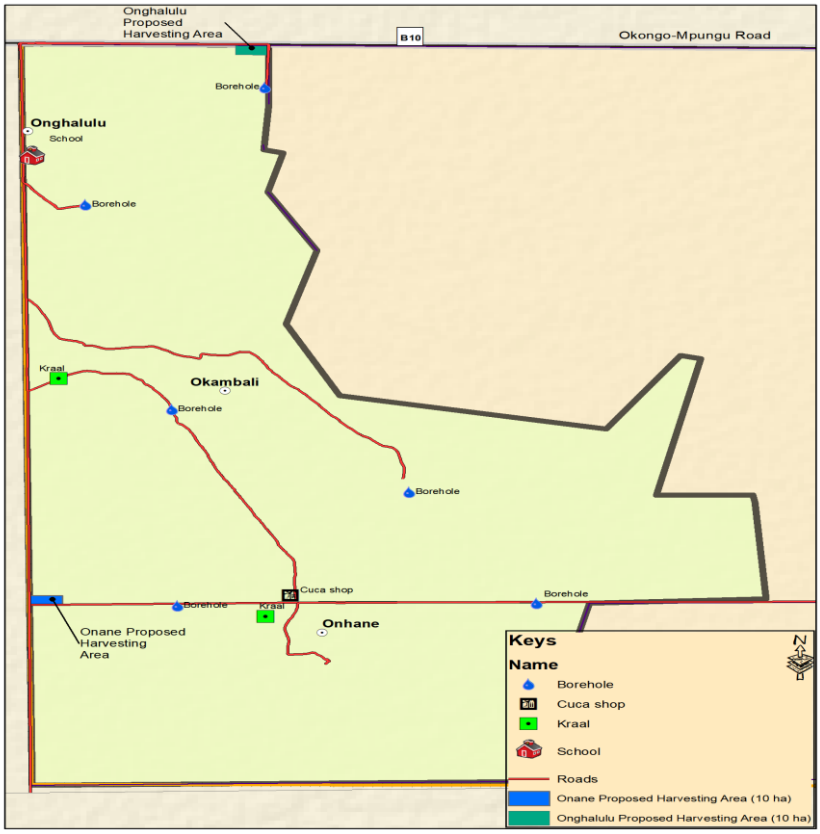
FOREST INVENTORY REPORT FOR ONGHALULU FARMERS' COOPERATIVES



Compiled by: Andreas Nikodemus, Cecilia P. Shinyala and Agnes Shikomba

Windhoek, November 2019

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ACRONYMS

DBH	Diameter at Breast Height
DoF	Directorate of Forestry
FMC	Forest Management Committee
MAWF	Ministry of Agriculture, Water and Forestry
NFI	National Forest Inventory
PCLD	Programme for Communal Land Development
TAC	Total Allowable Cut
TAC	Total Allowable Cut

Executive Summary

This report presents results from forestry inventory on forest resources available in Onghalulu Farmers' Co-operative. This inventory was carried out by community members under the supervision of the Directorate of Forestry (DoF) officials. The National Forest Inventory (NFI) compiled the report. The inventory was conducted in July 2019. NFI under DoF under the Ministry of Agriculture, Water and Forestry (MAWF) carries out forest resource assessments in Namibia. Forest inventory has now a long tradition in the Namibian forestry sector. In this inventory the focal point has been the assessment of both standing and lying woody forest resources on the communal forested land in Onghalulu Farmers' Co-operative. This was the first type of this inventory and it was a success. In the recent forest inventories, efforts were made to incorporate local community participation in the resources assessments. The prime goal for these inventories is for forest management planning purpose. A forest inventory in Onghalulu Farmers' Co-operative was carried out in July 2019 cooperatively by NFI, the District Forestry Office and local community members. The NFI team was responsible for training the participants in inventory techniques. Farmers that participated were under the supervision of Mr. Abel Aushona (Chief Forest Technician, Okongo Forestry Office).

1. The Background of Onghalulu Farmers' Co-operative

The Onghalulu Farmers' Co-operative is situated in the Ohangwena Region of Namibia and was formed as an outcome of the Local Level Participatory Planning component of the Programme for Communal Land Development (PCLD) of the Ministry of Land Reform, with membership drawn from the Onghalulu, Okambali and Onane villages. The cooperative has the hectarage of 10487, including the homesteads and unoccupied land. The cooperative is under Oukwanyama Traditional Authority. The Co-operative operates according to a set of By-Laws and Internal Rules, adopted in 2014. It was provisionally registered with the Ministry of Agriculture, Water and Forestry as a co-operative on 27 January 2015, but to date very few real benefits have realised to its members. The main livelihood activity of Co-operative members has traditionally been livestock farming (predominantly cattle, and goats to a lesser extent), with low levels of dryland cropping.

The polygon is bush-encroached, resulting in over-grazing and the depletion of rangeland resources. In order to improve pastures and to increase the carrying capacity of the grazing area, the Onghalulu Farmers' Co-operative members have decided to engage in a systematic and sustainable bush-thinning exercise, through engaging in economic activities based on the utilization of the excess bush biomass, in a sustainable manner that aims to restore the ecosystem integrity of the area, rather than negatively impact it.

Its primary purpose is to provide services and support to its members, who are both the beneficiaries and the shareholders of the business. The focus is thus not so much on maximizing profits, but rather on maximizing member benefits, through the provision of inputs and services, and collective marketing of products. Thus, the vision of the Co-operative is "To make the Onghalulu Farmers' Co-operative a model co-operative, by becoming self-sufficient, and becoming an educated community growing to its full potential." The Co-operative particularly recognizes the importance of a sound natural ecosystem for the services it provides, in terms of economic, social, cultural and livelihood benefits, and therefore places emphasis on the environmental sustainability of its activities. Although there are numerous bush biomass value chains that can be developed over time, the approach is to focus on the quick wins to start with.

Onghalulu Farmers' Co-operative falls within the 500-550mm rainfall. There is generally a long dry season from April to October and a shorter, wet season between November and March. The average annual temperature is 34°C, and at an altitude of approximately 1000m.

Frost occurs annually mainly between June and August. The soil ranges from sandy loam to loam clay, but most of the area has deep Kalahari Sand. The loamy areas (known as ondobe) tend to be more fertile, and therefore where the communities settle and practice limited dryland cropping. The deep sand areas are unfertile and cannot be cultivated. The cooperative is more dominated by the *Terminalia sericea*, *Combretum collinum*, *Croton gratissimus* and *Dichrostachys cinerea* among others.

2. Inventory design and data analysis

For data collection purpose, a total of 16 plots were systematically sampled. The coordinates of the sample plots are attached in the appendix (Appendix II) of this report. The inventory data for forest resources was collected on circular sample plots of 20 meters radius (Figure 2.1). A measuring tape was used to measure sample plots radius. All forest resources ranging from regeneration to trees were recorded within the 20 meters radius. Regeneration, saplings and trees were given by species as well as by diameter at breast height (dbh) for standing woods and middle diameter for lying woods. The dbh standardized at 1.3 m above the ground of all woody plants was measured by using a diameter tape to determine the diameter and a ruler stick to measure the potential log length. Regeneration which is made up of all woody plants with a dbh less than 5 cm and a plant height equal to or greater than 150 cm as well as saplings which are defined as woody plants with a dbh of 5cm–9.9cm were recorded within the sub-plot of 10 meters radius. The circumference of the plots was measured using a measuring tape.

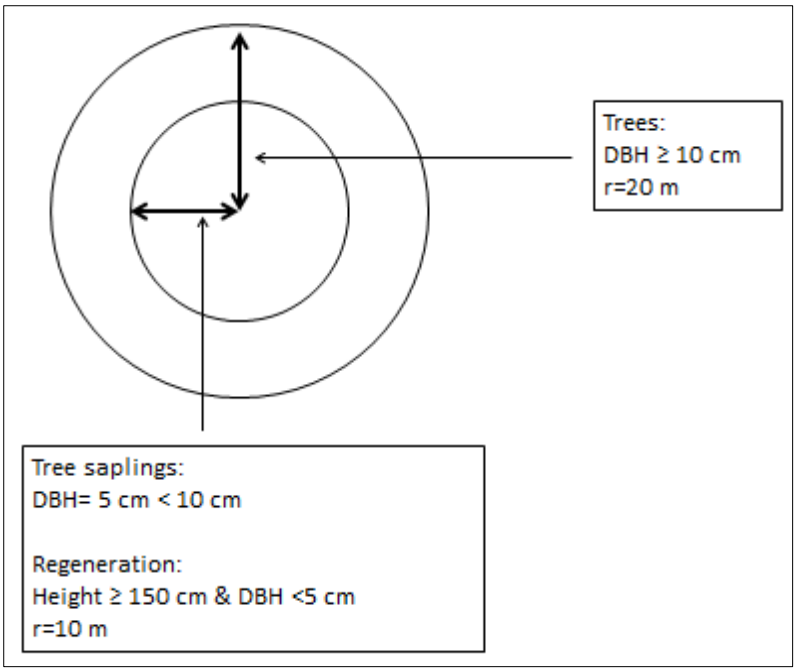

Figure 2.1: *Sample plot design*

The inventory data was entered and analysed with the Microsoft Excel. The main results of the inventory are reported in the following section.

3. Inventory Results

The assessments in this inventory mostly covered aspects such as regeneration, saplings, poles, timber, diameter classes, and total allowable cut (TAC) for poles, timber and deadwood/firewood.

3.1 Regeneration

Regeneration refers to all young woody plants that are capable of becoming trees with a dbh of <5cm are regarded as regeneration. Regeneration plays a vital role in the renewal and perpetuation of forest and woodland ecosystems. It is one of the most important indicators of a healthy ecosystem. Good regeneration means that there is continuously going to be sufficient number of saplings growing into tree sizes, which in turn means later on trees entering into mature stage. Table 3.1 shows the percentage of regeneration according to the inventory.

Table 3.1: *Regeneration*

SPECIES	COUNT	PERCENTAGE (%)
Croton gratissimus	340	49%
Baphia massaiensis	158	23%
Bauhinia petersiana	97	14%
Combretum collinum	32	5%
Oluputa	14	2%
Philenoptera nelsii	13	2%
Burkea africana	6	1%
Commiphora glandulosa	7	1%
Dichrostachys cinerea	4	1%
Parinari capensis	8	1%
Grewia flavescens	4	1%
Ombanyanyana	4	1%
Berchimia discolor	3	0%
Boscia albitrunca	4	1%
Terminalia sericea	1	0%
TOTAL	**695**	**100%**

It can be said that there is good to very good regeneration in Onghalulu Farmers' Co-operative with *Croton gratissimus* (36%), *Baphia massaiensis* (23%) and *Bauhinia petersiana* (14%) being dominant regeneration species. Among the least regeneration species, *Commiphora glandulosa* (1%), *Dichrostachys cinerea* (1%) were identified.

3.2 Saplings

All young woody plants that are capable of becoming trees with dbh of ≥5 cm ≤ 10 cm are defined as tree saplings. Table 3.2 shows the list of saplings observed in Onghalulu Farmers' Co-operative.

Table 3.2: *Saplings*

SPECIES	COUNT	PERCENTAGE (%)
Terminalia sericea	50	54%
Combretum collinum	13	14%
Combretum apiculatum	11	12%
Dichrostachys cinerea	6	7%
Croton gratissimus	3	3%
Burkea africana	2	2%
Berchimia discolor	2	2%
Baikiea plurijuga	2	2%
Combretum zeyheri	1	1%
Acacia fleckii	1	1%
Acacia erioloba	1	1%
TOTAL	**92**	**100%**

It was observed that there is good abundance of saplings in the area with *Terminalia sericea* (54%) and *Combretum collinum* (14%) and *Combretum apiculatum* (12%). The lowest abundance of sapling was identified among *Acacia spp.* such as *Acacia fleckii* (1%), *Acacia erioloba* (1%) as well as in *Burkea africana* (1%) and *Combretum zeyheri* (1%). A good abundance of saplings indicates that there will be a good forest stand in the future. However, this requires proper forest management and regulated harvesting to make sure that young trees are given a chance to grow into mature trees.

3.3 Measured trees

Table 3.3: *Measured tress*

TREE SPECIES	COUNT	PERCENTAGE (%)
Terminalia sericea	132	33%
Combretum apiculatum	64	16%
Combretum collinum	78	19%
Burkea africana	46	12%
Dichrostachys cinerea	30	8%
Philenoptera nelsii	12	3%
Baikiea plurijuga	6	2%
Berchemia discolor	8	2%
Combretum zeyheri	6	2%
Acacia erioloba	3	1%
Croton gratissimus	3	1%
Schinziophyton rautanenii	5	1%
Strychnos pungens	2	1%
Boscia albitrunca	1	0%
TOTAL	**396**	**100%**

A total of 369 live trees were measured in the entire Onghalulu Farmers' Co-operative of which *Terminalia sericea* (33%), *Combretum apiculatum* (16%) and *Combretum collinum* (15%) were identified as dominant tree species. Among the least dominant tree species *Combretum zeyheri* (2%), *Acacia erioloba* (1%) and *Croton gratissimus* (1%) were identified.

3.4 Poles

Table 3.4: *Poles*

SPECIES	COUNT	PERCENTAGE (%)
Terminalia sericea	85	33%
Combretum collinum	72	28%
Combretum apiculatum	42	16%
Dichrostachys cinerea	24	9%
Philenoptera nelsii	12	5%
Berchemia discolor	4	2%
Combretum zeyheri	6	2%
Schinziophyton rautanenii	4	2%
Acacia erioloba	2	1%
Croton gratissimus	3	1%
Strychnos pungens	2	1%
Boscia albitrunca	1	0%
TOTAL	**257**	**100**

Most of the tree species in Namibia are used as poles. The standard diameter class for poles is 25-44.9 cm at dbh. The results show that the highest percentage of poles was observed in species such as *Terminalia sericea* (33%), *Combretum collinum* (28%) and *Combretum apiculatum* (16%). *Combretum zeyheri* (1%), Acacia erioloba (1%), *Croton gratissimus* (1%) and *Strychnos pungens* (1%) are the least dominant pole species in the area.

3.5 Droppers

Table 3.5: *Droppers*

SPECIES	COUNT	PERCENTAGE (%)
Terminalia sericea	48	55%
Combretum apiculatum	22	25%
Combretum collinum	6	7%
Dichrostachys cinerea	6	7%
Berchemia discolor	4	5%
Acacia erioloba	1	1%
TOTAL	**87**	**100**

Droppers are woody plants with the dbh from 10-24.9 cm. Droppers are commonly used for fencing off farmers, yards and other types of similar uses. The dominant dropper species in Onghalulu Farmers' Co-operative is *Terminalia sericea* (55%) and *Combretum apiculatum* (25%). *Acacia erioloba* (1%) is the least used tree species for droppers.

3.6 Timber

Timber refers to the woody tree species used for a variety of purposes such as saw wood, pulp wood poles etc. In the Namibian context, only four tree species are classified as timber, namely *Burkea africana*, *Baikiaea plurijuga*, *Pterocarpus angolensis* and *Guibourtia coleosperma*. Figure 3.1 shows two timber species that were identified in Onghalulu Farmers' Co-operative.

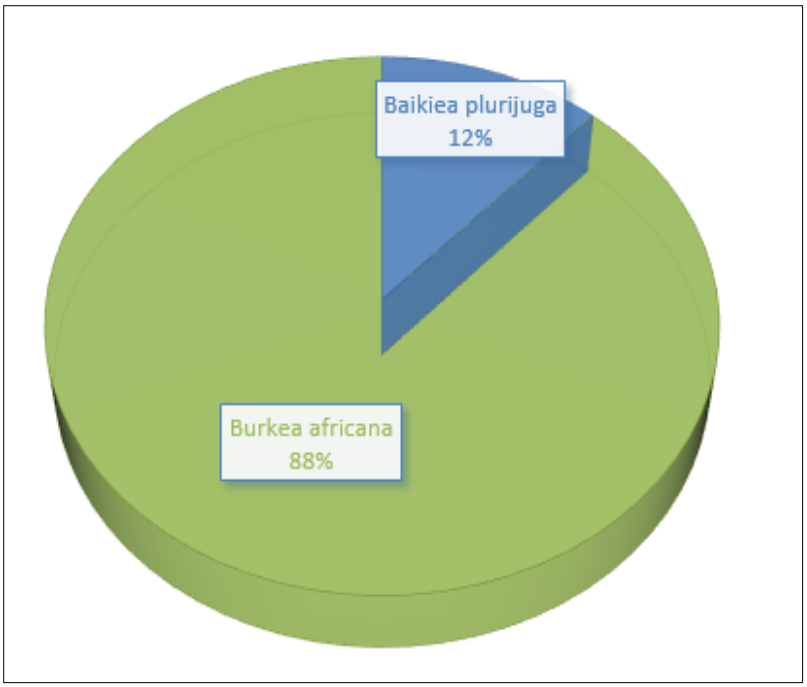

Figure 3.1 *Timber species*

Baikiaea africana is the dominant timber species in the area with 88%, whereas *Baikiaea plurijuga* only constitutes about 12%.

3.7 Diameter classes

From a management perspective, it is ideal to have a diameter distribution characterized by a gradually decreasing distribution curve (Figure 3.2).

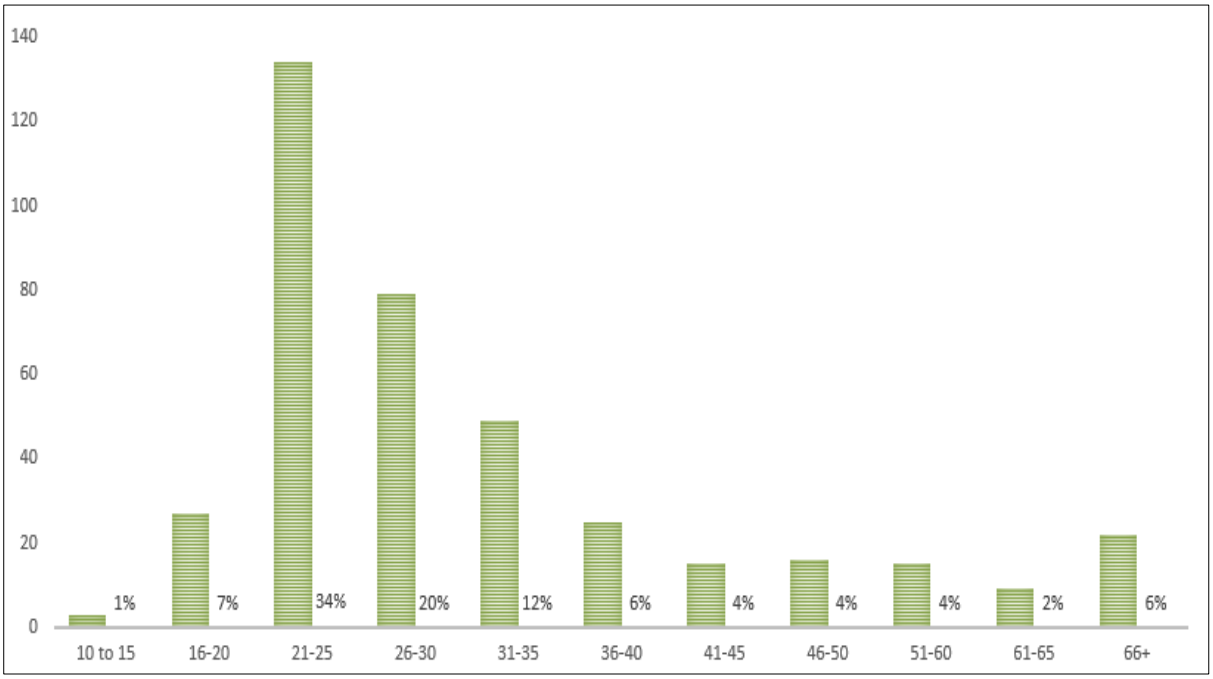

Figure 3.2: *Tree diameter distribution*

An optimal curve would display a large number of stems in low diameter classes and a small number of stems in large diameter classes. The results show that diameter distribution for Onghalulu Farmers' Co-operative is optimal with more trees distributed in smaller diameter classes. More trees are concentrated in lower to middle diameter classes, particularly 21-25 cm (34%), followed by diameter class 26-30 cm (20%) and 31-35 cm (12%). The concentration of trees declines with the increase in the size of diameter classes. For example, there are relatively a low diameter distribution in diameter classes from 51 cm and greater.

With this favoured distribution, trees are continuously reaching the mature stages allowing the continuous harvest of timber and poles. If the actual diameter distribution deviates from the optimal curve short, medium and long term management strategies have to be adjusted correspondingly.

3.8 Total Allowable Cut

Allowable cut is a guide used to regulate timber and/or pole harvests in both plantation and natural forests (Vanclay, 2014). The concept is long-established, but it remains loosely defined as *"the volume, number of stems, or area cut over, either annually or periodically"* (Robertson, 1971). For the purpose of this inventory, allowable cut focused on poles, timber and firewood.

3.8.1 Poles

Poles refer to woody plants (except for timber species) with dbh from 25 cm and greater. Table 3.4 presents total allowable cut for poles in Onghalulu Farmers' Co-operative.

Table 3.6: *Poles total allowable*

SPECIES	COUNT	TOTAL AREA (HA)	ROTATION PERIOD	TAC	TAC/YR
Terminalia sericea	85	10487	36	24761	4952
Combretum collinum	72	10487	43	17560	3512
Combretum apiculatum	42	10487	43	10243	2049
Dichrostachys cinerea	24	10487	36	6991	1398
Philenoptera nelsii	12	10487	43	2927	585
Combretum zeyheri	6	10487	43	1463	293
Schinziophyton rautanenii	4	10487	43	976	195
Croton gratissimus	3	10487	54	583	117
Acacia erioloba	2	10487	100	210	42
Strychnos pungens	2	10487	43	488	98
Boscia albitrunca	1	10487	36	291	58
TOTAL	**253**			**66492**	**13298**

Farmers are allowed to harvest a minimal amount form all the observed tree species as indicated on the table above. The highest allowable cut per year was displayed by *Terminalia sericea* (4952 stems), followed by *Combretum collinum* (3512 stems) and *Combretum apiculatum* (2049 stems). The lowest allowable cut was identified in species such as *Strychnos pungens* (98 stems) and *Acacia erioloba* (42 stems).

It is worth noting that farmers are allowed to strictly harvest only an amount indicated under "AC/year" per species as indicated on the table above. Failure to comply with the scientifically calculated allowable cut will result in the degradation of the forest and is punishable by the law.

3.8.2 Droppers

Table 3.7: *Droppers total allowable cut*

SPECIES	COUNT	TOTAL AREA (HA)	ROTATION AGE	TAC	TAC/YR
Terminalia sericea	47	10487	18	27965	5593
Combretum apiculatum	22	10487	23	10031	2006
Dichrostachys cinerea	6	10487	18	3496	699
Combretum collinum	6	10487	23	2736	547
Berchemia discolor	4	10487	18	2330	466
Acacia erioloba	1	10487	50	210	42
TOTAL	**88**			**46768**	**9354**

The highest total allowable cut was demonstrated by *Terminalia sericea* (5593 stems), followed by *Combretum apiculatum* (2006 stems) and the least was *Acacia erioloba* (42 stems).

3.8.3 Timber

Table 3.8 shows the total allowable cut for timber in the area according to the inventory results.

Table 3.8: *Timber total allowable cut*

SPECIES	COUNT	TOTAL AREA (HA)	ROTATION PERIOD	TAC	TAC/YR
Burkea africana	45	10487	130	3630	726
Baikiea plurijuga	6	10487	142	443	89
TOTAL	**51**			**4073**	**815**

Timber is in a relatively low abundance in the area. Therefore, the results indicate that is relatively small amount of timber that can be harvested per species. The total allowable cut for timber in Onghalulu Farmers' Co-operative was observed in *Burkea africana* (726 stems) and *Baikiaea plurijuga* (89 stems).

3.8.4 Dead wood/firewood

Table 3.9: *Dead wood total allowable cut*

SPECIES	COUNT	TOTAL AREA (HA)	FACTOR (20%)	TAC	TAC/YR
Terminalia sericea	10	10487	20	5244	1049
Dichrostachys cinerea	4	10487	20	2097	419
Combretum collinum	3	10487	20	1573	315
Boscia albitrunca	1	10487	20	524	105
Combretum apiculatum	1	10487	20	524	105
Schinziophyton rautanenii	1	10487	20	524	105
TOTAL	**20**	**10487**	**20**	**10487**	**2097**

Deadwood is commonly used for firewood. Dead wood for firewood was recorded from five species, namely, *Terminalia sericea Combretum collinum, Dichrostachys cinerea, Combretum collinum, Boscia albitrunca, Combretum apiculatum* and *Schinziophyton rautanenii*. The highest allowable cut was observed in *Terminalia sericea* (1049 stems), *Dichrostachys cinerea* (419 stems), *and Combretum collinum* (315 stems). The lowest total allowable cut was observed in species such as *Boscia albitrunca*, *Combretum apiculatum* and *Schinziophyton rautanenii* all recorded 105 stems.

4. Conclusions and recommendations

The area displays a good abundance of trees from various species whereby *Terminalia sericea*, *Combretum apiculatum* and *Combretum collinum*. Only two timber species were recorded, namely *Burkea africana* and *Baikiaea plurijuga* were identified. It was further observed that there are sufficient trees from use classes such as poles, timber, droppers and deadwood/firewood for the next five years. However, it is important that farmers comply with the law and all forest management regulations in order to benefit and manage the resources in a sustainable manner. This aligns with the Forest Policy statement of DoF: to *"practise and promote the sustainable and participatory management of forest resources and other woody vegetation, to enhance socio-economic development and environmental stability"* (Louw, 2007). Therefore, the farmers in Onghalulu Farmers' Co-operative are encouraged to stick to the prescribed allowable cut. The office forestry (DoF) is determined to monitor the harvest of trees from farms in order to promote a sustainable forest management. The office of forestry is encouraged to ensure that tree harvest is verified at all costs to prevent illegal harvesting which might pose a serious threat to the status of the forest.

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APPENDICES

GPS CORDINATES

PLOT NO.	GPS COORDINATES		TEAM LEADERS
	SOUTH	NORTH	
20	17.62.12	17.66256	Abel Aushona
4	17.7286	17.6441	Abel Aushona
6 (Crop Field)	17.72847	17.68181	Abel Aushona
1	17.74667	17.64417	Abel Aushona
5	17.72853	17.66296	Abel Aushona
8	17.71053	17.64404	Abel Aushona
9	17.71046	17.66289	Abel Aushona
10	17.71033	17.7006	Abel Aushona
11 (Private area)	17.71027	17.719445	Abel Aushona
12	17.7102	17.7383	Abel Aushona
18 (Crop Field)	17.63825	17.64378	Abel Aushona
13	17.6924	17.66282	Abel Aushona
19	17.62018	17.64571	Abel Aushona
17	17.65626	17.66269	Abel Aushona
15	17.69226	17.70053	Abel Aushona
14	17.69233	17.68167	Abel Aushona

Map of Onghalulu Farmers' Co-operative