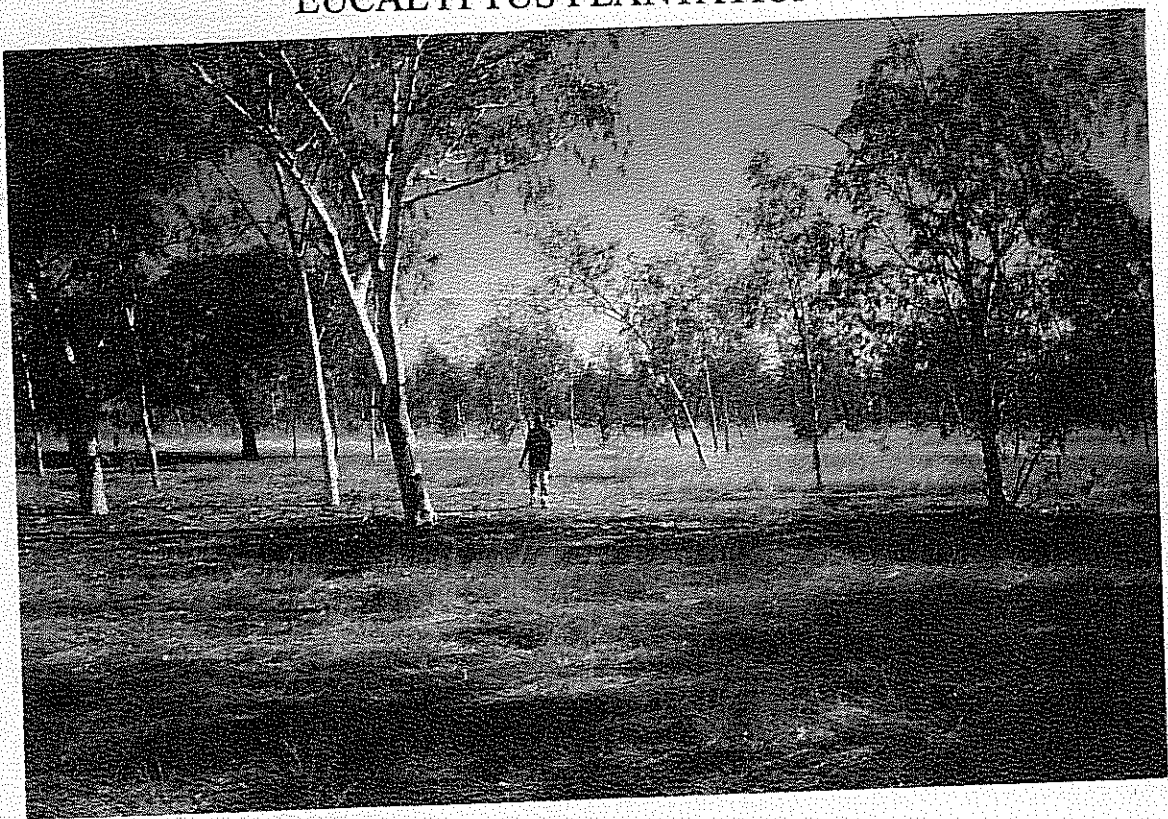


MINISTRY OF ENVIRONMENT AND TOURISM
Directorate of Forestry



**FOREST INVENTORY REPORT FOR ONANKALI
EUCALYPTUS PLANTATION**



Namibia-Finland Forestry Programme

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1.0 INTRODUCTION

The information on Namibian forest resources has been limited on all levels (local, regional and national). Therefore, in 1995 the Directorate of Forestry in cooperation with FINNIDA started a National Forest Inventory (NFI) with the main aim to produce region level information on the woody vegetation in the communal lands of Northern Namibia. In April 1997 the Directorate began a comprehensive implementation of the Namibia Forestry Strategic Plan of 1996 by launching the Namibia-Finland Forestry Programme. The NFI was incorporated as a sub-component, into this programme. The main objectives of the NFI are: (1) To produce region level forest resource data on northern Namibia for strategic planning; (2) To produce more detailed forest resource data for strategic or operational management planning on sub-region areas, and (3) To build Namibian capacity to carry out the inventories. Therefore, the aims of the NFI are both to produce resource information on different levels and to build Namibian capacity for woody resource assessments.

The utility of information from different levels of inventories is different. The region level inventories provide information on the forest resource for the entire region for region level planning. The sampling intensity is low, hence the information on very small units cannot be derived, and the results cannot be used for operational management planning. To get detailed information for operational management, local level inventories has to be carried out. Basically the information substance is the same in the local level inventories as in the higher level inventories. The sampling intensity in the local level inventories is high compared to the region level inventories, and the information is site specific to small units in the area inventoried.

The decision to prioritise the region level inventories in the Directorate of Forestry was taken at the start of the NFI in 1995. The logical sequence in developing forestry in a region is to first carry out a region inventory to determine the resource potential for different uses in the region. If the region inventory indicates potential for forestry development, e.g. timber utilization, the next step is to identify smaller areas for forestry development and to carry out local level inventories in those smaller areas. The inventories on sub-region areas (e.g. Caprivi State Forest) carried out within the NFI have a higher sampling intensity than the region inventories and provide site-specific information to a certain extent. Hence, they can be classified as something between region level and local level inventories.

The current NFFP phase II aims specifically at carrying out local level inventories in order to facilitate operational forest management planning. Onankali inventory is an example of a local level inventory.

This report presents the results from the Eucalyptus Plantation in Oshikoto Region. The Plantation is separated by the road into two parts. One part being on the South and one in the North.

Below is listed the resource reports so far produced within the NFI. The reports are all available at the Directorate of Forestry. The previous reports are:

- Forest Inventory Report of Caprivi Region
- Woody Resources of Western Tsumkwe

- Woody Resources of East and South Tsumkwe, Otjinene and Okakarara Districts
- Forest Inventory Report of Ongadjera Community Forest
- Forest Inventory Report on Uukwaludhi Community Forest
- Forest Inventory Report of Caprivi State Forest
- Inventory of the Directorate of Forestry Eucalyptus Plantations in Kavango Region
- Forest Inventory Report on Nkurenkuru Concession Area
- Forest Inventory Report of Oshana Region
- Forest Inventory Report of Omusati Region
- Forest Inventory Report of Okongo Community Forest
- Forest Inventory Report of M'kata Pilot Forest
- Forest Inventory Report of Bukalo Pilot Forest areas.

2.0 General description of the area

Onankali eucalyptus plantation is located in Oshikoto region, in northern part of Namibia, along Ondangwa-Tsumeb road, 50 km from Ondangwa. The plantation was started on the roadsides along the road in 1976, and has been continued on a trial basis purpose throughout to 1982. The two main species planted were *Eucalyptus camaldulensis* and *Eucalyptus tereticornis*. Afterwards other eucalyptus trees of different sub-species were planted.

According to the management plan, the first survey of the plantation was done in 1989 and Kreike published the result in (1992). The information were presented on Average height, Average Dbh, Average tree volume per ha, Number of trees and Total volume. The second survey was done in August 2000. The aim was an in-service training of the Directorate of Forestry staff members in Forest Inventory both field work and data analysis.

In this report it is deemed necessary to mention the important factors for Oshikoto Region in general that affects the tree growth. This will enable us to understand the tree growth pattern in this particular plantation.

2.1 Climate

The rainfall in Oshikoto increases from 350 mm in the southwest to 550 mm in the northeast. Usually most of the rain fall between November and April with the peak in February. Drought, a long period of low rainfall, is common. It is highly predictable that drought will occur frequently, and thus cannot be considered 'abnormal'.

2.2 Soils

Geographically, the soils of Onankali belong to the Kalahari group (arenosols). Rocks do not occur but precipitated calcareous concretes, 'white stones', are found in some sites. The soils are poor in humus and plant nutrients. The soil reaction varies from neutral to strongly alkaline, which together with high evaporation causes the danger of salinization. The soil and the plantation is sensitive to erosion.

3.0 Inventory design

3.1 Sampling method

Systematic selective sampling method was used to locate plots in the in the field to estimate the quantity and quality of the woody resources of the plantation. The shape of the plots was circular with radius equal to 15 m.

Total number of 60 plots was located in the area. The plots were at the distance of 100 m apart in parallel lines in square plots. The plots were located on grid lines. Because this inventory was a training exercise for measuring trees, some plots were shifted from open places to more wooded ones. In the field the plots were located using Compass and measuring tape.

3.2 Field measurement

The data was collected in circular sample plots, within 15 m radius. All the trees with dbh >3 cm in the plots were measured. Only two parameters was measured; height and dbh. The dbh was recorded in all plots, while the height was measured in every third (3rd) plot. No information was gathered on the environment surrounding the sample plot.

3.3 Data analysis

The height curve was calculated for the plantation using regression analysis. The heights measured in the field in each every third plot were used to estimate the height per dbh. The volumes were calculated using height and volume formula for *Eucalyptus globulus* from "Forestry Inventory and Management Planning in the fuelwood plantations of Ethiopia" (T. Pukkala, V. Pohjonen, 1989). There are no volume functions in Namibia for *Eucalyptus* species. Therefore it was assumed that the growing conditions and characteristics of *Eucalyptus globulus* from Ethiopia resemble the *Eucalyptus* species in Namibia. Microsoft Excel was used for computation.

4.0 Inventory results

4.1 Measured data

The inventory fieldwork was carried out in August 2000. A total of 60-sample plots were measured. 1344 trees were measured, which is on average 22 trees measured trees per sample plot. This is a very high number of trees and indicates the crowding of trees in the plantation. Since only 44 % of the total area was inventoried, the figure of 22 trees per sample plot represents only less than half of the area. 56 % of the plantation was open and therefore not included in the inventory area.

The plantation consists of two different types of eucalyptus. The species names were not considered. That means there is no information on quantity and quality of the species.

The bulk of the stems were found in smaller diameter classes, between 3-6cm, where more than half of the stems were found.

4.2 Results

	Area inventoried
Area in ha	68.2
Total volume m ³	679.53
Volume per ha, m ³	9.96
Total trees	20913
Trees per ha	306.64
Average dbh, cm	9.34
Total number of measured trees	1344

The table above shows the results of the inventoried area (68.2ha), which represents 44 % of Onankali Eucalyptus Plantation. The total area for the whole plantation is 156.6 ha. The total volume in the inventoried area is 679.53 m³, which gives 9.96 m³ per hectare. A total of 1344 trees were measured. In the area inventoried there are 20913 trees, which gives 306.64 trees per hectare. The average dbh is 9.34 cm.

The tree volumes in the plantation are very low, compared to a Eucalyptus plantation in Kavango region, both when it comes to total volume and mean volume per hectare. The average volume per tree is 0.032 m³. As it can be seen in appendix 3 the volume distribution is skewed to the left. This is an indication that the volumes are concentrated in the small diameter class. There is less volume in the bigger diameter class.

Most of the trees were found in small diameter classes, see appendix 4. More than 90 % of the total number of trees was below 15 cm dbh. The maximum

diameter is 46 cm. Only trees with $dbh \geq 3$ cm were measured in the inventory, hence the minimum diameter is 3 cm.

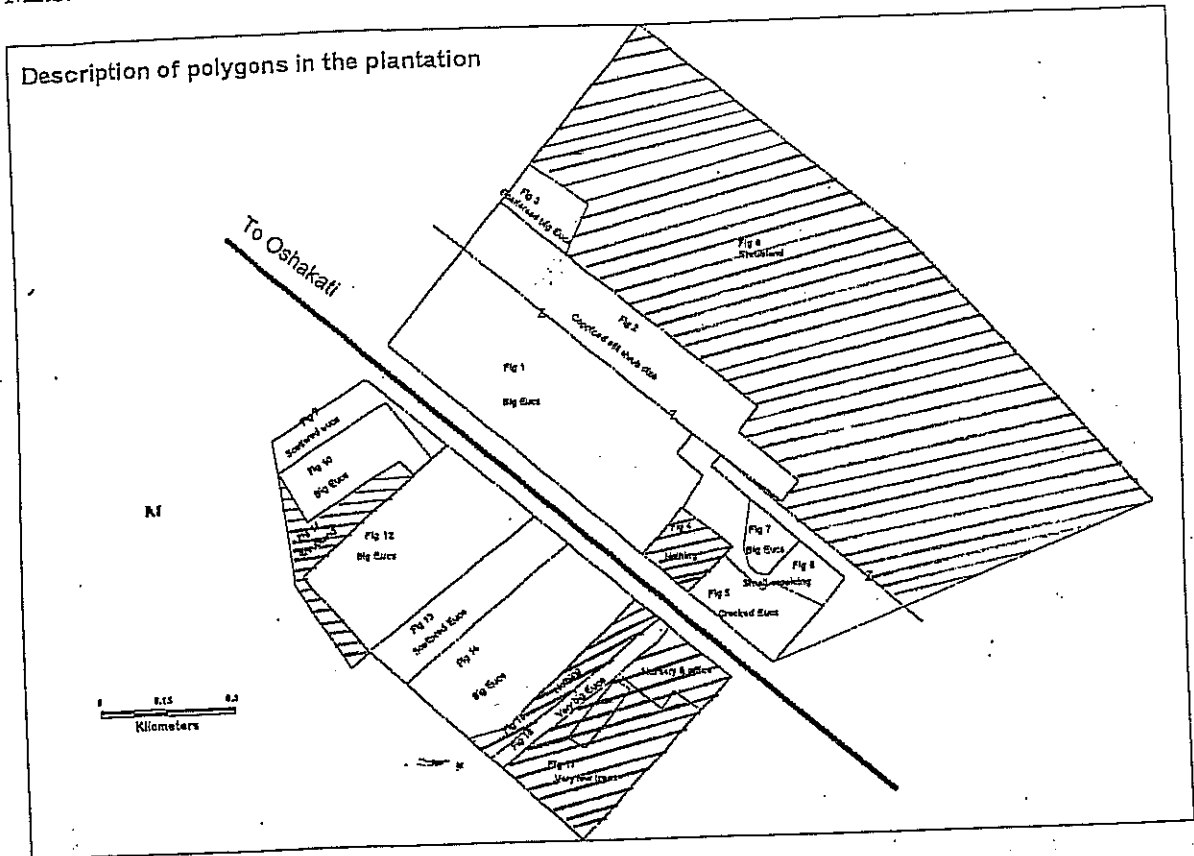
5.0 Discussion

The growth of the plantation is very low considering the time since it was planted. The cause for slow growth is related to the poor soil fertility and lack of water. The growth rate of the coppices is faster than the growth of trees originated from the seedlings. The first harvest was done in 1997. From our observation the height of coppices from year 1997 are of the same height as old trees that have grown from the seedlings planted between 1976 and 1982.

6.0 Proposal for the utilization of the Plantation

Thinning should be done to enhance the proper growth of the trees into more useful timber. Other suggestion is to clear-fell at least 5 % of the area and let trees grow again from coppices. The income from these harvests should be used to improve the welfare of the plantation.

MAP FOR ONANKALI EUCALYPTUS PLANTATION



Note:

The shaded area of the plantation was not included in the inventory. This constitutes 88.4 ha. The unshaded area was inventoried and constitutes 68.2 ha.

References

Pukkala T, Pohjonen V. Forest Inventory and Management planning in the Fuelwood Plantations of Ethiopia.

Shikaputa C. 1994. Management plan for Eucalyptus Woodlots Grown in the Northern region.

Selanniemi T, Chakanga M 1999. Inventory of the Directorate of Forestry Eucalyptus plantations in Kavango Region.

Antti Erkila and Harri Siiskonen. Forestry in Namibia 1850-1990.

Appendix 1

Dbh	Total number of trees per	Total volume per dbh dbh	% of total volume m ³
3	3873.01	14.58	2.15
4	3406.00	22.36	3.29
5	2289.32	23.22	3.42
6	2284.19	33.14	4.88
7	1267.17	24.94	3.67
8	1464.67	37.62	5.54
9	1139.00	37.06	5.45
10	1067.12	42.95	6.32
11	763.33	37.29	5.49
12	671.32	39.18	5.77
13	521.95	35.91	5.28
14	506.35	40.60	5.97
15	330.65	30.60	4.5
16	267.67	28.34	4.17
17	262.02	31.51	4.64
18	193.85	26.30	3.87
19	86.00	13.08	1.93
20	106.99	18.15	2.67
21	22.28	4.19	0.62
22	47.23	9.83	1.45
23	103.84	23.78	3.5
24	18.27	4.59	0.67
25	20.51	5.63	0.83
26	33.87	10.12	1.49
27	10.26	3.33	0.49
28			
29	68.17	25.87	3.81
30	20.51	8.39	1.23
31			
32			
33	10.26	5.18	0.76
34			
35	10.26	5.91	0.87
36			
37	10.26	6.70	0.99
38	26.29	18.23	2.68
39			
40			
41			
42			
43			
44			
45			
46	10.26	10.99	1.62
Total	20912.86	679.53	
% of total volume			100

Appendix 2: Acknowledgements

This report was compiled by Jonathan Kamwi. The successful completion of the Forest Inventory exercise in Onankali Plantation was as a result of commitment and co-operative nature of the National Forest Inventory team and Finnish technical advisor in providing information that is needed to provide a sound management plan for the District Forest Office concerned. The Personnel that were directly involved in the inventory comprised of:

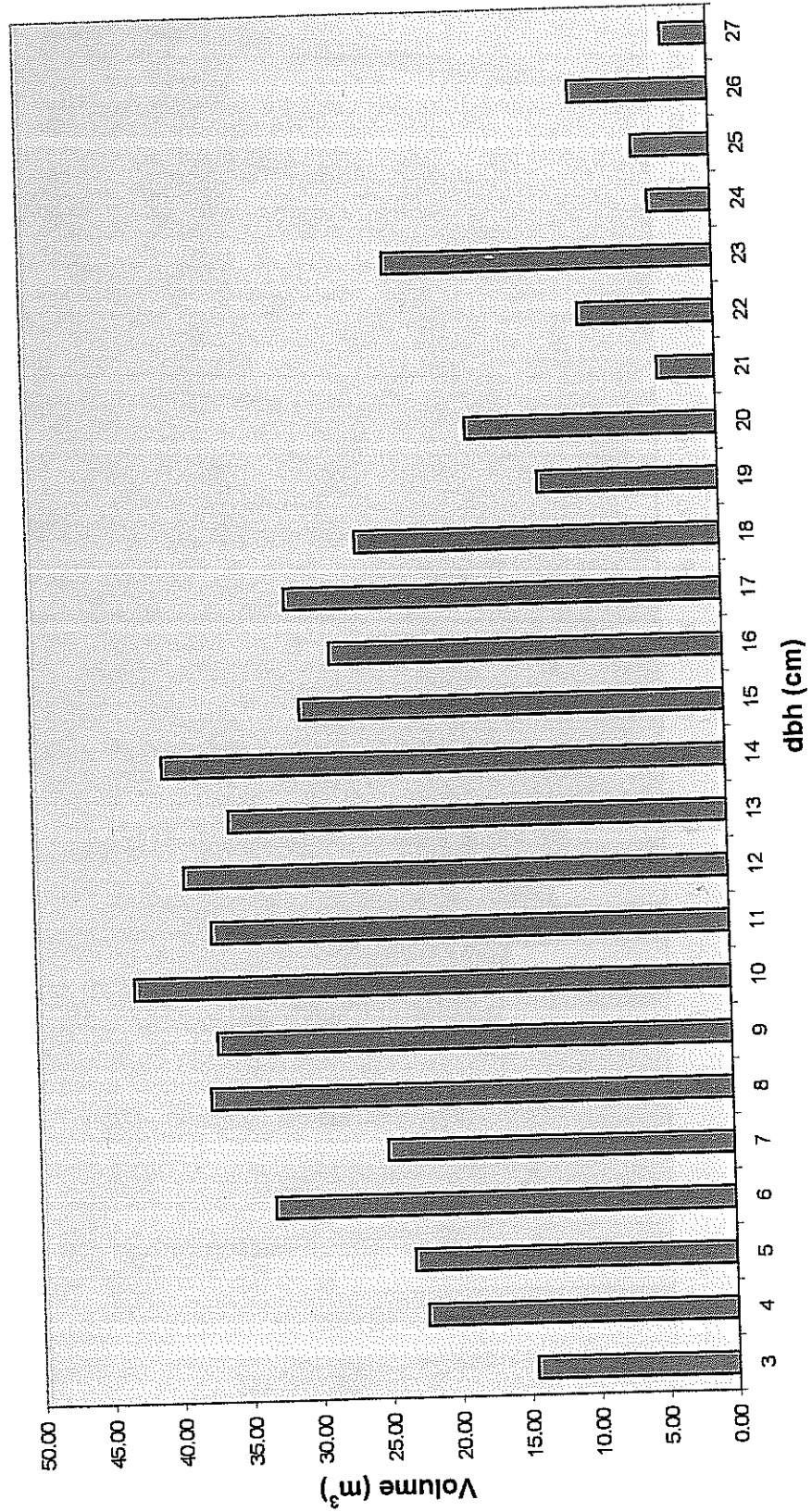
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Appendix 3

Volume distribution for the plantation



Appendix 4

Total number of trees per dbh

