Forestry Publication No. 4

The Ovambo Agro-Silvipastoral System: Traditional Land Use and Indigenous Natural Resource Management in Northcentral Namibia

Emmanuel H.P.M. Kreike

Directorate of Forestry
Ministry of Environment and Tourism
Republic of Namibia

Windhoek
January 1995

Forestry Publication No. 4

The Ovambo Agro-Silvipastoral System: Traditional Land Use and Indigenous Natural Resource Management in Northcentral Namibia

Emmanuel H.P.M. Kreike

Directorate of Forestry
Ministry of Environment and Tourism
Republic of Namibia

Windhoek
January 1995

Acknowledgements

The report, based on field research undertaken in Namibia from February 1991 to October 1993, was supported by several institutions.

Financial support was received from the Dutch General Directorate for International Cooperation (DGIS) - the main donor - through the Namibian Directorate of Forestry, from IBIS-Denmark through the Ogongo Agricultural College, and Finnida. Many individuals and institutions have supported the project with ideas and hard work. It is impossible to thank them all in person, but especially helpful were the staff and students of Ogongo Agricultural College, especially Haaveshe Nekongo, Arne Larsen, and Carlos Salinas, the Directorate of Forestry, especially Dr. H.O. Kojwang, Director of Forestry, Björn Finne, Dr. Mike Müller, Antti Erkkilä, and Owen Mubita. I also would like to thank Jackson Hamatwi for his invaluable assistance during the fieldwork, and Professor A. van Maaren and Ir. F. Wiersum of Wageningen Agricultural University and Professor R. Harms from Yale University for their support. I am also grateful to the staff of the National Archives of Namibia for their advice, and Father Hamutenya, Michael Hishikushitja, and Peter and Jane Katjavivi for their hospitality in Odibo and Windhoek. Last, but not least, I owe gratitude to the Chairman of the National Council of Namibia, Kandy Nehova, the traditional leaders of Ovamboland, the Regional Councillors of Omusati, Oshana, Ohangwena, and Oshikoto, and the many women and men from Ovamboland who were interviewed and who made the research possible.

Emmanuel Kreike

Windhoek, January 23, 1995

TABLE OF CONTENTS

Emmanuel H. Kreike

THE OVAMBO AGRO-SILVIPASTORAL SYSTEM: TRADITIONAL LAND USE AND INDIGENOUS NATURAL RESOURCE MANAGEMENT IN NORTHCENTRAL NAMIBIA

1. INTRODUCTION

1.1 Executive Summary

(a) the land use system in northcentral Namibia is an Agro-Silvipastoral system, based on a crop component, livestock (cattle and goats), and a mix of multipurpose indigenous trees and shrubs. The woody vegetation not only constitutes an important resource in its own right, but also provides critical linkages between the various resources and components.

(b) the indigenous land use system is highly dynamic and flexible and characterized by mobility. Crises are cushioned by a reliance on mixes of resources, and new opportunities and technologies are easily seized if they meet local needs and priorities.

(c) Despite having been subjected to decades of warfare and rapid population growth the Ovambo Agro-Silvipastoral system has enabled the population of northcentral Namibia to deal with crises (the war, droughts, plagues) relatively successful, especially when compared to other areas of Namibia, including the "commercial" farming areas of the north.

(d) Nevertheless, the land use system is under severe stress. Shortage of water, fuel- and construction wood, and land degradation are serious constraints to sustainable development. The stress is not caused only by an increase in the human population and/or the livestock population. Warfare and political measures which inhibited movement of people and livestock (transhumance) and loss of traditional lands (Namutoni) also contributed.

(e) Fears of desertification, however, are overdrawn. Land degradation is a serious problem, including an increase in problems with saline soils which is not a new problem and local farmers have developed a system to limit the impact on crop cultivation. Within the traditional land use system there is considerable potential for improvement and for halting the process of environmental degradation before it becomes irreversible. Before interventions are made, it is critical to first evaluate indigenous and traditional knowledge, natural resources management structures, technology, and tenure arrangements relating to land use. The crucial question is how the traditional and indigenous land use system can be improved upon and where and how interventions and outside ideas and technology can contribute. In northcentral Namibia, a careful and detailed evaluation and assessment has to precede major projects relating to land use. For example, local millet production can be greatly improved, but it is important to

assess what the millet is used for. Sanga cattle is also far superior to any exotic cattle under local conditions. Little is known about the potential of indigenous trees. Yet, before setting priorities it is important to assess what local needs and priorities are. Introducing a dwarf millet which outproduces landraces in grain but offers stalks which are too short to be used in construction are not necessarily an optimal solution, although Okashana 1 already has a firm niche of its own. Indigenous agroforestry technology, including farm forestry and community forestry and intricate management structures for woody vegetation, although subject to erosion, are widespread.

(f) The keyword in development is sustainability. But this requires that all factors be taken into account, in the case of northcentral Namibia which has an agricultural base, it means that the entire land use system has to be looked at. Land and environment are not natural givens, they are cultural, political, economic, and social constructs. Therefore, sustainability requires that an intervention is sustainable, i.e. locally acceptable in all these realms.

1.2 General Introduction

There is a dearth of up-to-date knowledge about the structures and processes affecting and constituting land use in northcentral Namibia, where close to 50 % of the Namibian population is concentrated. Very little in-depth research and analysis of the land use system in northcentral Namibia has been done in recent years. Most of the recent research has been piecemeal, since it has only been conducted on a project by project basis, without the possibility to study the land use system as a whole, as opposed to concentrating on segments, with a limited geographical focus. Most studies focus on individual elements of the system (for example, only graincrops or only cattle) which are furthermore seen as static and regarded as obstacles to development. Moreover, many of the data used for these reports are based on previous reports, which in turn are based on fieldwork conducted 2-3 decades ago (since the war conditions made any research in northcentral Namibia impossible until Independence in 1990) Pre-1990 research was strongly biased by an Apartheid ideology which by definition condemned the indigenous and traditional land use system as backward, static, and detrimental to the environment (i.e. unsustainable). The Ovambo Multi-purpose Investigation for Tree-use Improvement (OMITI) project's findings, based on 3 years of field research in northcentral Namibia, contradict many of the presumptions and conclusions reached in previous reports, and argues that the Ovambo land use system is highly efficient, providing the staple

for nearly half of Namibia's population on a fraction of its total landmass. The local land use system is clearly under stress, evidenced by land degradation (deforestation), but, the application of the term "desertification" as a diagnosis of the problems of the Ovamboland land use system is inappropriate and it is also more a reflection of earlier reports on northcentral Namibia (formerly known as Ovamboland), which were based more on ideology than on any hard data. Environmental problems do mar northcentral Namibia, they do threaten the sustainability of the land use system, and they can be expected to grow more serious in the near future if no intelligent changes are made. The indigenous land use system, however, is also extremely resilient and dynamic, offering a multitude of techniques which can be greatly improved upon to assure sustainability to adress crises facing the population of northcentral Namibia. The crises facing the population of northcentral Namibia are serious, but a careful diagnosis of the causes of the problems is critical and the potential of the local land use system should be tapped to its fullest. Condemning the land use system out of hand as the cause of environmental degradation and misdiagnosing the problems facing northcentral Namibia is only a recipy for disaster.

The aims of the project document that is the basis for this report are as follows:

"- to identify and analyse local knowledge and usage of crucial natural resources in Ovamboland - being water, land and vegetation - in relationship with socio-economical and ecological

processes;

- to formulate and analyse ownership and organisational structures of these natural resources (including rules, regulations and institutions that regulate access and usage of land, water, vegetation and animals);

- to accumulate qualitative and quantitative socio economic and ecological data in order to attain relevant basic knowledge for future planning in the field of land and water management; in order to provide the availability of valuable information and analyses in the described field, which information can be used as a basis for future planning and implementation of rural development in Ovamboland."[1]

This report feeds into a larger research project based on field research undertaken in Namibia from February 1991 to October 1993. The extensive database that resulted from this field research underpins more systematically (with quantitative data) the analysis and conclusions presented in this report in a more scientific way. The final study will also compare the economic and environmental efficiency of smallholder farming in Northcentral Namibia and the so-called commercial farms south of the Red Line, a fence running east to west to control the spread of livestock diseases from northern Namibia to the rest of the country.

[1] Project Document Socio-Economic Baseline Survey in Ovambo Regions (NA 001201), Feb. 1994.

1.3 Agro-silvopastoral System

The Ovambo land use system can be classified as an Agro-Silvipastoral system because it consists of three main components:

(1) Agriculture: crop cultivation;

(2) Pastoralism: use of livestock;

(3) Silviculture: use of trees.

The Ovambo Agro-Silvipastoral System is spatially based on the Cuvelai and Oshimolo seasonal rivers basin. The system comprises an area of approximately 500 by 500 kilometers between the Cunene River in the West, the Kavango (Cubango) River in the East, Cassinga in the North, and the Etosha Pan in the South. The land use system includes the Lower Kunene area of Angola and what was formerly known as Ovamboland (the modern regions of Ohangwena, Omusati, Oshana, and Oshikoto) in Namibia. The Angolan and Namibian sections of the land use system are very closely connected, as is, for example, very clearly illustated by the importance of the seasonal floodwaters (Efundja) from Angola to Namibia. This report will focus on the Namibian part of the land use system.

The report first discusses the crops component, followed by an analysis of the livestock component, while a third section outlines the trees component.

2. THE CROP COMPONENT

2.1 Introduction

Of the approximately 6,000,000 ha surface area of Ohangwena, Omusati, Oshana, and Oshikoto, only an estimated 150,000 ha is arable land. An estimate from 1978-1979 claimed that 110,000 ha was planted with pearl millet, the staple crop of northcentral Namibia.

Most of the crop cultivation is concentrated in the Ovambo floodplain, a flat plain that gently slopes southwards, interspersed by seasonal rivers and floodchannels running roughly north-south. On the Namibian side of the border, the floodplain forms a delta whose mouth points towards the source of the water in Angola, and narrows towards the Etosha Lake. The seasonal rivers and floodchannels (Kw: sing. oshana; pl. eeshana) are fed by two distinct watersheds in Angola: the Cuvelai system in the western part of the Lower Kunene, and the Oshimolo system in the eastern part of the Lower Kunene.[2] The flood (Kw: Efundja) is irregular, occuring on average once every three years, but is critical to settlement, crop production, livestock and wildlife, and vegetation in general.

With the construction of the Ovamboland canals (the Oshakati canal and the Etaka canal) in the 1960s and the pipeline system, the Cunene River was added as an alternative source of water,

[2] The two main variants of the Ovambo language (Oshivambo) in northern Namibia are the Ndonga and Kwanyama dialects. The dialects are identified by Nd (Ndonga dialect) or Kw (Kwanyama dialect).

feeding the floodplain, although the canals also captured and redirected the naturally occurring flood.

The flood regime is critical for crop cultivation in two respects. First, it inhibits the use of much of the lower ground in the floodplain as arable land. This was illustrated clearly in 1992-1993 and 1993-1994, when farms and fields which had been constructed in floodchannels after decades of faltering floods, were flooded and destroyed. The soils in the center of the floodchannels and rivers consist of dense clay and are highly saline. The soil on the edges of the floodchannels and rivers is more suitable for crop cultivation but a thin A horizont is underlain by a slowly impregnable solonetz B horizont and is very susceptible to flooding, even as a result of heavy local rains. Therefore, in the Ovambo floodplain, crop cultivation is confined to the higher ground between the rivers and floodchannels.

Second, during flood years, the flood regime acts as a natural irrigation system, enabling deeprooting graincrops to survive the "little dry season" which often characterizes part of the month January, after the crops have been planted during the onset of the rains in November and December. The floods follow the rains with some delay, and commonly the first floodwater from Angola reaches the Namibian side of the floodplain in late January or early February, recharging both surface and subsurface water supplies.

Outside of the Ovambo floodplain, in most of the Oshikoto and Ohangwena regions, where seasonal flood channels

(oshana/eeshana) are totally absent, crop cultivation is confined to the lower ground, on the lower banks of seasonal rivers, on the edges of pans, or even within pans. Soils are clayish and crop cultivation here is much more dependent on ploughs, in contrast to the higher ground in the floodplain, where the soils facilitate the use of hoes.

The average field size of a farm is estimated to be from 2 to 5 ha. Farms outside the floodplain (most of Ohangwena and Oshikoto) are larger than farms in the floodplain.[3] With the adaption of the plough since the Second World War (WWII), farmlands have been encroaching on communal grazings between individual farms, as ploughs allow for the preparation of larger fields, relieving a labor bottleneck during the planting season.

2.2. Land Tenure

Farms, consisting of a homestead, fields, and a fallow, are allocated to young couples after they marry (either "legal" church marriages or traditional marriages) dependening upon the availability of arable land. Tenure is very secure, and short of alienation through sale, mortgage, or gift, tenure is almost comparable to freehold. Originally, land tenure endured for the lifetime of the head of the household, and upon the death of the head of the household (usually a male), the farm could be reallocated.

---

[3] Land related Issues in the Communal Areas, 1: Owambo. Namibian Economic Policy Research Unit (NEPRU) Paper for the National Land Conference, Windhoek, 1991.

After the Second World War, however, a significant change has gradually taken place concerning the inheritance of farms by the widow and children of a deceased male head of a household. Policy statements by the government after Independence in 1990 have de facto institutionalized this practice, and inheritance not only by a widow of a late husband's farm, but also the inheritance of a parent's farm by male children, have become a rule rather than an exception. Female children, however, can not inherit their parent's farm, a reflection of a steady deterioration of the legal status of women under colonial rule and especially Apartheid.

Inheritance of land is a recent innovation in the Ovambo land use system. Previously, land would revert back to the land allocator (usually the village headman or "subheadman") who could allocate it to any applicant and receive an allocation fee for the farm. It was not uncommon that a widow was allowed to remain on the farm with her children if she could pay the land fee. It was more common, however, that a widow could not pay the land fee and was therefore evicted. The land fee is usually from 1 to 2 oxen, or their equivalent in money. The land fee is only paid for existing farms; no land fee is paid in cases where a newly wed couple clears a piece of bush.

Land is allocated by the "village owner" (Kw: Omwene womukunda; Nd: Omwene gwomukunda). The village owner manages all land resources within the boundaries of a "village" (omukunda), which consists of 30 to 100 dispersed farms. People apply for the

position of village heads by applying to the "land owner" (Kw: Omwene woshilongo or an Elenga) who is a Chief, or King, whenever a position becomes vacant after the death of a village owner.[4] After the payment of a land fee to the "land owner," the village is allocated to the successful applicant. The village headmen should be considered like village mayors, whose primary responsibilities are the arbitration of local disputes, and the management of resources at the village level (both the allocation of farms and the management of a village's commons, that may include dams, pastures, trees, and the woods surrounding the village).

The land fee for a village can be considerable, and is easily three to four times the amount charged for an individual farm. The village headman recuperates the land fee he paid for the village by charging land fees for the allocation of existing farms which become available. Since farm tenure is lifelong, however, the turnover of existing farms is very low. The land fees and the imposing and payments of fines - from which the village headman generally receives a share - constitute the village headman's salary, which constitutes a part-time job since the village headman is also a farmer. A less transparent part of a village headman's returns from his office are favors he can extend to relatives and patron-client relationships a village

[4] In colonial discourse titles of traditional rulers were deflated: a King (Ohamba) became a Chief, a Chief (Omwene woshilongo) became a Headman, and a Village Headman (Omwene womukunda) became a Subheadman. In this report, the titles are used their original meaning, i.e. an Ohamba is a King, etc.

headman can built up through his control over a village's natural resources. Newly wed male relatives frequently move in with uncles or brothers who are village headmen until the latter can allocate them a farm in his village.

The shift to the automatic inheritance of farms without the payment of any land fees obviously will lead to considerable changes in the system. The control of the village headman over land declines as land tenure becomes even more similar to freehold tenure. Also, village headmen will lose a considerable share of their "salary." Their income from land fees should not be overestimated anyway, because many villages are small, averaging up to 30-50 farms, and the turnover of farms is low because of the lifelong lease. It is not surprising, therefore, that traditional leaders have been petitioning the Namibian government to be paid salaries for their time consuming duties.

The size of the land fee varies from community to community in Northcentral Namibia and is also dependent upon the quality of the farmland. Outside of the floodplain, in large parts of Ohangwena and Oshikoto regions, where pressure on land is less intense, the payment of a fee for farmland has virtually died out. In the more densely settled floodplain, however, the land fee is a critical transaction required to gain access to land and to formalize tenure.

A land fee is only charged for existing farmlands, i.e. land that has been previously cleared and cultivated. A household that wants to clear land in order to establish a farm on that land in

a village needs the permission of the village headman, but is not required to pay a land fee. Clearing new land, however, is labor intensive, and farming on newly cleared land can be risky. Within the floodplain, most arable land has been brought under cultivation for decades and only very marginal lands are available. Improving land by manuring in the floodplain is difficult because of the scarcity of grazing; most cattle is kept far form the floodplain and manure is not readily available. Outside the floodplain, in most of Ohangwena and Oshikoto regions and southern Omusati region, the lack of water inhibits settlement.

The head of a household is the farm owner (Kw: Omwene weumbo; Nd: Omwene wegumbo). As was stressed above, in many ways, land tenure in northcentral Namibia is very close to freehold tenure. A farm owner can be expelled from the land with his or her family, but this is extremely rare. Theoretically, however, it is still possible if the head of a household has been responsible for a serious disturbance of the peace or is found guilty of a crime by a (traditional) court.

Because of the labor contract system, many de facto heads of household in northcentral Namibia are women, although the imposition of Roman Dutch Law under Apartheid has demoted the formal legal status of women in Namibia to one of legal minors, an Apartheid legacy of which the consequences - although the Namibian government has been focussing on the issue - continue to mar the Namibian present and future. The imposition of Roman

Dutch principles denegrating the legal status of women contributed to a decline in agricultural output in northcentral Namibia.

The head of the household, as the farm manager, may suballocate fields (Kw: Oshikolo (sing.)/Oikolo (pl.)) to other members of the household. Tenure of these fields is highly secure, and graincrops grown on a field become the property of the field manager, who may sell the grain s/he harvested from the field. A field, however, reverts to the farm manager when a field manager ceases to belong to the household, for example, by establishing her/his own farm. In the recent past, this practice was an alternative through which unmarried young women (and men) could accumulate private property, including livestock, clothes, and jewelry. Under the last decades of Apartheid occupation, however, this practice declined rapidly, and is at present no longer universal in northcentral Namibia.

2.3 The Cropping System

2.3.1. Millet

The staple crop is a drought resistant millet landrace, Omahangu (Pennisetum glaucum, formerly known as Pennisetum typhoides). Seed selection is widely practised. Milletheads are broken or cut off the stalks and collected on the threshing floor. They are selected by type: the best seeds of the different cultivars are selected as seed for the next season. After the selection, the seed supply for the next year is mixed for

storage. A substantial amount of seed is stored, enough to seed at least twice if the first batch of seeds fails to develop.

The major local cultivars are: Ovambo or Kwanyama millet, Engipiti, and Okashana. Ovambo or Kwanyama millet is distinguished by its extremely long stalk. Kwanyama millet needs lots of rain because it first grows very tall and only then forms its heads.

Engipiti has somewhat shorter stalks than Ovambo or Kwanyama millet, but it has bigger grains and longer heads. Its productivity is equal to Ovambo or Kwanyama millet, but Engipiti grows faster and shows heads before Kwanyama. Engipiti is actually a fairly recently adopted exotic cultivar. Its local name is derived from the word for Egypt, Engipiti. It was an open pollinated cultivar introduced during the 1940s and 1950s via South Africa from the Sudan. The fact that it is stilll locally recognized as a separate variety with distinct properties is a dramatic illustration of the sophisticated level of local agricultural knowledge in general and seed selection in particular.

Ovambo or Kwanyama and Engipiti seeds are intercropped. Okashana, however, can not be mixed in with these two cultivars since it grows much faster and if planted simultaneous, quickly outshades other cultivars. Moreover, if the planting of Okashana is delayed when it is intercropped with Ovambo or Kwanyama and Engipiti, it can not compete with the much taller and probably much deeper rooting traditional millet varieties. Okashana,

therefore has to be planted on separate fields. Okashana 1 was developed by the ICRISAT and introduced in Namibia in 1990 by the FAO and Rossing. It is a fast growing and high producing dwarf cultivar which ripens in three months.

The Food and Agriculture Organization (FAO) has expressed disappointment over the low rate of adaption of Okashana 1. The FAO, however, set its goals too high by hoping that the new cultivar would replace the local cultivars. It has not, and is not likely to do so, because the local varieties are highly adapted to the local climate, do not have to be bought for cash, and serve other needs besides food production (the long stalks of Ovambo or Kwanyama millet, for example, are highly regarded as a construction material, while Okashana 1 has very short stalks).

At the same time, the FAO has underestimated the great contribution Okashana 1 has made. Okashana 1's fame has spread even to the remotest corners of northcentral Namibia, and it is held in high esteem for its own distinctive properties. Farmers from Omusati, Oshana, Ohangwena, and Oshikoto regions do not see Okashana as a substitute of the local cultivars, but as an important addition to their food security arsenal. Farmers plant the Ovambo or Kwanyama and Engipiti cultivars first on the best soil to be assured of at least a minimum harvest of these hardy species to ensure survival. When time, labor, and soil is permit, and the seed is available (and in the remote districts it is not), farmers plant Okashana 1 on separate plots. Okashana grows much faster than the local varieties, it is held in reserve by

farmers who have access to the seed: if the fields with the local seeds are likely to fail, and not enough time is left to plant them again, Okashana 1 seed, however, is often not readily accessible to farmers in remote areas and even at major centers supplies of the seed run out when the demand rises. The government could greatly enhance food security in northcentral Namibia if it held large supplies in stock in the area to sell it to farmers through all distribution channels (government, churches, schools, NGO's) in years when the rains are very late as in the current year. If the lack of rains has not allowed planting by early February, time is running out for using the traditional cultivars, but Okashana 1 could still be planted with good harvest prospects. Stocks need to be in place for distribution by late January at the last. Such a service by the Government would make crops cultivation in northcentral Namibia even more secure that it already is and greatly diminish the cost and agony of famine relief in this part of the country.

The response to the introduction of improved cultivars based on experiments taking place at Mahenene Research Station in Omusati Region will be very similar to Okashana 1. Based on land races, ten varieties are being improved through careful seed selection: some are selected for the length of their stem, while others are selected for grainproduction. The research will make additional varieties available to farmers in northcentral Namibia, enhancing their flexibility to adapt to the circumstances during a particular growing season, to the specific

demands of a certain microclimate, or even to the tastes and needs of an individual household. Moreover, since the cultivars being selected and improved at Mahenene are open pollinated varieties, an infusion of selected higher yield varieties may boost total yields through a process of cross pollination. Farmers are likely though, to maintain supplies of the "original" land races. The adaption of new cultivars and careful seed selection are not new to northcentral Namibia. Both exotic millet and sorghum cultivars, and even wetland rice, were introduced during the colonial era and adapted by Ovambo farmers.

Through a process of careful rational seed selection, experimentation, and natural selection, Ovambo farmers over centuries have selected a series of millet cultivars which are best adapted to local conditions. Traditional cultivars were not only selected for short growing seasons and maximum grain yield (as Okashana 1 was), but also for their resistance to droughts, poor soils, salinity, local pests and plagues, and their vegetative production (millet stalks are important construction materials and livestock fodder). A case in point is the heavily bearded millet cultivar which is blessed with a natural defence against birds. Substituting the variety of cultivars with one cultivar would place all a farmers's eggs in one basket. One single disaster could wipe out the entire crop, as the fate of maize monocropping elsewhere in Namibia all too often has illustrated. The selection and use of an array of cultivars, with different properties, like staggered planting and intercropping,

constitute one of the many strategies to reduce the risks of an overall crop failure. Given the semi-arid conditions in northcentral Namibia a diversified approach to crop cultivation is the most rational choice. Ironically, many of the techniques used in traditional crops cultivation in northcentral Namibia - including intercropping, minimal tillage, and agroforestry - have been rediscovered recently for their potential to improve Western agriculture. Too often, however, development experts in southern Africa favor "commercial" farming based on monocropping, mechanized plowing and clearing of trees from fields (to allow mechanized cultivation) - responsible for land degradation and harvest failures in Europe and America - as the future for farming on northcentral Namibia.

There is no doubt much room to improve upon traditional crops cultivation. An Oxford University research team found that millet yields of 250 to 400 kg./ha were possible under "normal" rainfall conditions. Below average rainfall, however, could reduce the yield to 70 to 100 kg per ha.[5] With the use of chemical fertilizers, yields of up to 450 kg/ha were attained during experimental plantings in the Mangetti area in southeastern Oshikoto during the 1970s. Experiments with improved cultivars in colonial Ovamboland showed potential yields of up to 1,900 kg./ha.

---

[5] Hay, R., J. Pell, and C. Tanner, Household Food Security in Northern Namibia. Food Studies Group, Oxford University, 1990. For more comprehensice tests on millet productivity see, Elvira Haina and Flemming Eriksen, Results from CCN/Danchurchaid dryland crop experiments and farm demonstration plots, 1992-1993.

Crop production is very labor intensive may be compared in that respect with horticulture. Although the plough is important for field preparation, seeding, transplanting, weeding, and harvesting are done by hand with hoes.

Four to five seeds are planted in one "hole" and lightly covered with soil. Under good conditions, all seeds may sprout and grow. If the rains, space, and time allow, young plants are taken from the 4-5 that developed and transplanted to other locations in the field. The leaf tips of the transplanted plants are cut off to stimulate root development in the new location. Under normal rain conditions, after a few weeks transplanted millet can not be distinguished from the rest of the crops. The practice is widespread.

Competition of weeds is very fierce, especially in fields where manure has been applied, and up to three weedings are required to ensure an optimum yield. The weeding is done by hand, using a hoe, and is very labor intensive. Although the adaption of the plough after 1945 allowed for larger fields for seeding and released labor from field preparation to be used for seeding, weeding remains a serious bottleneck. Often, households do not manage to weed larger ploughed fields as effectively, resulting in declining yields per ha, although, since more of the farm's land can be tilled, the total yield per household remains the same. The result has been a gradual shift towards a more extensive use of arable land as a result of the adaption of the plough. On the other hand, the adaption of the plough has made a

larger percentage of northcentral Namibia's land surface available to crop cultivation, since the animal and tractor drawn ploughs facilitate the tilling of the heavier clay soils near and even in the seasonal watercourses, rivers, and pans.

Harvesting is done by hand, and millet and sorghum heads are broken off the stalks individually when they are ripe. The heads are stored and dried on the treshing floors, which are located in the fields. The threshing floors are fenced with thornbush to protect the harvest from animals. Harvested but unthreshed millet and sorghum are dried and stored on elevated platforms to decrease postharvest loss from vermin, insects and pests. The best heads are carefully separated and selected as seeds for the next agricultural season. The heads are also separated by species and use, for example, different kinds of sorghum are used for beer and porridge.

Staggered planting, the use of different cultivars of one crop, and intercropping allow a household to evade as much as possible harvest bottlenecks, facilitating labor intensive and careful harvesting, and thereby minimizing harvest and post harvest losses. Threshing the harvested grainheads begins as soon as a sufficient quantity of grain has been harvested.

2.3.2 Other Crops

A range of crops, including grains and legumes is intercropped with millet. Intercropping is still widespread, but its importance has decreased in recent decades as a result of

important transformations in crop cultivation.

In lower areas, close to the edge of seasonal watercourses, rivers, pans, and often even in watercourses and pans, sorghum is planted as a monocrop (millet is less resistant to flooding). Usually this is sorghum used for beermaking. Crops in these spots are at a much higher risk, but, in general, sorghums are not a food security crops, but rather a "luxury" crop or a market crop.

As in the case of millet, several distinct sorghum cultivars are distinguished based on grain size, color, form, and size of the head, height, and use. In the traditional area of Oukwanyama (encompassing Ohangwena and a large part of Oshana), farmers distinguish four varieties:

(A) hamunyela yokafinga: a very tall cultivar used for beermaking;

(B) eengonya (or "fist"): a short variety with a large head;

(C) ombate: a tall white sorghum used to make porridge (oshifima);

(D) okalya kaushimba: a red sorghum introduced from the Police Zone (i.e. colonial Namibia south of Etosha Park), and used to make tombo a widely sold alcoholic beverage.

Sorghum is seeded in separate "holes," 4-5 seeds of mixed cultivars per planting hole. Sorghum is also transplanted and the tips of the transplants' leaves are cut off.

Other crops which are intercropped with millet and sorghum are Omakunde beans (Vigna unguiculata subsp. dekindtiana),

several varieties of pumpkin (Cucurbita masima) and watermelon varieties (Citrullus vulgaris). Additional crops are calabash (Oshikola) and cucumbers (Oshitila) but these are dependent on good rains. Bambara nuts (Eefukwa) and groundnuts (Eembudufukwa) are grown separate from other crops.

An important part of the diet consists of a variety of leafy vegetables, called spinaches or cabbages. They are either eaten fresh (when in season during March-April) or dried. Although they are sometimes considered "wild plants," they are in fact crops, and some are grown as crops (leaves of Omakunde beans, for example are harvested as spinach), and a number of them may be qualified as "semi-domesticated." In eastern Ohahangwena, many of the spinach cultivars grown are exotics, imported from the Ovambo floodplain and initially grown from seeds. A German doctor at Engela Hospital pointed out that in January and February 1993 there were 15 deaths each month amongst malnutritioned children in the hospital. In March, however, the incidence of malnutrition and mortality due to malnutrition dropped dramatically, a phenomenon which he attributed to the availability fresh spinaces and tree fruits (marula fruit, i.e. the fruit of Sclerocarya birrea (Omwoongo) which is twenty times as rich in vitamin C as oranges).

2.3.4 Horticulture

As has been argued above, the intensive cropping system in northcentral Namibia can in many ways be designated as horticulture. Horticulture in a strict sense, i.e. as "vegetable gardening," is also practised. In the northern half of Oshana and in the eastern part of Ohangwena, small vegetable and fruit gardens for growing indigeneous vegetables (beans, spinach, sweet potato, maize, peppers), exotic vegetables (tomatoes, onions) and fruits (papaya, mango, guava), hand irrigated from local wells and waterholes, became increasingly common after WWII. In the semi-urbanized Oshakati-Ongwediva-Ondangwa axis, many vegetable gardens can be observed which include dense plantings of maize and sugarcane, irrigated from the pipeline running parallel to the road.

Water is obviously a constraint to vegetable gardening, but its potential is high along the Ovamboland canals and near the main pipeline, where a reliable water supply can be guaranteed throughout the year. On the so-called Fishgrate system, a system of smaller pipelines and taps running north and south of the main trunk pipeline, the potential is limited, however, except for reliable local supplies of water. If even the Rossing experimental farm at Okashana and St. Mary's Mission at Odibo (which are on opposite ends of the Fishgrate system) cannot be guaranteed water year around under the present supply restraints, then it would be unwise to encourage small farmers to take up vegetable and fruit gardening along the Fishgrate system. The low

capacity of local waterholes and wells - which during the dry season can often hardly sustain human consumption - is a serious constraint even to hand irrigated horticulture in many areas.

Despite the water constraints, however, horticulture is actually very widespread in northcentral Namibia, although not in a spatial concentration that makes it recognizable as such to western trained eyes. The pallisaded farms or homesteads themselves are almost perfect greenhouses, with microclimates created by shade, extensive windbreaks, soils rich in organic matter, humidity and water (refuse water is generally discarded in corners or on plants and under trees within the homestead). There is also a virtual absence of weeds since the soil is kept clean as a precaution against snakes and insects. Huts, fences, and stockades also provide support for crops. Young fruit trees, including exotic species (papaya, mango, guava), tomatoes, tobacco, cucumbers, gourds, and maize are favorite crops. These crops are not concentrated in one area, but are dispersed throughout the homestead in corners and on the sides of huts and fences.

2.3.5 Crop Pests and Plagues

The impact of pests is mitigated by the high variety of cultivars, intercropping, and the occurrence of trees and bushes in and along fields. In combination with drought conditions, however, pests can lead to serious pre-harvest losses. The 1915 harvest throughout Ovamboland was lost on account of an invasion

of army worms, which contributed to transforming a serious drought into a tragic famine which killed or displaced thousands of people.

The interplanting of different cultivars slows down the spread of diseases and other pests, as does intercropping. Trees and bushes function as windbreakers, reduce evapotranspiration, and protect crops against temperature oscillations and wind borne particles. Some tree and bushes, however, are disliked, especially in southern Oshana, southwestern Oshikoto and southern Omusati, because they harbor pests, especially certain species of birds, which can lead to serious losses.

2.3.6 Storage and Post-Harvest Losses

Before the harvest commences, large grain storage baskets (Omanda/Eemanda) are made or recycled. The size and quantity of the baskets are dependent on the expected harvest. The threshed grain is stored in the baskets, which are sealed and lined on the inside with clay. Ashes are added as a insect repellent. When a basket is full, it is sealed with a clay covered top, and the basket is placed on three legs and stored under a roof. This storage technique is highly efficient, both in its use of local materials and as a means to preserve the grain. The grain remains dry and is protected from insects, vermin, and birds. Grain can be effectively stored for up to 5 years without a significant loss of quality, provided the seal is not broken. The baskets themselves last for up to 20 years. Colonial experiments with

concrete storage silos were expensive and ineffective: the humidity level of the millet proved too high for the airtight concrete silos, while the baskets, because their walls are a composite of non-porous clay and more porous woody materials, proved to be able to accomodate the humidity level of the contents. Prolonged storage of millet, however, is associated with a fungus which causes a serious disease, known as Purpurae.

3. THE LIVESTOCK COMPONENT

3.1 Cattle

Cattle is a resource that is critical to the land use system and the economy of northern Namibia and southern Angola for five primary reasons:

(1) as a source of manure to maintain soil fertility and crop production. The use of cattle manure is very widespread in the region. Cattle ownership is but one way to gain access to manure. Many cattle are placed for shorter or longer periods in the care of friends, relatives and/or clients through complicated cattle lending agreements which enable people who do not own cattle to have access to cattle products, including manure. The shortage of grazing in the Ovambo floodplain allows households without cattle to permit neighbors to graze their cattle on their fields after the harvest, which is another way to gain access to manure. Given the intensive cropping system practised in northcentral Namibia, an annual supply of manure is critical in order to maintain soil productivity.

(2) as a source of dairy products.

(3) as a source of meat.

(4) as a source of animal power: oxen are used for ploughing.

(5) as a savings and insurance fund: cattle is a mobile resource which can be easily moved to better pastures or safer havens in times of crisis. Also, cattle can always be exchanged for millet or money.

Sanga cattle is indigenous to northern Namibia and southern Angola. Sanga cattle are small in stature, but very hardy and well adapted to the local conditions. The colonial administration attempted to introduce cattle species and/or to cross-breed the Sanga cattle with Afrikaner cattle and with such exotics as Herfordshire. These experiments, however, met with little or no success. Trials in the late 1970s shed new light on the favorable properties of the Sanga cattle and their productive potential under the local harsh and unpredictable conditions. Although a report by Chris Tapscott claims that the productivity of Sanga cattle is low, a research report based on trials with indigenous cattle in 1979/80 suggests that the contrary is true.[6] Sanga cattle calving percentages, for example, proved to be much higher than either Afrikaner or Simmentaler cattle, and although Sanga cattle were of smaller stature than Afrikaners and Simmentalers, their growth rate was higher from birth to 18 months.

It seems that livestock in general, and cattle in particular, are increasingly concentrated in the hands of fewer and fewer owners. To a certain extent, however, this trend is mitigated by the highly complicated system of cattle-lending, which tends to redistribute cattle over more people in order to spread the risks and to allocate the cattle over a broader resource base. Thus, the concentration of cattle in the hands of cattle barons does not necessarily diminish access to cattle

[6] Tapscott, C., The Social Economy of Livestock Production in the Ovambo Region. NISER Discussion Paper No. 4. Windhoek: University of Namibia, 1990.

products, e.g. manure, sour milk, and butter.

The first and foremost function of cattle is as an savings account and an insurance fund. Droughts and crop failures are always a threat in northcentral Namibia, subject as the area is to the vicissitudes of a semi-arid environment. Although the possession of cattle very much - but not exclusively - determines the status of its owner, cattle it is not considered to be "sacred," as it is said to be in some other southern African societies. When people are confronted with food shortages, cattle is readily exchanged for grain. Cattle owners also have a long tradition of selling cattle to traders, although the enforcement of the Red Line and the war conditions in Angola have curtailed access to external markets.

3.2 Other Livestock

Smallstock, mainly goats, and to a much lesser extent, sheep and pigs, are important sources of meat and manure. Smallstock is kept in the inhabited zones near the farms, and is allowed to graze and to browse in the communal areas. At night, smallstock is kept in kraals next to the homesteads. Fields are protected from livestock by fences and/or herders, who are usually small children. After the harvest, livestock is allowed to browse on the millet and sorghum stalks. Pigs are permanently kept in pens.

Horses and donkeys are generally not herded, and roam around almost freely. Horses are very limited in number, and are mainly a traditional symbol of status, associated with chiefly power.

Donkeys have increased greatly in numbers over the last decades because of their importance as cheap draught animals (plowing) and transport (water and wood) since supplies of water and wood are found at increasingly longer distances from the farms. Except for these functions which are seasonally bound and limited to the early morning and early evening, donkeys are little used. An additional advantage is that they require little maintenance and are easily replaced. Their impact on vegetation cover and soils, however, is substantial, because of their foraging habits and because they concentrate around permanent sources of water (the canal) without being managed through herding. Like smallstock, donkeys and horses are kept in the inhabited zones, near the kraals.

3.3 The Transhumance System and Grazing Resources

Until the 1970s, the cattle was taken from the central Ovambo floodplain to outlying areas in Namibia and Angola during the dry season, when supplies of water and grazing ran low. Early in the rainy season, most of the cattle was brought back to the floodplain area providing households with dairy products and manure to fertilize the soil. At present, however, fewer and fewer households with cattle have access to sufficient water and grazing, even during the rainy season. As a result, they are unable to bring their cattle back to the floodplain, resulting in a loss of dairy products and manure for households, with negative long term effects on diets and soil fertility.

During the time that the cattle remain in the floodplain, the higher areas which are not utilized for crops cultivation, are used as grazings. When the rain- and flood waters recede, the cattle descend to the oshana bedding-grazings.

Most of the cattle, guarded by herders, is kept away from the floodplain, and is led to cattleposts to the west, southwest, south, southeast, and even north into Angola, both in the Oshimolo and along the Cunene. Sanga cattle are also browsers, and the woodlands of eastern Ohangwena Region are an important source of fodder for cattle, especially when the grasses become increasingly unpalatable during the dry season. Lack of water, however, makes large areas of the southeast Ohangwena and Oshikoto) at present inaccessible as grazing and fodder reserves.

Despite the uncertain security conditions throughout the war, the Oshimolo in Angola remains an important grazing reserve for cattle from Namibia. Coordination between the governments of the two neighboring states is not only required regarding the region's water resources (the Cunene), but also with regard to access to grazing. The difficult conditions of access to the Oshimolo to cattle from Namibia during the last decade may be an important factor explaining land degradation, especially pastureland in the southern parts of northcentral Namibia. A renewed reliance upon the Oshimolo will relieve much of the pressure on grazings in the southern and western areas. If the Red Line is extended to the boundary between Angola and Namibia, however, and the grazing reserves in Angola once more becomes

inaccessible, grazing pressure on the remaining pasturage will greatly increase and the environmental problems facing northcentral Namibia will dramatically increase. It is highly questionable if the gains to extending the Red Line to the Namibian-Angolan border and by closing the border fence would offsett the long term economic and ecological loss to Namibia of the loss of the dry season forages in Angola.

The present canal to Oshakati affects the transhumance system of northcentral Namibia in two major ways. Firstly, although the transhumance system has not collapsed because grazing shortages still require most of the cattle to be moved away from the actual floodplain in the dry season, water is now much less of a restraint in the areas along the canal and the pipeline. Before the construction of the canal, the lack of water was the main factor necessitating the seasonal movement of cattle. The presence of water year-round means that cattle can be kept in the inhabited zone longer, which is beneficial from a dietary point of view (more sour milk and butter is available) and a crops production perspective (manure), but it increases pressures on vegetation cover, especially along the canal.

Secondly, the canal obstructs the movement of cattle. Cattle can pass through the canal where it is still a dirt canal, but if the canal from Ogongo to Oshakati is upgraded, e.g. lined with concrete, cattle will be restricted to the bridges, which are few and far in between. The cattle north of the canal need to be moved across the canal in order to gain access to the dry season

grazing reserves in the southern and southwestern uninhabited zones. More bridges and/or artificial fords will alleviate this problem.

A key factor in preventing massive land degradation is the continuation of the type of rotational grazing practised in the region's traditional range management techniques. The linchpin of the silvipastoral component was and is to keep the cattle moving from one grazing/fodder reserve to the next, to allow the natural regeneration of grazing and fodder resources. The result is that area are subject to high impact use for a short period, followed by a long period during which the vegetation can recover. This traditional system is very reminiscent of range management strategies as favored by "Holistic" resource managment. The necessity to move the cattle was not only dictated by the availability of grazing and fodder, but, more importantly, by the seasonal availability of water and by the tenure arrangements regulating access to water. The availability of unlimited and reliable supplies of water without clear management responsibilities in the case of government boreholes, the canals, the pipelines, contribute to waste of resources. The "Government" can not be expected to take care of all repairs and maintenance because of its limited resources. On the other hand, local authorities (including Chiefs and village headmen) and individuals can not be expected to repair and maintain water resources and prevent overuse without clear local tenure arrangements. This tenure vacuum contributes with constructs

which cut off cattle migration routes (the present canal and the envisaged border fence with Angola), and the large-scale illegal fencing of former grazing and fodder reserves limit the cattle population of northcentral Namibia to an ever diminishing area resulting in a massive increase of grazing pressure on the remaining areas. The maintenance of traditional water tenure patterns - or the creation of a new system constructed from the many positive elements of traditional indigenous water managment structures in northcentral Namibia is critical.

Under the traditional system all water resources were owned and or managed and the manager(s) guarded their resources carfully against overexploitation. Wells and waterholes were often privately owned, while some wells and waterholes, as well as traditional dams and even colonial dams were "owned" by communities. This water tenure system was, however, never extended to include the canals, the pipelines and taps, and boreholes. Boreholes are more often than not government property, and as a result in fact are regarded as open access resources. Any responsibility for maintenance, repair, and management (for example, the limitation of livestock numbers allowed to graze around the waterpoint) is conferred totally upon a distant central government, often resulting in overuse of the resource and the surrounding area. The same mechanism affects watertaps along the pipeline system. An effective solution would be to formally devolve management rights (and duties) to local structures.

Chris Tapscott estimates that the internal market for cattle absorbs about 15,600 head of cattle annually, i.e. an annual take-off of 4.3%, a figure well below the sustainable take-off rate of 10%.[7] The 1979/1980 annual report for agriculture, however, estimated that 30,000 head of cattle annually were slaughtered and sold through the local "bush butcheries," i.e. a take-off of 7.5%. Furthermore, an additional 40,000 head were estimated to have died, which amounts to a total take-off (through slaughtering and natural death) of 17.5%. In 1969, when the Angolan markets were still accessible to cattle from northcentral Namibia it was estimated that the commercially slaughtered cattle only constituted 17% of the total number of cattle slaughtered, while the remainder was consumed locally, including the consumption of cattle which had died. In 1969, 6,000 head of cattle were formally exported to Angola, about 1.5% of the total estimated cattle population of what was then Ovamboland.

3.4 Livestock Statistics

The droughts in the 1970s and 1980s caused a progressive decline in the regional cattle herd and a decline in the mean herd size per household. Owambo's human population increased from 230,000 people in 1960 to 550,000 in 1990, while the cattle population declined from 379,500 in 1960 to 350,000 in 1990. The

[7] Tapscott, C., The Social Economy of Livestock Production in the Ovambo Region. NISER Discussion Paper No. 4. Windhoek: University of Namibia, 1990.

ratio of cattle to people decreased from 1.7:1 (1970), to 0.88:1 (1980) to 0.63:1 in 1990.[8] Cattle numbers, however, vary greatly from year to year, and it is not clear if there is actually a progressive linear decline in the regional cattle herd size, or if 1990 was the low point of a conjunctural cycle, reflecting droughts, the war, and cattle diseases. It is also important to note that cattle figures in particular, and livestock figures in general, are estimates, and that, especially during the 1970s and 1980s, actual counts were impossible due to the war conditions. Earlier figures for the 1950s and 1960s were based on counts that took place during cattle vaccinations.

Livestock numbers in general are also clearly subject to cyclical movements of increase and decrease and are subject to the same factors as cattle numbers. An increase of total livestock numbers can be seen in the long term from 1946 to 1990, and especially the increase in the number of donkeys is a worrisome trend.

[8] Tapscott, C., The Social Economy of Livestock Production in the Ovambo Region. NISER Discussion Paper No. 4. Windhoek: University of Namibia, 1990.

Table 1

LIVESTOCK STATISTICS IN NORTHCENTRAL NAMIBIA, 1925-1991

Year	Cattle	Goats	Sheep	Donkeys
1925	60,000	80,000		
1945/				
1946	350,000	120,000	300	6,000
1949/				
1950	84,000	119,000	6,050	7,700
1957	385,983			
1959/				
1960	368,630	450,000 (incl. sheep)		31,382
1967	420,000	315,000	3,500	
1969	466,700	350,000	5,000	30,000
1970	516,000	338,000	9,000	
1975	530,552	411,621	3,556	
1980	400,000	340,000	7,000	
1985	350,000	230,000	7,000	
1990	350,000	360,000	12,000	120,000
1991	350,000	360,000	12,000	

3.5 Carrying Capacity

The concept carrying capacity figures prominently in discussions about desertification and overgrazing. Its usefulness is, however, limited. The entire debate about overgrazing has been offset by the realization that

underutilization of grazings (and forages) is as often - if not more often - a cause of land degradation as overgrazing. The carrying capacity of northcentral Namibia has been estimated at wildly varying rates. The figures given here should be seen as illustrations of the variations in the calculations and not as authoritative of the carrying capacity in northcentral Namibia.

In 1974, the Department of Agriculture estimated the carrying capacity in the various parts of northcentral Namibia (then Ovamboland) as follows:

- 1 Livestock Unit (LSU) per 16 ha in Eastern Ovambo (now the eastern parts of Ohangwena and Oshikoto regions);
- 1 LSU per 12 ha in Omusati Region;
- 1 LSU per 16 ha in Oshana Region.

Some natural pastureland in northcentral Namibia, however, has much higher potential. Trials conducted at Ogongo Agricultural College in 1978-1979 to gauge the carrying capacity of Oshana types of grazing (i.e. grazing in the floodchannels after they dried out) indicated that a carrying capacity of 1 LSU per 2 ha could be sustained for a period of six months from January to August.

A 1978 report concluded that the floodplain area of northcentral Namibia was overgrazed, but that many areas (including major parts of the modern regions of Ohangwena and Oshikoto) were underused due to a lack of water. Moreover, in Namibia the problem of underutilization of grazing lands is clearly illustrated by the problem of bush encroachment which led

and continues to lead to serious environmental and economic losses to both "commercial" farmers and the nation (through government subsidies to commercial farming). The threats to the environment and the economy in the so-called commercial farming areas in the north are much more serious than the overdrawn fears for desertification caused by overgrazing in the so-called "communal" farming areas of northcentral Namibia. Shortage of grazing is a problem in northcentral Namibia, but the figures available about livestock numbers do not support the thesis that land degradation in northcentral Namibia is caused by an explosion of the cattle or livestock population in the area. Livestock statistics over a longer period do not bear out a population explosion: an increase of the livestock population can be discerned, but the numbers show sharp oscillations from year to year, caused by high losses during droughts. At the same time the available grazing and forage acreage in northcentral Namibia has increased by the opening up of eastern Ohangwena by water development projects since 1945.

Much more important to the availability of grazing to livestock in northcentral Namibia have been the loss of traditional pastures by the erection of fences after 1945 along the western border with Kaokoland, along the southern border with the Etosha Park (Ovambo cattleholders lost important dry season pastures to the Etosha Park as late as the early 1970s), and the erection of fences along the international border with Angola. The causes of the present overgrazing - the extent of which is

difficult to measure - therefore are first and foremost political. In northcentral Namibia overgrazing is "corrected" by natural mechanisms which apply to wildlife populations: massive livestock losses as a result of starvation and disease. This is reflected in the livestock statistics.

3.6 Livestock Diseases

Livestock-owners from northcentral Namibia currently have no access to the more lucrative livestock markets in central Namibia and overseas because of veterinary restrictions: livestock from northern Namibia is not allowed to move south of the so-called Red Line.

The Red Line was instituted to prevent the spread of livestock diseases southward from the colonial "Native Reserves" of northern Namibia and Angola. Large epizootics of Footh and Mouth, Anthrax, and Bovine Pleuromonia (Lungsickness) occured in the 1950s, 60s, 70s, and the early 80s. In sharp contrast to exotic livestock elsewhere in Namibia, the livestock landraces in northcentral Namibia are highly resistant to Footh and Mouth and Anthrax, except when they have been severely weakened by drought conditions. In the past, vaccination campaigns, except in the case of Bovine Pleuromonia, were aimed more at preventing diseases from spreading into the White farming areas than at protecting the herds of the African farmers of northcentral Namibia. No dipping programs against tick borne diseases currently exist in northcentral Namibia. Before Independence

dipping programs and inoculation campains were conducted in a very heavy-handed manner and were frequently met by fierce resistance by African livestock owners. Livestock losses due to diseases and other natural causes are high; during the 1979/80 season, for example, cattle losses amounted to 10%, while smallstock losses were as high as 6%. OMITI survey data suggest that smallstock losses for the 1991/1992 drought were as high as 50%, with high losses among cattle and donkeys as well.

Cattlekeepers in northcentral Namibia have an extensive traditional knowledge of cattle diseases. They diagnose diseases as Epunga or Oshipungu (Bovine Pleuromonia), Ombulwa (Anthrax), and Ondenga (Footh and Mouth) through autopsies, the smell, or other marks. Despite decades of "Western" veterinary assistance, some people retained knowledge of how to cure cattle diseases with traditional methods: Ombulwa or Anthrax can be treated with herbs, for example. Cattlekeepers consider Bovine Pleuromonia as the most serious disease since it causes considerable losses. Farmers who keep cattle are very much in favor of government sponsored vaccination programs against this dreaded disease. Traditional cures based on herbs against Bovine Pleuromonia existed but could only contain the disease and could not eradicate it. Farmers in northcentral Namibia do not consider Foot and Mouth and Anthrax serious threats to their Sanga cattle herds since the diseases only cause minor losses. In 1993, the veterinary department, however, continued to vaccinate cattle in northcentral Namibia using the same methods as it applied before

independence: vaccinating cattle against Bovine Pleuromonia, and Anthrax, and Foot and Mouth which has caused some resentment.

Livestock poisoning, involving plants of Urginea spp and Geigeria spp., is also only a minor problem. Sanga cattle - compared to exotic cattle breeds - is known to avoid poisonous plant species in its range and sound livestock management also contributes to lower incidences of livestock poisoning in northcentral Namibia. In sharp contrast to cattle on the so-called commercial farms south of the Red Line, cattle in northcentral Namibia is carefully herded, and losses of livestock to predators and poisenous plants are much lower. On the "commercial" farms south of the Red Line cattle is left to roam around unprotected within individual camps and is thus exposed to predators and poisonous plants. Significant losses are a result. An additional result of the lack of livestock management on many "commercial" farms is that the cattle grazes highly selectively resulting in overgrazing of palatable grass and herbaceous species and evasion of less palatable sources of fodder causing land degradation.

4. THE TREE COMPONENT

4.1 Tree Tenure

Tree tenure in northcentral Namibia is very complicated. First, historical, cultural, and ecological factors make for a tree tenure system which is dynamic and diverse. Before colonial occupation in 1917, certain trees, especially fruit trees as the Marula, were controlled by Kings or Chiefs. Tree tenure, however was not identical in all the traditional Ovambo polities. In Ombalantu, for example, a strong central authority was totally absent. With the killing or deposing of traditional Kings (Oukwanyama in 1917 and Uukwambi in 1932) these rules collapsed.

In different parts of northcentral Namibia different trees were important. By the early colonial period the marula (Omwongo) tree, for example, was largely confined to the Angolan part of the Ovambo floodplain, and the same was true for Omuve. The baobab (Omukwa) remains largely confined to the western half the floodplain, while the Mangetti tree (Omunghete) is confined to the east (eastern Ohangwena and Oshikoto Regions), outside of the actual floodplain.

Second, tree tenure and land tenure are separate, especially in the case of fruit trees. Under the traditional system of tree tenure, "ownership" of a certain piece of land did not automatically confer ownership of the trees located on the land. Traditional Chiefs and local village headmen often reserved certain rights to certain trees on an individual's farm to themselves. They often shared in the harvest of fruit trees, and

cutting fruit trees required their permission. Also, trees outside individual farmlands were communal property and the responsibility of the village headman, but, marula trees in communal lands could be "owned" and fenced by individual farmers.

Colonial forestry legislation in as far as it was applied to northcentral Namibia before Independence, notably the drawing up and enforcement of a list of "protected trees," in fact confirmed the same general principle that underlay traditional law. Colonial forestry legislation stressed the segregation of land and tree tenure. Trees of species on individual farms that were included in the "protected trees" list - and most of the indigenous fruit trees were - were not totally "owned" by the owner of the farm. They could not be cut down without the permission of the colonial authorities. Colonial forestry legislation, however, did - in the long run - contribute to deforestation, because it took the responsibility of formal control and management of the species on the list of protected trees away from local managers, i.e. farmers in the case of trees on individual farms, and village headmen in the case of trees on communal land. Management responsibility of these trees was transferred to the "government," a fairly abstract concept in the remote areas of northcentral Namibia, and, in daily practice, to the local foresters. In reality, however, the forest service was never equipped for the daily supervision of the vast expanses of in the north. A more sustainable solution would be to formally transfer much of the daily supervision back to local authorities

at the village level. This should be done by transferring managment of local renewable natural resources to the village level (water, land, and vegetation). The Directorate of Forestry could then concentrate on its functions as a coordinating and advisory institute. The initiative to make traditional leaders "honorary foresters" is laudable, but may detach local leaders from their communities by integrating them in the hierarchy of central government. Also, local natural resource management should be integrated management - as traditional management is in northcentral Namibia - and it seems impractical for each directorate to make its separate arrangements and nominate honorary land managers, water managers, etc. A coordinated effort is required to restore resource management to the local level which in the long run is the only truly sustainable strategy. Finally, designating some local traditional leaders as honorary foresters may also create expectations for renumeration. This report is in favor of some future part-time renumeration for, for example, village headmen, in their functions as local mayors-arbitors-overseers of local resources - the traditional role they played but based in the local communities first and only then linked to other levels, especially the Regional Councils. A permanent solution may be to have villagers elect future village headmen from amonst the village's residents (this is already a not uncommon practice). If fines and fees for local dispute settlement are still kept at the village level - as they have been under the traditional system - this constitutes a local

taxbase. In addition, the government, through the Regional Councils, for example, may consider some additional renumeration in the form of a small salary and/or transport allowance.

A third complication of tree tenure in northcentral Namibia is a common trait of tree tenure systems throughout Africa: different people may have different rights to one single tree, i.e. instead of single rights there are bundles of rights to a tree/trees. Fruit trees are especially prone to bundled rights. A fruit tree on a farm is ultimately "owned" by the owner of the farm, i.e. the head of a household. The head of the household, however, may allocate the plot with the tree to a daughter. The women of the household may use part of the fruit harvest of the tree to distill liquor and sell part of it for their own profit. Fresh and dried fruit is consumed by all members of the household. Members of the household can only cut branches of the fruit tree - for firewood, for example, with the permission of the head of the household. If the household has no livestock, they may allow a neighbor's livestock to forage from the lower branches of the tree and they may even allow the neighbor to cut small branches from the tree when grazing is scarce. For cutting the tree, the permission of the village headman and or the Directorate of forestry are required. If a household has more fruit trees than it can harvest it may allow neighbors to harvest some of the fruit. Again, marula fruit is the most intriguing example since - unlike the fruit of other trees - it is not really commodified. Marula fruit is fermented into wine during

the rainy season, but it is rarely sold. In former days it was shared with local Headmen, and even today it is shared with neighbors, friends and neighbors and the local headman on a voluntary basis.

4.2 Agroforestry

Older farmers in northcentral Namibia are very aware of relationships between trees and crops and practice a variety of agroforestrty techniques. They consider trees important as windbreaks. Trees in and around fields reduce waterloss (evaporation and evapotranspiration), buffer temperature extremes (shade on the one hand and low temperatures (frost occurs occassionally during the winter), and protect crops from winddamage (either direct or from sand particles carried by the wind). Throughout northcentral Namibia, but especially in eastern Ohangwena strong winds carry sand and dust which may impact damage crops (which are especially vulnerable during the flowering stage) or cover crops with a fine layer of dust.

Farmers also are aware of a strong link between trees and soils. Some trees only occur on certain soils. The clayish Omutunda soil, for example, supports Omufyaati, Omuhongo, and Omunaluko tree species while the sandy Eheuene or Omahenene soil only supports Omufyaati bush. But trees also affect and change soil composition. The soil under Omukwiyu, Omunghete, and Omuuva, for example, makes the soil useless to crops cultivation, because of their "bad roots," as a farmer from eastern Ohangwena put it.

Species as Omunghudi, Omupanda, Omupalala, and Omwoongo are considered to have beneficial effects on the soil.

Fruit trees as tree crops are carefully managed in northcentral Namibia and southcentral Angola. At present, many of the fruit trees in northcentral Namibia are outside of what was originally their "natural" range. In the recent past the source of fruit from the marula (Omwoongo) and Omuve trees was the Ovambo floodplain in Angola and on the Namibian side of the border these trees were rare. During the colonial occupation of Namibia marula and Omuve trees expanded south, southwest, and southeast. The spread of these trees is in northcentral Namibia always associated with farms and fields and was and is a result of human agency. Both active and passive regeneration occurred, but propagation of these trees was always active. Women play a dominant role in the propagation, use, and management of fruit trees, as well as in the processing and distribution of products based on tree fruit. These trees should therefore be considered (tree) crops, a result of silviculture and not as the gathering of fruits from "wild trees." In most of northcentral Namibia marula and omuve did not form part of the original indigenous vegetation. A parallel can here be drawn with Acacia albida which is the dominating tree species in Senegal's Peanut Basin, but is not indigenous to the basin.

Tree crops are tended, harvested and processed by women. Marula is made into two types of marula wine. The first type is Omaoongo, an alcoholic beverage based on the juice of pressed

fresh marula fruit which is fermented for two days. The second type is Oshinwa. To make oshinwa the pits of the marula fruit (eengongo) are put in a container and water and sugar are added.

Processing and consumption of marula beverages has to take place immediately upon harvesting. The fruit is harvested, processed, and consumed during what is known as the marula season, from March to April. Marula wine is seldom sold, rather it is shared with friends, relatives, and visitors.

The fruit of the Omuve (Eembe), and Omwandi trees (eenyandi), and, to a lesser extent Bushman Orange (Omunhi) and Mangetti (Omungheke) are consumed fresh, dried for storage, or distilled into liquor. Fruit from the wild Fig tree (Omukwiyu) is mainly consumed fresh or dried. Baobab (Omukwa) fruits are cooked. Dried fruits (especially eembe from the Omuve tree) are sold in local and regional markets. The sale of liquor is an important source of income for women.

4.3 Silvopastoralism

During the long dry season (May-June to December), livestock in northcentral Namibia is highly dependent in treefodder. Grasses dry out and turn yellow in June and retain little or no nutrients. Even for animals which depend for their sustenance mainly on grasses and herbs, it is treefodder which supplies most of the nutrients and vitamins. Cattle, equines, and smallstock forage on various parts of woody vegetation, including seedpods of Acacia spp., leaves, including even the leaves of Mopane trees

and shrub, fruits, twigs, and a very common parasitic bush, Oshilunda (Tapinanthus olaefolius).

Table 2

LIST OF FODDERTREES AND BUSHES '

Botanical name	Oshivambo	Foddertree		
		A	B	C
Acacia erioloba	omwoonde	Y	Y	Y
Acacia nebrownii	muhaloweyo	Y		
Acacia tortilis	kamutaka (B)/omutoka(D)		Y	
Adansonia digitata	omukwa			Y
Albizia versicolor	omusheshe		Y	
Baekiaea plurijuga	omupapa		Y	
Baphia massaiensis	ofufe	N	Y	Y
Bauhinia petersiana	omutwanghuta/omutsanguta	Y	Y	Y
Berchemia discolor	omuve/omuye	N		Y
Boscia albitrunca	omunghudi	Y		
Catophractes alexandri	okalyadi	Y		
Colophospermum mopane	omufyati/omusati	S	Y	Y
Combretum apiculatum	omulama/omunaluko	Y		

' Y=Yes; N=No; S=Sometimes. Sources: (A)=Based on Rundu Forestry, file "Protected Species," List of trees with botanical names and local names (Kavango and Owambo names); B= Robert J. Rodin, The Ethnobotany of the Kwanyama Ovambos (Missouri Botanical Garden, 1985); C=Preliminary data (random sample) OMITI Survey; D=B.C.H. Turvey, W. Zimmermann, and G.B. Taapopi, Kwanyama-English Dictionary (Johannesburg: Witwatersrand University Press, 1977); Keith Coates Palgrave, Trees of Southern Africa (Cape Town: Struik 1990 (first published, 1977; revised and updated, 1988).

Combretum hereroense	omukadhikuku	Y		
Combretum imberbe	omukuku (A)	S		
Combretum zeyheri	omushendje	S		
Commiphora glaucescens	omukuku (B)?	Y		
Crotolaria podocarpa		Y		
Croton gratissimus	ombango/omumakani	S	Y	Y
Dialium engleranum	omufimba	?		
Dichrostachys cinerea	onyege/ongete	Y		Y
Diospyros mespiliformis	omwandi			Y
Euclea undulata	(Herero)	S		
Ficus petersii	omungholyo		Y	
Ficus sycomorus	omukwiyu		Y	Y
Grewia spp.	ehonga (A) /omushe/ omuhonga	Y		
Grewia flavescens	omushe			Y
Grewia lenax	omuhonga (B)/ omundjebele(D)		Y	
Hyphaene ventricosa	omulunga			Y
Indigofera astragalina(B)	okambadanga		Y	
Kleinia longiflora (?)	oshinanganamwali (B)		Y	
Lonchocarpus nelsii	omupanda	Y		Y
Maerua schinzii	omupola/omupopola		Y	
Monechma divaricatum	okalimufita		Y	
Nerium duparquetiana'	omanyanga		Y	
Nidorella resedifolia	efindapya		Y	
Polycarpaea corymbosa	okapembe		Y	

Pterocarpus angolensis	omuuva			Y
Rhus lancea	(Herero)	S		
Ricinodendron rautanenii	omunghete			Y
Scelorcarya birrea	omwoongo/omugongo	N		Y
Scilla rautanenii	enyanga		Y	
Scirpus muricinux	?		Y	
Sida hoepfneri	okanangola		Y	
Spirostachys africana	omuhongo/omunghongo	N	Y	
Swartzia madagascariensis	omumonga		Y	
Tapinanthus olaefolius	oshilunda (parasite)		Y	
Tarchonanthus camphoratus	-	Y		
Tephrosia burchellii	?		Y	
Terminalia sericea	omwoolo/omugolo	S		Y
Ziziphus mucronata	omukekete	N		Y

* [NB Nerium oleander, origin. from Mediterranean, poisenous. (E) p. 797]

4.4 Wood Use and Deforestation

Wood consumption in northcentral Namibia is high. Wood is used for the construction of farmhouses, pallisades which surround the farm, and fences which surround the fields and fallows to protect crops from livestock. The principal fuel is firewood and local supplies in the semi-urbanized axis Ondangwa-

Oshakati is extremely low. NISER surveys have reported the use of dried dung, although this seems rare.[10] Large quantities of construction and firewood are imported from Angola.

Clay bricks and bricks based on a mixture of clay and cement are increasingly common in even the most remote rural areas of northcenttral Namibia. The clay is dug up from termitemounds and when the farm is moved to another site on the land, the clay bricks quickly break down, further enhancing the quality of the soil at the site of the former building site.

The shortage of construction material is very obvious especially in the Ondangwa-Oshakati area, traditionally a sparsely forested area. Millet and sorghum stalks are a common construction material here for both huts and pallisades. Fields are often not or incompletely fenced which makes households very prone to crop losses as a result from trespassing by people and animals.

The demand for firewood is a major pressure on woody vegetation in northcentral Namibia. Local shortages of firewood are critical in the central areas of the Ovambo floodplain, especially along the semi-urban axis Oshakati-Ondangwa. In Oshomokwiyu, for example, in the center of the heavily populated Ovambo floodplain, tree cover is limited mainly to fruit trees. Very few small and heavily coppiced mopane trees and some mopane

[10] Namibian Institute for Social and Economic Research (NISER), Namibai Energy Assessment: Household Energy Consumption, Distribution and Supply Survey of the Owambo Region of Northern Namibia and Katatura, Windhoek. Windhoek: University of Namibia, 1992.

bush remain. Even mopane tree stumps and roots are dug up as fuel, which further diminishes the number of mopane and other non-fruit trees and thus further depletes firewood supplies in the long run. A major share of the firewood demand in this area is supplied through the markets from surrounding areas including Angola.

The main all purpose woody species in Omusaati, Oshana, and Oshikoto Regions is mopane, which is used for construction, as firewood, and supplies fodder to livestock and protein to humans (mopane worm). Coppice vigor of mopane is remarkeable and good and sustainable yields are possible as evidenced by results under conditions of traditional management and during scientific trials. The wood is extremely durable, being largely resistant to termites and other insects without being treated with chemicals. It is also a high-quality fuel. In areas under extreme fuel stress, however, traditional management structures are breaking down and people coppice mopane (and other species) too low to ground level and/or dig out the stumps and roots of mopane to use it as firewood. Local farmers who use tractors and ploughs (roots often destroy deep plowing steel plows, especially when used with a tractor) frequently clearcut and destumping fields. These factors gravely undermine the sustainability of use of mopane, which is still extremely abundant in northcentral Namibia. Research into the properties, use, traditional management, and possible improvement of mopane management should be a first priority in northcentral Namibia.

In most of Ohangwena Region, mopane does not occur, and an array of other hardwood trees - including a diversity of Acacia spp. - fulfill comparable role. Stress on woody vegetation, despite clear evidence of deforestation of a number of species, seems less.

Lowering the demand for wood products (by substituting bricks for wooden poles in construction, for example) is but one solution. On the supply side there is potential as well. Improved management of woody vegetation may result in more sustainable yields of the wood production. Young trees of many indigenous species show strong coppice vigor, including Omukadikuku, Omukuku, Omuhongo, Omupupwaheke, Omboo, Omwoongo, Omunaluko, Omwandi, and Omudengambwa. The DAPP nursery at Ombalantu is successfully propagating Omwoongo (marula), from cutlings, following the traditional methods.

Deforestation and reforestation were a preoccupation of the colonial government since at least the 1940s. From the 1960s onwards the administration initiated experiments with both indigenous and exotic trees to select tree species for reforestation projects.

An important initiative was a series of trials with mopane at the Onankali plantation (53 km south of Ondangwa on the road to Tsumeb) and at Ogongo Agricultural College which took place during the early 1970s. At Onankali, natural stands of mopane bush were subjected to different regimes of coppice and thinning management after measurements had been taken. The trials

indicated that with careful management mopane could produce good dropper-size poles in 3-4 years. At Ogongo four smaller trial plots were established and measured within a larger plot laid out in 1971. The experiments were shortlived: the plots at Onankali were cut clear in August 1976, but not after mopane coppice vigor had impressed the forestry officials. The director of Forestry at Pretoria optimistically concluded that Ovamboland's (now the regions of Omusaati, Oshana, Ohangwena, and Oshikoto) entire demand for poles and droppers could be met by managing the natural stands of mopane in the southern and southwestern parts of the Ovambo Region. Illustrative of the coppice vigor of mopane is that during the 1960s, white farmers considered mopane as a dangerous bush encroacher and at least one farmer petitioned the colonial government to take mopane from the list of protected tree species.

After the mopane trials at Onankali were ended two other species were planted next to the Eucalyptus trials (the latter are discussed below). A Casuarina spp. was planted in 1979: only two trees tremained in 1989. A Grevillea robusta trial plot was established at an unknown date but by 1989 all the trees had died.

During the late 1960s and early 1970s period experiments with other indigenous and exotic trees were conducted at several trial plantations in northcentral Namibia. In December 1968, the first trials in the region were initiated at Oponono Lake, 40 km south of Ondangwa. The trial consisted of four rows of 16

seedlings, with a 5 m. spacing between the rows, and a 2.7 m. spacing between the individual seedlings within a single row. Four tree species were tested in the trial: Eucalyptus (probably camaldulensis), Parkinsonia (aculeata?), Casuarina cunninhamiana, and some poplars (Populus wislizenii?). The seedlings were watered once a month. The Eucalyptus and the Casuarina seedlings developed reasonably, but the Parkonsonia showed only a weak performance while the Populus failed completely.

Another important center of trials with various exotic and indigenous species was at the Onuno Plantation, on the road from Ondangwa to Oshikango. The main trials were with Eucalyptus as was the case at Onankali Plantation, but the Onuno trials included other species. In 1973, Rhus lancea, Jacaranda mimosafolia, Prosopis (juliflora ?), Melia azedarach, and Albizia versicolor. In 1976, a plot of Entandrophragma spicatum was added to the trial plantation. The seed for for the latter was collected near the Ohangwena administrative offices. In 1978, 54 of the original seedlings in the Entandrophragma plot that had died were replaced. A 1989 survey found most of the surviving trees in the trials badly deformed and the Prosopis stunted. Of the Rhus lancea only 11 remained, of the Prosopis only 12, of the Jacaranda only 17, of the Melia, 22, and of the Albizia, 33. It is unclear how many seedlings of each individual species were originally planted but the plots seem to have been of roughly similar size and the plot with Entandrophragma spicatum originally counted at least 54 seedlings.

In 1976, a number of seedlings - of both exotic and indigenous species - was planted at the Ombalantu trial plantation. The trial planting included Prosopis.

The Oshakati nursery predated 1977, when it was rehabilitated. The nursery boasted an irrigation system and a glass house for growing seedlings. Eucalyptus and ornamental trees proved successful in the nursery. Experiments with Kigali africana and Berchemia discolor were also attempted at the nursery in 1976 but no reports on the results have been located. In the early 1980s, an experiment with Simondsia chinensis ("Inland Mountain" variety) took place but it proved unsuccessful despite a high seed germination rate.

In 1977, a nursery was started at Mahenene to grow Eucalyptus and exotic fruit trees. The nursery was a temporary measure to minimize transportation costs. This probably explains the origins of the lush stands of fruit trees presently covering part of the grounds of the experimental station at Mahenene.

The largest trials with tree species undertaken in northcentral Namibia before Independence were trials with exotic Eucalyptus. The first small-scale trials involving Eucalyptus in Ovambo took place as early as 1968. Preparations for larger-scale trials began in 1970, when Dr. A.H. Lueckhoff recommended a spacing of 2.7x2.7 m. for envisaged trials with exotic tree species at Oponono Lake, Ombalantu, Ondangwa, and Oshakati.

The principal aims of the first provenance trials with Eucalyptus of 1973/74 were to select provenances suitable for the

conditions in northcentral Namibia and to assure a future supply of construction and firewood for the Ovambo "homeland." An additional objective of the first trials with exotic species in the Ovambo region, including Eucalyptus was to test their potential as sources of nectar for bees, since Ovambo was considered an area short of natural food for bees.

The Onuno trial plantings were first established in 1973/74 along the Ondangwa-Oshikango road, about 16 km south of Oshikango. Soil conditions at Onuno differ sharply from those at the plantations at Onanakali or the older Oponono Lake plantation. At Onuno, no restricting solonetz B horizont underlays the very sandy A horizont within the first 4 meters.

The first provenance trial established at Onuno (experiment 1/01/03/02 EA 24/06 or R 3790/Ovambo/1) with Eucalyptus camaldulensis and Eucalyptus tereticornis started in 1973 and formed part of a series of provenance trials with Eucalyptus throughout Namibia and South Africa. The seedlings were planted on the Onuno plot in March 18-19, 1974.

Although reports are contradictory, it seems that some soil preparation took place previous to planting, and that plastic covers and fertilizer were applied selectively at this trial in a similar way as at the related trial series at Mile 37 (Kavango). The plot consisted of 6x7 stands with a rectangular lattice pattern with three replications, each plot with 5 rows of 5 trees. The total area covered by the trial was 2.6 ha.

In 1982, the experiment was abandoned together with an

identical experiment at Mile 37 in Okavango. The first series of trials in Onuno also included trials with Eucalyptus citriodora and Eucalyptus hybrids. The former trial was known as Ovambo trial 2 (R 3790/Ovambo/2). A number of Eucalyptus citriodora seedlings were planted at Onuno on 29/4/1974. The original planting did not follow any particular design, no replications were used, and plots were of different sizes although 6 rows of 7 trees were planted in each. The total area of this trial was 0.18 ha.

The last trial in this series involved two Eucalyptus hybrids. A hybrid of Eucalyptus tereticornis x Eucalyptus saligna x Eucalyptus grandis from Mauritius and a hybrid of Eucalyptus grandis x Eucalyptus tereticornis were planted at Onuno.

A second series of trial plantings of Eucalyptus camaldulensis and Eucalyptus tereticornis was started in the 1977/78 season. The seed was received in 1977 from Pretoria. Twelve provenances of Eucalyptus camaldulensis and three provenances of Eucalyptus tereticornis were seeded in the nursery on August 10, 1977 and August 26 and 28, 1977 respectively.

As no agricultural implements were available, no soil preparation was undertaken nor was any fertilizer applied. The seedlings were planted at Onuno on 1-2/3/1978 and a planting distance of 3x3 m. was used. In order to replicate the competition conditions of the 1973/74 trial, a row of trees was planted as a screen around the trial lots. The Eucalyptus tereticornis screens were from the same provenances as the actual

trial plantings. The Eucalyptus camaldulensis screens were grown from seed collected at Onuno in 1976/77 from the seedbearing trees of the 1973/74 trial.

All superfluous seedlings that were seeded in 1977 but not used for the actual trial, were planted in Onuno section II. The trees planted in this lot were not part of the trial.

Preparations for the first Eucalyptus trial plantings at Onankali, about 40 km southeast of Ondangwa on the Ondangwa-Tsumeb road, started in 1976. The soil conditions at Onankali are characterized by a compacted solonetz B horizont at a depth varying from 0.5-4.0 m., covered by a sandy A horizont. The compacted solonetz B horizont is a major obstacle for root development.

During the first three series of trials in 1976/77, 1977/78, and 1978/79, Eucalyptus camaldulensis and Eucalyptus tereticornis proved to be the most successful. In 1979, the Onankali plantation counted about 5,700 Eucalyptus trees of different species on 10 ha. The species included approximately 700 Eucalyptus gomphocephala, approximately 2000 Eucalyptus tereticornis, and approximately 3000 Eucalyptus camaldulensis.

In February 1980, a total of 17,108 (according to another report: 27,600) seedlings of mainly Eucalyptus citriodora (10,814 seedlings), Eucalyptus camaldulensis (3,060 seedlings), and Eucalyptus gomphocephala (3,234 seedlings) was added to the plantation. The last plantings at Onankali took place in 1982. The main species still occurring in 1989 were Eucalyptus

camaldulensis and Eucalyptus tereticornis, but some lots of other species also remained. In 1987 a plan was formulated to greatly extend the Onankali plantation in 1991, but due to Independence the plans did not materialize.

The Leeukop trial plantation was situated along the road Ondangwa-Tsumeb, about 100-120 km from Ondangwa. A total of 630 seedlings was planted at the site on April 7 and 13, 1976. The seedlings were sown in September 1973 and were earmarked for the provenance trial at Onuno. However, not all the seedlings were used at Onuno. The roots of many of the seedlings used at Leeukop - left in the seedbags for too long - were damaged when they were separated for planting. Other seedlings planted at Leeukop were grown from seed originally sown in November 1975. Due to time constraints only a quarter of the planned hectare was planted in 21 rows of 30 trees with a spacing between individual trees of 2x2 m. The species used were Eucalyptus citriodora, Eucalyptus camaldulensis, Eucalyptus polyanthemos, and Eucalyptus tereticornis.

A second series of seedlings was planted in 1977/78, consisted of Eucalyptus camaldulensis and Eucalyptus tereticornis.

Minor trials with Eucalyptus were also conducted at Ondangwa and Mahenene."

" For a more detailed description of tree trials in Northcentral Namibia, see Emmanuel Kreike, An Inventory of Trials with Exotic Tree Species in Northern Namibia, with special Reference to Provenance Trials with Eucalyptus spp. Directorate of Forestry Internal Report, 1992).

The trials with trees in northcentral Namibia indicate the potential of both indigenous and selected exotic trees. Eucalyptus, especially species camaldulensis and tereticornis have been the subject of extensive and extended trials and proved technically to be suitable to local conditions. In practice, however, the potential of Eucalyptus and other exotics seems limited. Eucalyptus species have proved to be extremely vulnerable to termites and other local pests, and except when used as firewood, treatment with insecticides and preservatives is required. There are, however, certainly niches for Eucalyptus and other exotics, but exotics compete directly for limited local supplies of water, nutrients, and often space, with indigenous trees, crops and human and animal populations. Therefore, exotics should only be introduced where and when indigenous species do not suffice. Indigenous trees, although some species are clearly under threat in some areas, are high in variety and number, and extremely well adapted to local conditions. Local communities also have an intricate knowledge of managing and protecting these species, inclusive an artificial regeneration technology, although there is a clear loss of this knowledge over time. Introducing exotic technology - in this case exotic trees - is not merely "technical." Introducing exotic technology also has socio-economic, cultural, and political effects. Exotic technology is controlled by scientist and professionals, and - until the new technology is not only introduced but also internalized - it creates relations of dependency, which are

often perpetuated. Also, preliminary data from the OMITI Agroforestry Systems Research survey suggest that with the exception of exotic fruit trees, preferences are for local trees, most of which are multipurpose trees. This is not to say that exotic technology is negative, but it is important to stress that unintended effects may result which need to be addressed.

In interviews local farmers - both men and women - stress as the most important trees the following:

(a) indigenous fruit trees: Omulunga, Omwoongo, Omuve, Omwandi, Omukwiyu, and Omunghete;

(b) indigenous non-fruit trees: Omusati and Omwoolo;

(c) exotic trees: Guava, Mango, Paw-paw (Papaya), and Orange

5. CONCLUSIONS AND RECCOMENDATIONS

5.1 The Agro-Silvipastoral System and Land-Use Zones

Although in general the land use system is the same in northcentral Namibia and even across the border with Angola, there are also important variations and differences which, however, because of the limited scope of the paper can not be discussed in detail. Variations in soil types, vegetation, water availability and rainfall make it possible to distinguish three major subzones in northcentral Namibia: the Ovambo floodplain (which can be subdivided into the northern floodplain and the southern flats characterized by much broader flood channels and and a dominance of palmtrees); the flats southwest and south of the actual floodplain, and the the sandy more heavily forested

areas of the east (most of Ohangwena and parts of Oshikoto).

Access to infrastructure, notably the Ombalantu-Oshakati canal, the trunk pipeline and to a lesser extent the "Fishgrate system" of waterpipelines feeding off the trunkline, and tarred roads make for a further subdivision. The trunk pipeline and the canal radically changed land use for households facilitating easy water access. This also created the potential for hand-irrigated intensive horticulture and orchards. Roads facilitate access of households to acquire resources (firewood, water) and sell crops and livestock. Under the present conditions, however, the Fishgrate system can not be fully exploited because it is not reliable.

5.2 Conclusions and Recommendations

Woody vegetation plays a critical role in the land use system and the environment of northcentral Namibia and is the key to its sustainability. Woody vegetation is not only an important resource in itself (production of fuel, construction material, fruit trees) but it also provides the cement which unites the various components of the land use system. Trees interact with crops, soils, and water and trees provide shelter and food to people and animals. It is therefore essential that the woody vegetation of northcentral Namibia is exploited in a sustainable way. Solutions for this critical problem can be sought in the following realms:

1. Tree management: More emphasis should be placed on indigenous trees and their use and management, including traditional knowledge about managment and tree recruitment. Management should be restored at a local level (villages and households) with the Directorate of Forestry acting as advisor, and clearinghouse of knowledge (both indigenous knowledge and scientific knowledge and technology) and technology (including knowledge about exotic species).

2. Technology: Although research is being undertaken on traditional technological knowledge regarding trees and tree use, very little scientific knowledge has as yet been conducted into the ecological properties of indigenous trees. Many of the indigenous trees are of high value to the local economy and have export potential (furniture industry, artifacts for the tourist trade, but also, for example, marula based liquors presently only manufactured in South Africa). Trials and experiments with the major non-fruit trees (especially mopane) and fruit trees (Marula, Omuve, Omwandi, etc) are of high priority. The fruit of all fruit trees, for example, is made into liquors, which are critical components in the informal economy of northcentral Namibia, providing an income especially to women. A comparison can be drawn here with the role of liquor in the urban and semi-urban economies of South Africa. Also, no scientific knowledge is available about the relationships between trees indigenous to the area and soils. For example, it is inferred from research elsewhere in Africa that Acacia trees indigenous to Namibia

↓? Not necessarily
Acidity inhibits nodulation
↓ some species do not nodulate
but efficiently scavenge nutrients!

fixate atmospheric Nitrogen, but it has not been proved scientifically.

3. A systemic strategy to ensure a future sustainable system: Solutions for the problems and crises facing the Agro-Silvi-pastoral land use system in northcentral Namibia should not be sought in one single reource, strategy, field, or technology. If the history of land use and the environment of the area clearly teaches one critical lesson for the future it is that this traditional system - despite problems and crises - has been very successful in sustaining its population, because of its reliance on a highly diversified resource base. Intervening now, making use of the potential of the system, will prevent a major agricultural and environmental crisis in the future. Without change, the system will collapse, and environmental distaster and famine will be the result.

It should be stressed that until now the land use system of northcentral Namibia during crises - despite having been a war zone for decades - fared much better than other parts of Namibia, and in many respects this is true even compared to what was the White farming sector. The latter sector only survived crisis upon crisis through heavy subsidies issued by the colonial government. One of the major reasons for the relative success of the land use system in northcentral Namibia was its flexibility. The Ovambo Agro-Silvipastoral system was and is based on exploiting not a single resource (as in Maize monocropping, for example), but rather on a differentiated mix of resources, including different

crops on different soils, a mix of livestock (including long distance transhumance of cattle), and a heavy reliance on a wide array of indigenous trees. This land use system was and is institutionalized at several levels, and based on an extensive and intricate empirically-based indigenous knowledge system. The in-built flexibility and mobility enabled local communities to adapt to crises which affected one or more resources by shifting to other resources, despite a strong increase in the population. Therefore, the existing land use system and its components should be the base on which sustainable development of northcentral Namibia should be based. Wherever possible improvements upon existing local technology, use and managment should be made, but not before assessing local needs, local priorities and the potential impact upon the system as a whole. In northcentral Namibia, tradition is not an obstacle to development. The history of the region makes very clear that new ideas and technology were readily adapted if they made sense under local priorities. Illustrations here are the introduction of new cultivars of sorghum and millet, new crops (tomatoes, pawpaw, guava etc.), welltechnology, and plows. Forestry can play a critical role here, because it is woody vegetation which plays a critical role in linking up the various components of the land use system of northcentral Namibia.

There is limited scope for commercial forestry in the form of, for example, small-scale commercial plantations in some areas. Plantations with indigenous and exotic species can supply

fuel, construction materials, and fruit through the local markets. In the natural woodlands outside the densely inhabited floodplain has a limited potential for forest exploitation. Since the supply of indigenous woody vegetation with commercial value in northcentral Namibia is low but of high quality the emphasis should be on local woodprocessing which adds maximum value: i.e. furniture and crafts (tourism).

Forestry, however, in northcentral Namibia, should be principally social forestry rather than "pure" forestry. Forestry should - in this area - support local initiatives, with technical and other support. Four areas of priority can be distinguished:

(a) Wood as construction material: For the construction of houses a substitution of all-wood construction by clay and clay/cement bricks - a process that is already well underway - should be further encouraged. Fencing is critical to reduce pre-harvest and harvest losses to crops. The potential of life fencing based on local trees should be investigated. A variety of local techniques is already in use, including life fencing with woody vegetation and aloes.

(b) Firewood: The most effective strategy is to built on indigenous practices - which are in decline - of keeping part of the farm under a bush/tree fallow (ekove) which is often an important household source of wood.

(c) Agroforestry as trees in fields: this is very widely practised with mainly, but not exclusively, indigenous fruit trees. Scientific research and experiments with agroforestry

technoiques based on local crops and local trees are priorities. Nitrogen fixation by leguminous species is one example. Possibly more important is the contribution of woody vegetation to Phosphorous in the soil, an element which is lacking in most soils in northcentral Namibia. Also important are relationships between trees and crops as well as the use of trees as producers of food and fodder. The relationship between trees and ground- and surface water is also important and has to include research into tolerance of trees to soil and water salinity (especially the Fanpalm (Omulunga) and Jackal Berry (Omwandi) and the water consumption of trees. The Wild Fig (Omukwiyu), for example, is tolerated in fields, although it is known as a direct competitor with crops for water.

(d) Silvopastoralism: During the dry season treefodder is critical to livestock in the densily inhabited Ovambo flood plain and in the less densely settled areas outside the floodplain. Compared to exotic cattle, a much larger percentage of the diet of Sanga cattle, for example, consists of tree fodder. In diet and forage and grazing behaviour, Sanga cattle in its impact on vegetation is much more alike to wildlife than exotic cattle. Herding practices (transhumance) contribute to this phenomenon. Sanga cattleherds impact an area heavily but only for a short period since they remain on the move, as do herds of migratory wildlife. This factor has obviously significant consequences for calculations of grazing densities and overgrazing.

SELECTED SOURCES

This report is mainly based on unpublished sources. The main collections the report draws on are:

The National Archives of Namibia (NAN), especially the following collections:

(a) NAO: Native Commissioner Ovamboland, 1919-1955
(b) AGR: South West Africa Administration: Directorate of Agriculture
(c) Accessions 450: Carl Hugo Linsingen Hahn Papers.

OMITI project field interviews: 70 farmers from northcentral Namibia (half of the interviewees were women) were formally interviewed in-depth on land use and the environment in past and present during 1992 and 1993. The interviewees were selected from 30 villages representing different microenvironments, administative units, and cultural areas. The large majority of the interviews were taped and copies have been deposited at the Namibian National Archives in Windhoek. Many more farmers were interviewed informally.

OMITI Farming/Agroforestry Systems Survey: A highly detailed 400 household survey was conducted with the assistance of 40 students and teachers of Ogongo Agricultural College during August and September 1993.

MIAA (Missao de Inqueritas Agricolas de Angola/ Agricultural Survey Mission of Angola): largely unpublished results of FAO farming systems research surveys conducted during the late 1960s and early 1970s. About 200 households on the Angolan side of the Ovambo Agro-silvipastoral system were surveyed.

APPENDIX
LIST OF SELECTED TREES AND BUSHES [17]

The list consists of two sections. The first section lists the trees by their scientific name and the second section lists the trees by the Oshivambo names.

SECTION A: Listed by scientific name

Botanical name (No. SA Treelist)	Oshivambo	English/Afrikaans
Acacia ataxacantha (160)	enghono (A)/ omumangandjaba (D)	Flame Thorn/ Vlamdoring
Acacia erioloba (168)	omwoonde	Camel Thorn/ Kameeldoring
Acacia erubescens (164)	omunkono	Blue Thorn/ Blouhaak
Acacia fleckii (165)	omangandjaba	Plate Thorn/ Bladdoring
Acacia hebeclada (170)	omutyuula/ omutokano (F)	Candle Thorn/ Trassiedoring
Acacia mellifera (176)	okadilanghono	Black Thorn/ Swarthaak
Acacia nebrownii (177.1)	omuhaloweyo	Water Thorn/ Waterdoring
Acacia nilotica (179)	omuyele	Scented Thorn/ Lekkerruikpeul
Acacia reficiens (181)	omutyuula	Red Umbrella Thorn /Rooihaak-en-steek
Acacia sieberiana (187)	omutyuula (D) omuyele (F)	Paperbark Thorn/ Papierbasdoring
Acacia tortilis (188)	okamutaka (B)/omutoka (D) omushu (F)	Umbrella Thorn/ Haak-en-steek
Adansonia digitata (467)	omukwa	Baobab/Kremetart

[17] The list is based on unpublished archival documents, filed interviews, the OMITI Survey, and Robert J. Rodin, The Ethnobotany of the Kwanyama Ovambos (Missouri Botanical Garden, 1985) [=B]; B.C.H. Turvey, W. Zimmermann, and G.B. Taapopi, Kwanyama-English Dictionary (Johannesburg: Witwatersrand University Press, 1977) [=D]; Keith Coates Palgrave, Trees of Southern Africa (Cape Town: Struik 1990 (first published, 1977; revised and updated, 1988) [=E]; and P.J. Le Roux, "The Common Names and a few Uses of the better known indigenous plants of South West Africa/ Algemene Benaming en enkele gebruike van die meer bekende inheemse Plante van Suidwes-Afrika," Bulletin No. 47 (Pretoria: Department of Forestry: 1971).

Albizia anthelmintica (150)	omupopo; omuhanguti	Worm bark False Thorn /Aruboom (F)
Albizia versicolor (158)	omusheshe	Large-leaved False Thorn /Grootblaarvalsdoring; Sandkiaat
Baikiaea plurijuga (206)	omupapa	Rhodesian Teak/ Rhodesiese Teak
Baphia massaiensis (223)	ofufa; omutsanguta (F)	Sand Camwood/ Sandkamhout
Bauhinia petersiana (A) (208.3) or B. macrantha (F)	omutwanghuta/ omutsanguta	Coffee Neat's Foot /Koffiebeesklou; Koffiebos (F)
Berchemia discolor (449)	omuve/omuye	Birdplum/Voelpruim Wildedadel
Boscia albitrunca (122)	omunghudi; omunkunzi (F)	Sheperd's Tree/ Witgat
Burkea africana (197)	omutundungu	Wild Seringa/ Sandsering
Cassine transvaalensis (416)	omudengambwa	Transvaal Saffron /Transvaalsaffraan
Catophractes alexandri (-)	okalyadi (A); okalyanzi (F)	- /Skaapbos (F)
Colophospermum mopane (198)	omufyati/omusati	Mopane/Mopanie
Combretum apiculatum (532.1)	omulama/omumaluko	Red Bushwillow/ Rooibos (F)
Combretum hereroense (538)	omukadhikuku	Russet Bushwillow /Kierieklapper
Combretum imberbe (539)	omukuku (A/F)	Leadwood/ Hardekool
Combretum mechowianum (541)	omupupwaheke	Rhodesian Bushwillow /Rhodesiese Boswilg
Combretum zeyheri (546)	omushendje; omusheshe (F)	Large-fruited Bushwillow/ Raasblaar
Commiphora (Generic)	omboo	Corkwood Trees/ Kanniedoodbome
Commiphora glaucescens (276)	omukuku (B)?	Blue-leaved Corkwood /Bloublaarkanniedood
Croton gratissimus spp. gratissimus (328)	ombango/omumakani ombango (F)	Lavender Fever-berry /Laventelkoorsbessie; Apteek(F); Vaalbos(F)
spp. subgratissimus (328.1)	omumakani?; ombango (F)	Hairy Lavender Fever-berry/Harige Laventelkoorsbessie; Apteek(F); Vaalbos(F)
Dialium englerianum (210)	omufimba; omuthimba (F)	Kalahari Podberry/ Kalaharipeulbessie
Dichrostachys cinerea (190)	onyege/ongete	Sickle Bush/ Sekelbos

Diospyros mespiliformis (606)	omwandi	Transvaal or African Ebony/Jakkalsbessie
Ehretia rigida (657)	omushadi; oshadi (F)	Puzzle Bush/ Deurmekaarbos
Elephantorrhiza elephantina (191.1?)	omutulu (F)	Sumach Bean -/Elandsboontjie
Elephantorrhiza suffruticosa (?)	omumbalandongo	Looiwortelbos (F)
Entandrophragma spicatum (294)	omutaku	Ovambo Mahogany/ Ovambomahonie
Euclea divinorum (595)	omudime; omudhime (F)	Magic Guarri/ (Tower)Ghwarrie
Fagara ovatifoliolata (255.2)	omuhandwa/okanakamuma	Ovambo Knobwood/ Ovamboperdepram
Ficus craterostoma (52) (formerly F. petersii)	omulemba (?)	Forest Fig; Strangler Fig/ Bosvy; Wurgvy
Ficus glumosa (52.1)	omholyo(F); omukuyumba(F); omungholyo?(F)/ omukuyumbwa(F)	-/-
Ficus kiloneura (68)	omungholyo(F)/ omu-ngholuo(F)(?); omunkolyo(F)	-/-
Ficus petersii (see F. thonningi)	omungholyo	
Ficus sycomorus	omukwiyu; omukuyu(F)/omukwiyu(F)	Wild Fig/ Wildevy
spp. sycomorus (66)		Common Cluster Fig; Sycamore Fig/ Wildevy; Wurgvy
spp. gnaphalocarpa (66.1)		False Cluster Fig/ Valstrosvy
Ficus thonningii (48) (formerly F. petersii)	omulemba (?)	Common Wild Fig; Strangler Fig/ Gewone Wildevy; Wurgvy
Gardenia volkensii (691) (formerly G. spatulifolia)	omulavi/ omulayi (F)	Transvaal Gardenia/ Transvaalkatjie-piering
Grewia (Generic)	ehonga (A); omushe; omuhonga	Wildraisin Bushes /Kruisbessie; Rosyntjiebos
Grewia avellana (-)	omukopakopa	
Grewia deserticola (-)	omupundu	
Grewia falcistipula (F)	omwila/omwiila (F)	-/-
Grewia flava (F)	ehonga (F)	-/Rosyntjiebos
Grewia flavescens var. flavesceni (495.2)	omushe	Sandpaper Raisin/ Skurwerosyntjie
var. olukondae (495.3)		Broad-leaved Sand-Paper Raisin/Breë-blaarskurwerosyntjie
Grewia retinervis (F) (	oshipundu (F)	-/-
Grewia tenax (-)	omuhonga (B)/ omundjebele(D)	-/-
Guibourtia coleosperma (199)	omushii/omusii (F)	Cobalwood/ Bastermopanie; Rooi-sering; Schivi (F)
Hippocratea africana	omupetangobe	-/-
Hyphaene petersiana (24) (formerly H. ventricosa)	omulunga	Real Fan Palm/ Makalanie-palm (F); Waaierpalm (F)
Indigofera astragalina (-) (Indigofera (Generic))	okambadanga (B)	-/- Indigo Bushes
Kleinia longiflora (-)	oshinanganamwali (B); elangelamwali (F)	-/-
Lonchocarpus capassa (238)	omupanda (F)	Apple-leaf/ Appelblaar
Lonchocarpus nelsii (239)	omupanda	Kalahari Appleleaf/ Kalahari-appelblaar
Maerua schinzii (136)	omupola/omupopola; oshihamupolo (F)	Ringwood Tree/ Kringboom; Kwarda(F)
Maytenus senegalensis (402)	oshingodwe (F)/ omungonze; enolyomungolwe (F); omungolwe (F)	Red Spike-thorn/ (Rooi-)Pendoring
Monechma divaricatum (-)	okalimufita	-/-
Mundulea sericea (226)	omumbanganyana	Cork Bush; Silver Bush/Kurkbos
Nerium duparquetiana * (Nerium Oleander?) (X942)	omanyanga	Oleander
Nidorella resedifolia	efindapya	-/-
Ochna pulchra (483)	omumwe/ omweeguki (F)	Wild Pear/ Lekkerbreek
Peltophorum africanum (215)	omupalala	Weeping Wattle; African Wattle/ Huilbos
Polycarpaea corymbosa (-)	okapembe	-/-
Pterocarpus angolensis (236)	omuuva / omuguya (F)	Wild Teak; Transvaal Teak/Dolf; Kiaat
Rhigozum brevispinosum (674)	omumakani	Short-thorn Pomegranate/Kort-doringgranaat
Rhus tenuinervis (393.2)	omupombo	Kalahari Currant/ Kalahari Taaibos
Ricinodendron rautanenii (337)	omunghete/ omunkete (F)	Mangetti Tree/ Manketti
Sclerocarya birrea (360)	omwoongo/omugongo	Marula/Maroela
Scilla rautanenii (-)	enyanga	-/-

Securidaca longipedunculata (303)	omudiku; omutiwongobe (F)/ omudhiku (F)	Violet Tree/ Krinkhout; Fibre Tree
Sida hoepfneri (-)	okanangola	-/-
Spirostachys africana (341)	omuhongo/omunghongo	Tamboti/Tambotie
Strychnos cocculoides (623)	omuuni/omuguni (F)	Corky Monkey Orange; Kaffir Orange/ Suurklapper (F)
Strychnos pungens (628)	omupwaka	Bushman Orange/ Steekblaarklapper
Swartzia madagascariensis (217)	omumonga	Snakebean/ Slangboom
Tapinanthus olaefolius (-)	oshilunda (parasite)	-/-
Terminalia prunioides (550)	omuhama/omunghama	Lowveld Cluster-leaf Deurmekaar (F)
Terminalia sericea (551)	omwoolo/omugolo	Silver Cluster-leaf/ Vaalboom; (Sand)Geelhout (F)
Vangueria infausta (702)	omumbu/osimbu; oshimbu (F)	Wild medlar/ Wildemispel
Ximenia americana (102)	oshipeke (F)/ okakukupeke (F)	Sourplum;Wild Plum /Suurpruim
Ximenia caffra (103)	oshipeke (F)/ oshimbyupeke (F)	Sourplum;Wild Plum /Kaffersuurpruim
Ziziphus mucronata (447)	omukekete/ omusheshete (F)	Buffalo Thorn/ Aruboom; Blinkblaar-wag-'n-bietjie

* [NB Nerium oleander, origin. from Mediterranean, poisenous. (E) p. 797]

SECTION B: listed by Oshivambo names

efindapya	Nidorella resedifolia	
ehonga	Grewia flava (F)	-/Rosyntjiebos
elangelamwali	see oshinanganamwali	
enghono (A)/ omumangandjaba (D)	Acacia ataxacantha	Flame Thorn/ Vlamdoring
enolyomungolwe	see oshingodwe	
enyanga	Scilla rautanenii	
ofufe/ omutsanguta (F)	Baphia massaiensis	Sand Camwood/ Sandkamhout
okadilanghono	Acacia mellifera	Black Thorn/ Swarthaak
okakukupeke	see oshipeke	
okalimufita	Monechma divaricatum	
okalyadi (A); okalyanzi (F)	Catophractes alexandri	- /Skaapbos (F)
okalyanzi	see okalyadi	
okambadanga	Indigofera astragalina	
okamutaka (B)/	Acacia tortilis	Umbrella Thorn/
okanakamuma	see omuhandwa	
okanangola	Sida hoepfneri	
okapembe	Polycarpaea corymbosa	
omangandjaba	Acacia fleckii	Plate Thorn
omanyanga	Nerium duparquetiana (Nerium Oleander?)	Oleander
ombango/omumakani ombango (F)	Croton gratissimus subsp. gratissimus	Lavender Fever-berry /Laventel-koorsbessie; Apteek(F); Vaalbos(F)
omboo	Commiphora (Generic)	Corkwood Trees/

		Kanniedoodbome
omholyo(F); omukuyumba(F); omungholyo?(F)/ omukuyumbwa(F)	Ficus glumosa	
omudengambwa	Cassine transvaalensis	Transvaal Saffron Transvaalsaffraan
omudhiku	see omudiku	
omudhime	see omudime	
omudiku; omutiwongobe (F)/ omudhiku (F)	Securidaca longipedunculata	Violet Tree/ Krinkhout; Fibre Tree
omudime; omudhime (F)	Euclea divinorum	Magic Guarri/ (Tower)Ghwarrie
omufimba; omufhimba (F)	Dialium englerianum	Kalahari Podberry/ Kalahari-peulbessie
omufyaati	see omufyati	
omufyati/omusati	Colophospermum mopane	Mopane/Mopanie
omugolo	see omwoolo	
omugongo	see omwongo	
omuguni	see omuuni	
omuguya	see omuuva	
omuhaloweyo	Acacia nebrownii	Water Thorn
omuhama/omunghama	Terminalia prunioides	Lowveld Cluster-leaf/ Deurmekaar
omuhandwa/okanakamuma	Fagara ovatifoliolata	Ovambo Knobwood/ Ovamboperdepram
omuhanguti	see omupopo	
omuhonga	see ehonga	
omuhonga (B)/ omundjebele(D)	Grewia tenax	

omuhongo/omunghongo	Spirostachys africana	Tamboti/Tambotie
omukadhikuku	Combretum hereroense	Russet Bushwillow /Kierieklapper
omukekete/ omusheshete	Ziziphus mucronata	Buffalo Thorn/ Ruiboom; Blinkblaar-wag-'n-bietjie
omukuku (A/F)	Combretum imberbe	Leadwood/ Hardekool
omukuku (B)?	Commiphora glaucescens	Blue-leaved Corkwood /Bloublaar-kanniedood
omukuyumba	see omholyo	
omukwa	Adansonia digitata	Baobab/Kremetart Waterdoring
omulama/omumaluko	Combretum apiculatum	Red Bushwillow/ Rooibos (F)
omumakani?; ombango (F)	Croton gratissimus subsp. sub-gratissimus	Hairy Lavender Feverberry/ Harige Laventel-koorsbessie; Apteek(F); Vaalbos(F)
omukopakopa	Grewia avellana	
omukuyu(F)	subsp. sycomorus	Wildevy Common Cluster Fig; Sycamore Fig/ Wildevy; Wurgvy
	subsp. gnaphalocarpa	False Cluster Fig /Valstrosvy
omukuyumbwa	see omholyo	
omulavi/ omulayi (F)	Gardenia volkensii (formerly G. spatulifolia)	Transvaal Gardenia/ Transvaalkatjie-
omulayi	see omulavi	
ehonga (A); omushe; omuhonga	Grewia (Generic)	Wildraisin Bushes /Kruisbessie; Rosyntjiebos piering

omulemba	1.Ficus craterostoma(?) (formerly F. petersii)	Forest Fig; Strangler Fig/ Bosvy; Wurgvy
	2.Ficus thonningii	Common Wild Fig; Strangler Fig/ Gewone Wildevy; Wurgvy
omulunga	Hyphaene petersiana (formerly H. ventricosa)	Real Fan Palm/ Makalanie-palm; Waaierpalm (F)
omumakani	Rhigozum brevispinosum	Short-thorn Pomegranate/Kort-doringgranaat
omumangandjaba	see enghono	
omumbalandongo	Elephantorrhiza suffruticosa (?)	Looiwortelbos (F)
omumbanganyana	Mundulea sericea	Cork Bush; Silver Bush/Kurkbos
omumbu/osimbu; oshimbu (F)	Vangueria infausta	Wild medlar/ Wildemispel
omumonga	Swartzia madagascariensis	Snakebean/ Slangboom
omumwe/ omweeguki (F)	Ochna pulchra	Wild Pear/ Lekkerbreek
omunaluko	see omulama	
omundjebele	see omuhonga	
omunghama	see omuhama	
omunghete/ omunkete	Ricinodendron rautanenii	Mangetti Tree/ Manketti
omungholuo	see omungholyo	
omungholyo/ omunkolyo(F) kiloneura	see 1.omholyo? 2.Ficus	
omunghongo	see omuhongo	
(+) omunghudi;	Boscia albitrunca	Sheperd's Tree/

omunkunzi (F)		Witgat
omungolwe	see oshingodwe	
omungonze	see oshingodwe	
omunkete	see omunghete	
omunkolyo	see omunholyo	
omunkono	Acacia erubescens	Blue Thorn
omunkunzi	see omunghudi	
(+) omupalala	Peltophorum africanum	Weeping Wattle; African Wattle/ Huilbos
(+) omupanda	1.Lonchocarpus capassa	Apple-leaf/ Appelblaar
	2.Lonchocarpus nelsii	Kalahari Appleleaf/ Kalahari-appelblaar
omupapa	Baikiaea plurijuga	Rhodesian Teak/ Rhodesiese Teak
omupetangobe	Hippocratea africana	
omupola/omupopola; oshihampolo (F)	Maerua schinzii	Ringwood Tree/ Kringboom; Kwarda(F)
omupombo	Rhus tenuinervis	Kalahari Currant/ Kalahari Taaibos
omupopo; omuhanguti	Albizia anthelmintica	Worm-bark False Thorn/Aruboom
omupopola	see omupola	
omupundu	Grewia deserticola	
omupupwaheke	Combretum mechowianum	Rhodesian Bushwillow /Rhodesiese Boswilg
omupwaka	Strychnos pungens	Bushman Orange/ Steekblaar-klapper

omusati	see omufyati	
omushadi; oshadi (F)	Ehretia rigida	Puzzle Bush/ Deurmekaarbos
omushe (1)	Grewia flavescens var. flavesceni	Sandpaper Raisin /Skurwerosyntjie
	var. olukondae	Broad-leaved Sand Paper Raisin/Bree-blaarskurwe-rosyntjie
omushe (2)	see ehonga	
omushendje; omusheshe (F)	Combretum zeyheri	Large-fruited Bushwillow/ Raasblaar
omusheshe	Albizia versicolor	Large-leaved False Thorn/ Sandkiaat
omusheshe	see omushendje(?)	
omusheshete	see omukekete	
omushii/omusii (F)	Guibourtia coleosperma	Cobalwood/ Bastermopanie; Rooisering; Schivi (F)
omusii	see omushii	
omushu	see okamutaka	
omutaku	Entandrophragma spicatum	Ovambo Mahogany/ Ovambomahonie
omuthimba	see omufimba	
omutiwongobe	see omudiku	
omutoka	see okamutaka	
omutoka(D)/ omushu (F)		Haak-en-steek
omutokano	see omutyuula	
omutsanguta	see 1.ofufe	

2.omutwanghuta

omutyuula	1.Acacia reficiens	Red Umbrella Thorn /Rooihaak-en-steek
	2.Acacia sieberiana (D)	Paperbark Thorn/ Papierbasdoring
omutyuula/ omutokano	Acacia hebeclada	Candle Thorn/ Transiedoring Blouhaak
omutwanghuta/ omutsanguta	Bauhinia petersiana or B. macrantha (F)	Coffee Neat's Foot/ Koffiebeesklou; Koffiebos (F)
omutulu (F)	Elephantorrhiza elephantina	Sumach Bean/ Elandsboontjie
omutundungu	Burkea africana	Wild Seringa/ Sandsering
omuuni/omuguni	Strychnos cocculoides	Corky Monkey Orange; Kaffir Orange/ Suurklapper (F)
omuuva/ omuguya	Pterocarpus angolensis	Wild Teak; Transvaal Teak/ Dolf; Kiaat
omuve/omuye	Berchemia discolor	Birdplum/ Voelpruim Wildedadel
omuye	see omuve	
omuyele	1.Acacia nilotica	Scented Thorn/ Lekkerruikpeul
	2.Acacia sieberiana (F)	Paperbark Thorn
omwandi	Diospyros mespiliformis	Transvaal or African Ebony
omweeguki	see omumwe	
omwila/omwiila (F)	Grewia falcistipula	
omwiila	see omwila	
omwoolo/omugolo	Terminalia sericea	Silver Cluster-

		leaf/Vaalboom; (Sand)Geelhout
omwoonde	Acacia erioloba	Camel Thorn/ Kameeldoring
omwoongo/omugongo	Sclerocarya birrea	Marula/Maroela
ongete	see onyege	
onyege/ongete	Dichrostachys cinerea	Sickle Bush/ Sekelbos
oshadi	see omushadi	
oshihamupolo	see omupola	
oshilunda	Tapinanthus olaefolius	
oshimbu	see omumbu	
oshimbyupeke	see oshipeke	
oshinanganamwali/ elangelamwali (F)	Kleinia longiflora(B;F)	
oshingodwe/ omungonze; enolyomungolwe (F); omungolwe (F)	Maytenus senegalensis	Red Spike-thorn/ (Rooi-)Pendoring
oshipeke/ okakukupeke	Ximenia americana	Sourplum;Wild Plum/Suurpruim
oshipeke/ oshimbyupeke	Ximenia caffra	Sourplum;Wild Plum/ Kaffersuurpruim
oshipundu	Grewia retinervis(F)	
osimbu	see omumbu	