the success of forest resource inventories. Inventory design and the size of the area to be inventoried determine the cost of an inventory.

7. CONCLUSION

According to the results of the inventory it is clear that very few mature trees are found in the area.

8. ACKNOWLEDGEMENTS

National Forest Inventory staff has to be commented for their hard work and dedication in executing their duties to ensure the completion of NayeNaye South inventory. Individuals who were involved in the forest inventory consist of the Directorate of Forestry and Government of Finland staff.

Directorate of Forestry

Simon Angombe	NFI supervisor
Immanuel Pieters	Field Supervisor
Hennie Kakondo	
Gerhard Boois	
Natanael Amadhila	
Clints Mwilima	
Philip Shipa	
Fernando Kaveta	

Government of Finland

Risto Laamanen	Technical Advisor for the National Forest Inventory and Management Planning Unit
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Thanks to the Tswumkwe Forestry Office for their support.

APPENDIX 1.a FOR NYAENYAE SOUTH

Live trees

Species	5-15	15-25	25-35	35-45	45-55	55-65	65-75	75-85	85-95	Total	% of total
Acacia ataxacantha		0.3								0.3	0.4
Acacia erioloba	2.2	2.2	0.1	0.1						4.6	5.6

Acacia fleckii	1.6	1.3							2.8	3.5
Boscia albitrunca			0.1						0.1	0.1
Burkea africana	3.8	1.9	1.0	0.3	1.3				7.8	9.6
Combretum collinum	11.4	6.6	1.4	0.1	1.5				21.0	25.8
Combretum psidioides (psidioides)	2.2								2.2	2.7
Combretum zeyheri	0.1	0.1	0.1						0.2	0.3
Lonchocarpus nelsii	2.3	3.5	0.1						5.8	7.2
Ochna pulchra	1.6	1.6							3.2	3.9
Pterocarpus angolensis	0.3	0.3		0.2	0.2	0.1			32.5	39.8
Schinziophyton rautanenii						0.1			0.1	0.1
Terminalia sericea	19.2	12.6							31.8	39.0
Total	44.7	30.3	2.7	0.7	3.0	0.1			81.5	
% of total	54.8	37.2	3.3	0.9	3.7	0.2				100

Diameter distribution for the total number of stems per ha by species for the live trees in NyaeNyae South

APPENDIX 2.a FOR NYAENYAE SOUTH

Dead trees

Species	5-15	15-25	25-35	35-45	Total	% of total
Acacia erioloba			0.1	0.1	0.2	1.0
Burkea Africana	2.8	2.8	0.5		6.1	36.6
Combretum collinum	0.6	0.6	0.1		1.3	8.0
Ochna pulchra	0.3				0.3	1.9
Terminalia sericea	4.4	4.4			8.8	52.6
Total	8.2	7.9	0.6	0.1	16.8	
% of total	48.8	46.9	3.8	0.5		100

Diameter distribution for the stems by species for the dead trees found per ha in NyaeNyae South

APPENDIX 3.b FOR NYAENYAE NORTH

Live trees

Diameter distribution for the total number of stems per ha by species for the live trees NyaeNyae North.

APPENDIX 4.b FOR NYAENYAE NORTH

Dead trees

Species	5-15	15-25	25-35	35-45	45-55	55-65	Total	% of total
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Acacia erioloba			0.1	0.1		0.0	0.2	0.94
Acacia karroo	0.5						0.5	2.9
Baikiaea plurijuga	1.8	0.7	0.6				3.1	19.2
Burkea africana	3.6	1.8	0.9	0.1		0.1	6.5	40.9
Combretum collinum	0.7	0.2	0.1	0.1			1.1	7.1
Combretum psidioides (psidioides)		0.2					0.2	1.4
Combretum zeyheri	0.5	0.2					0.7	4.3
Commiphora angolensis				0.1			0.1	0.4
Guibourtia coleosperma			0.1	0.1		0.1	0.2	1.1
Lonchocarpus nelsii	0.5						0.5	2.9
Ochna pulchra	0.2						0.2	1.4
Pterocarpus angolensis	0.7	0.1	0.2	0.1			1.0	6.1
Terminalia sericea	1.8						1.8	11.4
Total	10.3	3.3	1.8	0.4		0.2	16.0	
% of total	64.4	20.4	11.4	2.6		1.2		100

Diameter distribution for the stems by species for the dead trees found per ha in NyaeNyae South