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COMPREHENSIVE ASSESSMENT OF ENVIRONMENTAL PROBLEMS AND OPPORTUNITIES FOR USAID INTERVENTION IN NAMIBIA

PASTORAL AND AGRO-PASTORAL RESOURCES

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NAMIBIA RESOURCE CONSULTANTS

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Table of Contents

1. BACKGROUND 1
   1.1 The role of Agriculture in Namibia (a short perspective) 1
   1.2 Climate variability in Namibia 2

2. THE COMMERCIAL AND COMMUNAL SUB-SECTORS IN NAMIBIA - A BRIEF OVERVIEW 4

3. THE COMMERCIAL FARMING SECTOR 5
   3.1 Introduction and background 5
   3.2 Major threats to commercial livestock production 6
      3.2.1 Perception of Farmers 6
      3.2.2 Overestimation of the carrying capacity of the rangelands 7
      3.2.3 Structural hindrances in the way of sustainable resource use 8
      3.2.4 Land and Natural Resource Management Policy 10

4. THE COMMUNAL FARMING SECTOR 11
   4.1 General Introduction and Background 11
   4.2 The Southern Communal Areas (former Namaland) 12
      4.2.1 Orientation 12
      4.2.2 Livestock. 14
      4.2.3 Rangeland condition and Rangeland Use 14
   4.3 The Eastern communal areas (Former Hereroland) 17
      4.3.1 Orientation 17
      4.3.2 Livestock 20
      4.3.3 Rangeland condition and rangeland use 20
   4.4 The Western Communal Areas 24
      4.4.1 Orientation 24
      4.4.2 Livestock 25
   4.5 The Northern Communal Areas 28
      4.5.1 Orientation 28
      4.5.2 Kunene Region (former Kaokoland) 30
      4.5.3 North-Central Regions (former Owambo) 35
      4.5.4 The Kavango 44
      4.5.5 The (eastern) Caprivi 49
   4.6 Bushmanland 54
      4.6.1 Orientation 54
      4.6.2. Possibilities 54
   4.7 Rehoboth 55
      4.7.1 Orientation 55

5. MAJOR THREATS TO NAMIBIA'S RANGELAND RESOURCES 58

6. MAJOR CAUSES OF RANGELAND DEGRADATION IN NAMIBIA 58
   6.1 Overgrazing 58
   6.2 Overstocking 59
   6.3 Non - flexible use of rangelands 60
   6.4 Weak institutional basis on "grass- roots" level 61
   6.5 Lack of technical know-how and services 61
   6.6 Unconducive frame conditions 61

b

7. THE EFFECTS OF DESERTIFICATION AND RANGELAND DEGRADATION 62
7.1 Loss of productivity of the rangelands 63
7.2 Bush encroachment. 63
7.3 Deforestation 63
7.4 Unsustainable use of water resources 63
7.5 Salinisation of cultivated land 63

8. RECOMMENDATIONS FOR SUSTAINABLE RANGELAND MANAGEMENT AND IMPROVED LIVESTOCK PRODUCTION IN NAMIBIA 63
8.1 Introduction 63
8.2 Sustainable improvement of livestock production 64
8.2.1 Rotational resting under normal and good rainfall years 64
8.2.2 Strategies of livestock movement 65
8.2.3 The use of well adapted indigenous livestock together with improved animal husbandry practises 66
8.2.4 Feed supplementation to rangelands 66
8.3 Resettlement of large communal farmers to title deed areas 67
8.4 Livestock marketing as a way of tracking 68
8.5 Alternative income generating activities 69
8.6 Frame conditions 69
8.7 Alternatives for capital accumulation 70
8.8 Local investment packages 70
8.9 Institution building on communal land 70

9. REFERENCES 70

List of Acronyms

CA	Communal Area
CATAD	Centre for Advanced Training in Agricultural Development
CBO	Community Based Organisation
CDC	Culture, Development and Communication
CV	Coefficient of Variation
DRFN	Desert Research Foundation of Namibia
DVS	Directorate of Veterinary Services
EEAN	Environmental Evaluation Associates of Namibia
ENSO	El Nino Southern Oscillation
ENWC	Eastern National Water Carrier
GDP	Gross Domestic Product
GTZ	Gesellschaft fur Technische Zusammenarbeit
ICD	International Convention to Combat Desertification
IFAD	International Fund for Agricultural Development
KEK	Kultur, Entwicklung und Kommunikation
LRAC	Land Reform and Advisory Commission
LSU	Large Stock Unit
MAWRD	Ministry of Agriculture, Water and Rural Development
MET	Ministry of Environment and Tourism
MLRR	Ministry of Lands, Resettlement and Rehabilitation
NAP	National Agricultural Policy
NCA	Northern Communal Area
NEPRU	Namibia Economic and Policy Research Unit
NDC	Namibia Development Corporation
NOLIDEP	Northern Livestock Development Programme
NPC	National Planning Commission
RHFA	Relative Homogenous Farming Area
SADF	South African Defence Force
SARDEP	Sustainable Animal and Range Development Programme
SSD	Social Science Division
SSU	Small Stock Unit
UNAM	University of Namibia

Executive Summary

1. Namibia is mainly a **pastoral orientated country** where the major features are scarce productive land and fragile soils, coupled with limited water resources and an erratic rainfall regime. The agricultural sector is third after mining and fisheries as far as export earnings are concerned. The majority of the people in Namibia are dependent on agriculture for their livelihood.

2. **Climatic variability** is the most distinct characteristic of the Namibian environment. With variation in rainfall in time and space, subsequent variation in terms of fodder availability is also taking place. Rangeland management practices are based on the Clementsian succession theory which is an equilibrial concept. Since the rangeland ecology in Namibia is more dynamic and in disequilibrium, rangeland management should be more **flexible and opportunistic**.

3. Namibia has a unique farming sector with some 4 200 **commercial farmers** occupying 48% of the total farming area. The land is owned by individuals on the basis of title deeds. The majority of the **communal farmers** (some 130 000) occupy the rest of the farming areas on a subsistence basis where the land belongs to the state and the communities have the right to utilise the grazing.

4. The **major threats** to commercial livestock production are the **perceptions** of commercial farmers about the production ability of their farms and that everything will be back to normal after the next rainy season. The use of **fixed carrying capacity norms** for certain areas is another indication of the non-flexible approach of commercial farmers. The **bush encroachment** problem is perhaps the most important threat to livestock production. A few high risk areas with very low and erratic rainfall need to be identified and gradually withdrawn from any form of livestock production. The fact that many commercial **farming units** are no longer able to sustain the required number of animals needed for commercial viability is another factor to be taken into account.

5. There is currently **no global Government policy document** on land allocation or natural resource management. A Commercial Land Reform Act has been promulgated, but apart from the establishment of the Land Reform Advisory Committee to advise government on the implementation of the Act, nothing more has occurred in this regard. The so-called Communal Land Act is also still not available.

6. **Desertification**, or in other words, land degradation due mainly to human impact and climatic change, can be considered as the major threat to Namibia's rangeland resources.

7. There are **six major causes** of rangeland degradation, namely overgrazing, overstocking, the non-flexible use of rangeland resources, a weak institutional basis at "grass-roots" level, a lack of technical know-how and service, and unconducive frame conditions like land tenure.

8. Desertification has **many manifestations** in Namibia. The most visible and important ones are the loss of productivity of the rangelands, bush encroachment, deforestation, the unsustainable use of water resources, salinisation and erosion of cultivated land.

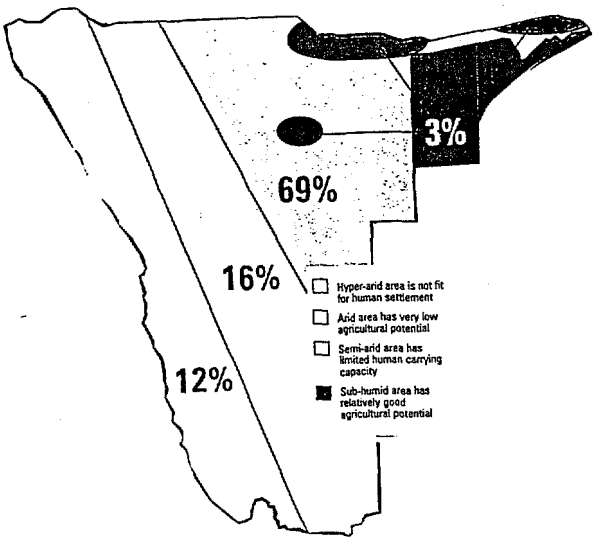
9. In order to reach the objectives of sustainable rangeland utilisation to reduce man-induced land degradation practices and to improve the welfare of the rural population, it is necessary to identify and implement a strategy that will take into consideration many more **elements** than just pure agricultural ones. Such elements are the resettlement of large communal farmers to title deed areas; improved marketing; alternative income generating activities; conducive policy environment; alternatives for capital accumulation and local investment packages as well as institution building on regional and local levels.

10. The sustainable improvement of livestock production should have a strategy that is very **flexible and adapted** to the changing climatic and economic environment. Elements of such strategy may include rotational resting practices in good and normal years; strategies of livestock relocation; the use of well adapted livestock and feed supplementation to the rangelands, to mention but a few.

1. BACKGROUND

1.1 The role of Agriculture in Namibia (a short perspective)

Namibia is mainly a pastoral country where the major features are scarce productive land and fragile soils, coupled with limited water resources and an erratic rainfall regime. Namibia is the driest country in Africa south of the Sahel and can be divided into four main ecological zones. (Map 1)



Map 1. The four major ecological zones of Namibia in relation to rainfall. (DRFN, 1996)

- *the desert region*, comprising 22% of the land area with a mean annual rainfall of less than 100 mm.
- *the arid region*, comprising 33% of the land area with a mean annual rainfall of between 100 an 300 mm.
- *the semi-arid region*, comprising 37% of the land area with a mean annual rainfall between 301 and 500 mm; and
- *the semi-humid and sub-tropical region*, comprising 8% of the land area with an annual rainfall between 501 and 700 mm.

About 34% of the land area receives more than 400 mm rainfall per year and can be seen as having at least some potential for rainfed crop production. About 95% of these soils have however a clay content of less than 5% and only one percent of the land area has soils with a medium to high potential for rainfed or irrigated arable production. Although and estimated 274 000 ha in the northern communal areas are used by approximately 137 000 farm households for rainfed crop production, it can be clearly stated that Namibia has a very limited potential for reliable crop production and that extensive livestock production is thus the major agricultural sector, taking into account that 85% to 90% of the nation's total agricultural income is derived from red meat production and livestock products. The country is largely unsuitable for crop production and possesses a varied potential for cattle and small stock farming.

The majority of the total population (an estimated 68%) derives their livelihood directly or indirectly from agriculture and forestry. Agricultural commodities ranked third in 1994 behind minerals, fish and processed fish products in terms of their contribution to merchandise export earnings and comprise about 15% of the total exports. Of this percentage livestock and meat products make the biggest contribution. Local farmers are able to supply in all the Nation's red meat requirements and up to 55% of the country's grain consumption needs in years of average of above average rainfall.

These relatively favourable rainy seasons have unfortunately only an occurrence of four out of ten years.

The agricultural sector contributes about 10% to the Gross Domestic Product (GDP). In 1994 the commercial farming sub-sector contributed an estimated 7,8% to the GDP where the communal sub-sector, due to low productivity, has contributed an average of 2,6% to the GDP since 1987. Annual per capita income from farming in the communal sub-sector is approximately N$ 260.

The communal farming sub-sector is characterised by low, unstable and declining levels of productivity, production and farm income. Low crop yields are mainly caused by the resource-poor and high-risk farming environment and the lack of access to appropriate production technologies and farm inputs. Poor access to and availability of credit, markets, rural infra-structure and effective institutions that serve smallholders, further contribute to these low levels of agricultural productivity and production.

In 1993/94, subsistence farming was the main source of income for almost 40% of households in the country. The commercial farming sub-sector provides employment to about 8% of the total working population.

1.2 Climate variability in Namibia

Climate variability is characteristic of all drylands, but in Africa it is particularly potent. This usually results in a high degree of uncertainty in the behaviour of such ecosystems. This in turn makes it difficult or impossible to predict the levels of production that the system might yield from one year to another, or how ecosystem structure may change over time. Systems which demonstrate this kind of behaviour, be they physical or biological, are sometimes categorised as non-equilibrium systems and the behaviour typical of these systems is called complex or non-linear dynamics (Prigogine, 1961). The theory of non-equilibrium dynamics is relatively new (Holling, 1973) and Walker *et. al.* (1981) recognised the relevance of these ideas to arid savannas and applied these approaches to the highly dynamic ecosystems of southern Africa.

Rainfall variability rather than the mean, is a more significant indicator in non-equilibrium environments. Coughley et.al. (1987:5) judged that the threshold, where a system becomes dominated by variability more than by average conditions, occurs when rainfall CV (Coefficient of Variation) nears or exceeds 30 percent. They also suggest that where CV's are below 20 percent, animal populations will remain relatively stable and strong feedback will develop between herbivores and plants.

Dry ecosystems are more unstable than wet ones because rainfall variability is inversely correlated with total rainfall. The lower the annual rainfall, the greater the coefficient of rainfall variation (Conrad, 1941). However dry equatorial systems are among the most variable on earth because rainfall variation is also negatively correlated with latitude. Variation also increases in regions influenced by sea surface temperature anomalies associated with El Nino-Southern Oscillation (ENSO) patterns. Nicholls and Wong (1990) developed a relationship which integrates the effects of total rainfall, latitude and ENSO on interannual rainfall CV's. Their analysis suggests that at latitudes near the equator, CV's of 33 percent or greater will occur at rainfall levels of about 600 mm or less, in other words we can expect non-equilibrium dynamics in equatorial regions with less that about 600 mm rainfall. However, where ENSO effects prevail, then CV's of 33 percent might be found even where rainfall levels are as high as 1400 mm.

At 30 degrees latitude CV's of 33% or greater are likely at about 350 mm rainfall or below, if there are no ENSO effects. With ENSO effects, 33% CV's could occur up to 600 mm rainfall (Nichols and Wong, 1990). Based on this information, it is reasonable to hypothesise that rainfall CV's might exceed 33 percent anywhere in Africa with 600 mm or less rainfall per year and in areas of southern and eastern Africa, where ENSO effects are prevalent, CV's may surpass 33 percent, even where rainfall exceeds 1000 mm per year. By taking a look at the 100 year annual rainfall figures for

Windhoek (Fig. 1), and with a CV of 38% it is clear that most of Namibia, if not the whole, can be classified as non-equilibrium environment.

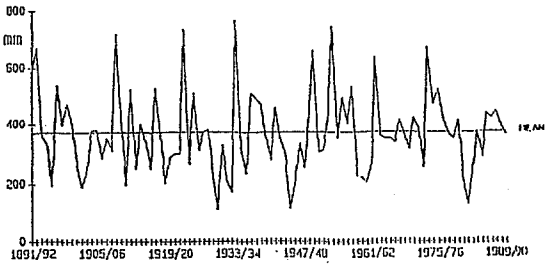
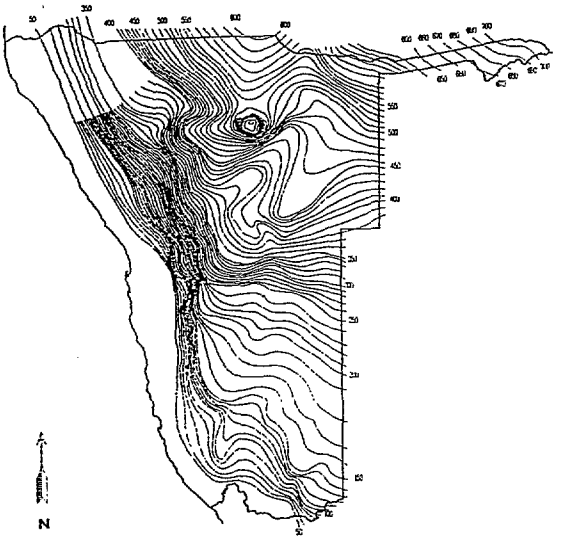


Fig. 1 : The annual rainfall for Windhoek (1890 - 1990) (GTZ, 1991).

Expect for the far north and north east, Namibia experiences a semi-arid to arid climate. Three basic seasons occur: a hot wet season (January-April), a cool dry season (May-August) and a hot dry season (September-December). The mean annual rainfall decreases from about 600 mm in the far north-east to virtually zero towards the west and south **(Map. 2)**.



Map 2 : Isohytal rainfall map of Namibia (MAWRD, 1996).

As in the other arid and semi-arid regions, rainfall in Namibia varies greatly between years. To demonstrate this, annual rainfall data from three stations have been analysed in more detail. **(Table 1 , Fig 1)**. The rainfall variability is highest in the areas with the lowest average rainfall, decreasing from west to east and from south to north.

Stations	Windhoek	Keetmanshoop	Rundu
No. of years of observations	99	40	48
Mean annual rainfall (mm)	367	163	599
Max. annual rainfall (mm)	763	548	1138
Min. annual rainfall (mm)	112	45.5	303.6
Rainfall exceeded in:			
90% of years (mm)	203	58.9	358
70% of years (mm)	281	100	505
50% of years (mm)	352	145	584
30% of years (mm)	411	176	681

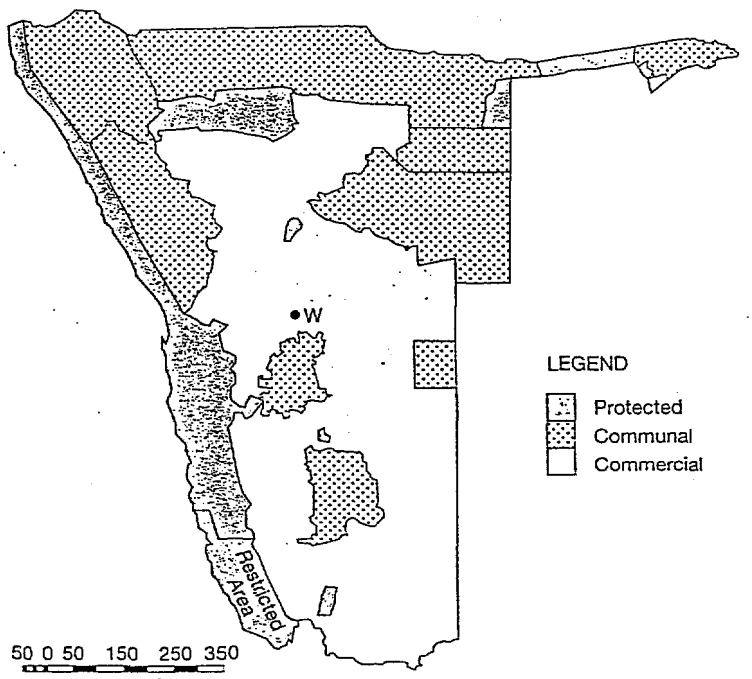
Table 1 : Rainfall variability at three meteorological stations in Namibia (GTZ, 1991).

Since rainfall is the most important single variable which determines plant growth, rainfall variability suggests a similar variability in primary plant production. However, actual primary plant production is also influenced by soil moisture reserves, soil structure, topography, run-off and run-on of water in particular areas and vegetation structure (e.g. relative importance of herbaceous layer and tree/shrub layer).

Standard range management procedures are based on the Clementsian succession theory, an equilibrial concept, and are implemented through efforts to maintain a desirable range condition class (Lauenroth and Laycock, 1989). The applicability of this concept to dry rangelands has long been questioned (Hyder et. al, 1966) both on a practical and theoretical basis. Scientists working in the dry tropics have begun to rethink the theoretical basis for range management and to suggest alternative concepts and practices. Secondary successional sequences are poorly understood for many dry rangelands and in some cases may not exist. Plant production and community structure seem to be largely under the control of climate in the arid tropics, although herbivores do modify these attributes. Carrying capacities probably have some utility in highly dynamic systems, but as an abstraction rather than a goal because the capacity is likely to change rapidly both within and between years (Ellis, Coughenour and Swift, 1993).

2. THE COMMERCIAL AND COMMUNAL SUB-SECTORS IN NAMIBIA - A BRIEF OVERVIEW

The agricultural sector is divided into a commercial farming sub-sector, where farmers operate on freehold title deed land, and a communal farming sub-sector, where farmers operate on land under a communal tenure system. These communal areas are still state land and no title deeds can be registered. The communal areas directly support 95% of the nation's farming population, but occupy only 48% of the total agricultural land as opposed to the bigger part being used by only a small percentage of commercial farmers mainly for extensive ranching. This results in an average of two hectares per communal farming household for crop production in the northern communal areas and just over 200 ha per communal farming household for extensive livestock production which is communally used. The commercial sub-sector however is made up of 6 337 freehold title deed farms belonging to about 4 200 large-scale farmers, each having an average landholding of 8 620 hectares. **(Map 3)**

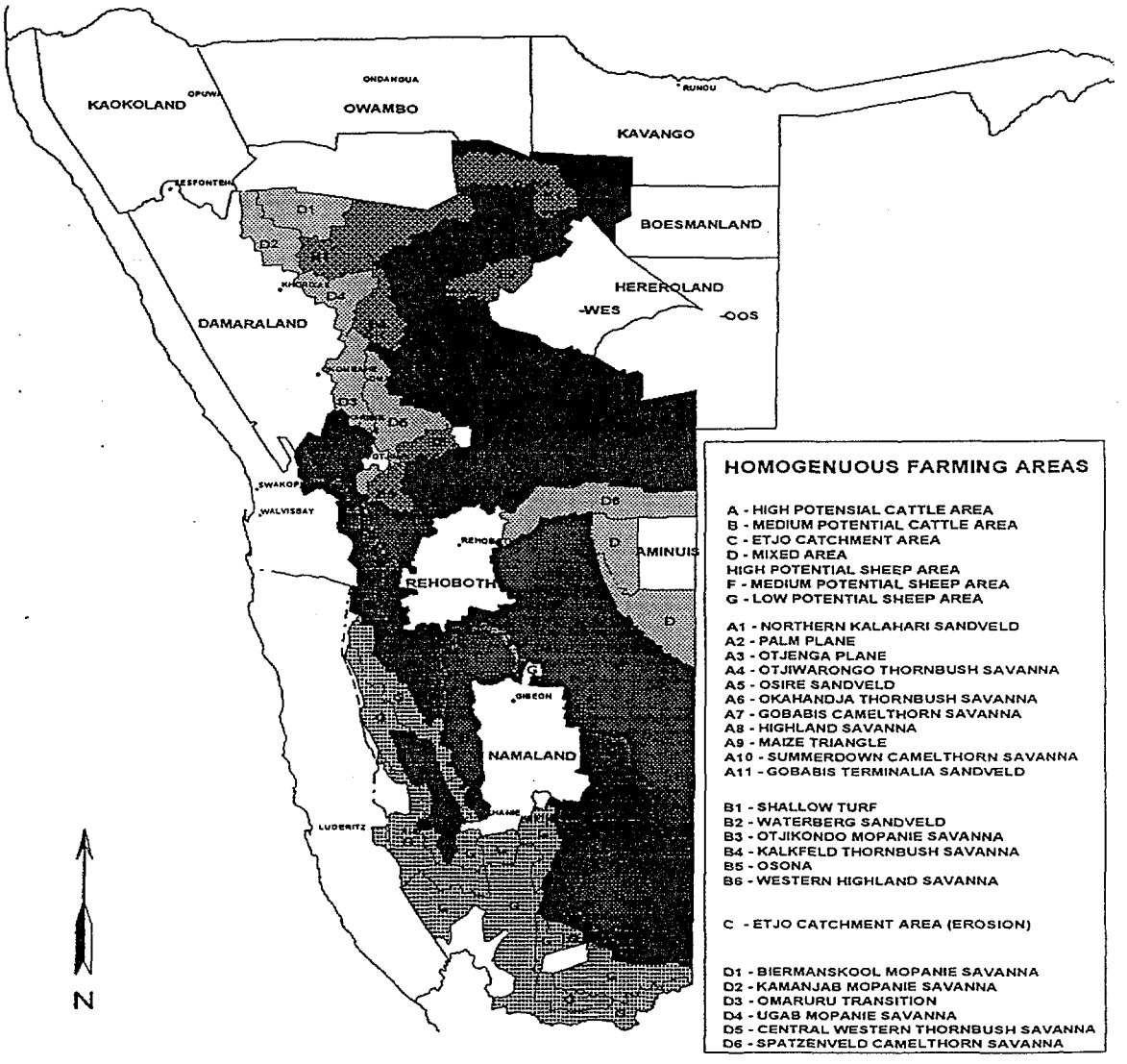


Map 3 : The commercial and communal areas of Namibia.

3. THE COMMERCIAL FARMING SECTOR

3.1 Introduction and background

The commercial farming area is divided into sub-areas on the basis of physical features of morphology, land use and macro climate **(Map 4)**. These sub-areas are called Relatively Homogenous Farming Areas (RHFA's) and very little differences in terms of farming practices and expected production outputs should occur (MAWRD, 1979). A further characterisation and description of these RHFA's cover areas of crop production is done and where smaller features like topography and soil characteristics are important.



Map 4 : Relative Homogeneous Farming Areas in Namibia (MAWRD, 1979).

The commercial areas are divided into high, medium and low potential areas in relation to large stock and small stock production (MAWRD, 1979). **Table 2** indicates these areas.

Production Potential	Number of farming units	Total Area (ha)
High potential for cattle farming	1473	9 564 000
Medium potential for cattle farming	433	3 100 000
Areas affected by erosion (cattle farming areas)	135	480 000
Total (cattle)	**2041**	**13 144 000**
Mixed small stock/large stock area	480	4 837 000
High potential smallstock farming area		8 100 000
Medium potential smallstock farming area		7 340 000
Low potential smallstock farming area		2 622 000
Total (Smallstock)	2606	18 062 000
Total (Namibia)	**5127**	**36 043 500**

Table 2 : The total land area and the number of farming units in the high, medium and low potential areas for commercial cattle and smallstock production in Namibia (MAWRD, 1979).

3.2 Major threats to commercial livestock production

Although it seems as if commercial farmers are able to reach their targets of sustainable production in order to maximise income per hectare, a large variation in the efficiency of these farmers exists. This can be clearly seen in the current condition and productivity of the rangelands in the commercial areas. The problem in commercial livestock production can always be related to one or a combination of the following: (Le Roux, 1988).

- The perception of the farmer about the land;
- An overestimation of the production ability or carrying capacity of the rangelands;
- Structural hindrances in the way of sustainable rangeland management (e.g. bush encroachment- mainly north and central areas; total loss of ground cover - mainly in south and due to the loss in productivity of the rangeland, too small and uneconomical farming units.

3.2.1 Perception of Farmers

Despite major inputs in the past in terms of research, extension and financial support from government, deterioration of the rangelands and, as a result, the financial instability of the farmers is still taking place at an alarming rate. It seems as if farmers are unwilling to adapt to the changing environment. Practises like overstocking are still taking place and it appears that farmers believe that the old stocking rate figures of the 1950's are still applicable today. Farmers fail to recognise the occurrence of droughts and periods of sub-normal rainfall as part of the variable environment in which they farm. Namibia is, in terms of commercial livestock production, relatively young. Big areas in the North and East of the country have only been commercially used for the past 50 - 60 years. The objectives of commercial farmers were therefore aimed at utilisation in order to maximise output. With the droughts of the 1960's the first signs of rangeland degradation was recorded and this

drought was "bridged" by means of "subsidy maize" provided by government to the farmers (MAWRD, 1988). This practice to bridge drought periods with the provision of maize to livestock continued until 1985. These "rescue" operations, although very well intended at the time, did save many animals from starvation, but contributed largely to degradation of the rangelands and other agricultural resources (MAWRD, 1988). The perception of the farmers were that the land has a high production ability, and should they run into problems, the government will support them to bridge the crises.

Other elements contributing to the sometimes wrong perception of the farmers towards their rangelands, are: The "good" years should be used to make up for the "bad" years; if it will only rain sufficiently again, all the problems will disappear; farmers think in general that they are very good managers and that they are able to manage the resources in a sustainable manner; farmer's expectations about the production potential of their farms are too high; farmers are too individualistic and their group cohesiveness is weak; farmers sometimes regard the know-how and experience of extension officers as inferior.

3.2.2 Overestimation of the carrying capacity of the rangelands

The traditional carrying capacity norm of number of hectares per livestock unit presents many problems and will be very difficult to change. A lot of confusion of what a livestock unit is, does exist amongst farmers, researchers and extension officers. The biomass principle where the livestock fodder demand on the basis of the live mass of animals being adjusted to the available plant biomass on an annual basis is much more applicable.

Although the use of RHFA's might give an indication of the long term carrying capacity of an area, the variability of the rainfall and thus the variability of fodder production is so high that an indication the carrying capacity should be obtained on an annual basis at the end of each rainy season. Variation in terms of space will imply that carrying capacity estimations will also have to be done on different places and that extrapolation of data is very difficult.

Carrying capacity is not a naturally given value, but depends on the production aim. This means that when maximum yield per hectare is the aim and the individual animals can be more leaner, stocking rates will be higher than where the aim is to have maximum yield per animal. Carrying capacity is also determined by the type of animals used. Grazers and browsers, livestock and game use different components on the range and depending on the combination of different types of animals, the carrying capacity will change accordingly. If animals only function as capital and for cultural uses, the condition of the animals are of minor importance and stocking rates can therefore be higher. These arguments are mainly applicable to situations where the rainfall varies little between years.

By taking another look at the long term rainfall figures of Windhoek (Fig. 1), the maximum annual rainfall measured was almost 7 times as much than the minimum. As vegetation yields are closely correlated with rainfall within the rainfall range in question, it can be assumed that vegetation yield and hence the amount of forage available varied accordingly. Rainfall also varies, not only between years, but also spatially. It is also true that annual rainfall alone does not determine the vegetation yields, but rainfall distribution over the year also has a strong effect.

By analysing the annual rainfall data of Windhoek over the past 100 years, the following assumptions can be made: if rainfall and thus the correspondent vegetation yield is less than 70% of what is planned for, the animals will experience a feed shortage which also can be called a drought. If rainfall exceeds 150% of what is planned for, there will be a surplus of forage which the animals can no longer use productively. If a farmer in Windhoek would take the average rainfall as the basis for planning and stocking, there would have been a shortage of forage or drought every fourth year and roughly in one year out of ten an

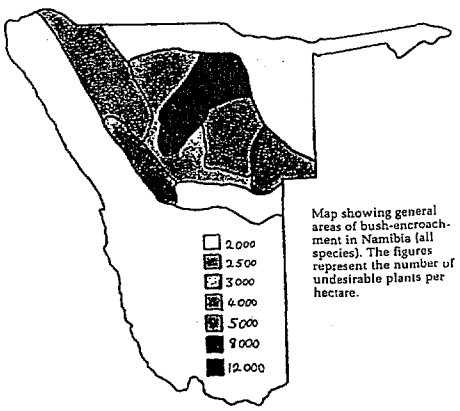
unused surplus of forage would have occurred. In 50 % of the years the average annual rainfall for Windhoek exceeded 352 mm and, if this figure is used as a basis for stocking rate, the picture would have been roughly the same. In 70 % of the years, the average annual rainfall was about 281 mm and should this figure be used, forage shortages would have occurred in one year out of eight and surplus of forage in one out of four years. In 90% of the years the average annual rainfall was in the order of 203 mm and forage shortage would still have occurred in 1 out of 30 years. At this level forage would have not been used to its potential in 2 out of 3 years, which no profit oriented manager could have afforded (GTZ, 1991).

With a variable resource such as rangeland in a dry and highly dynamic environment, the frequency of insufficient supply increases when the level of resource use increases and shortages decrease when the level of resource exploitation decreases. With a given production aim, carrying capacity of a given area of land is no fixed value, but will vary from year to year. It is therefore of little use to predetermine carrying capacity (Bayer, 1996). A strategy that is flexible, even opportunistic, has to be sought to be able to cope with such variations. This approach is called tracking and is where opportunities are grasped and risks are avoided (Scoones, 1995).

3.2.3 Structural hindrances in the way of sustainable resource use

3.2.3.1 Bush encroachment

This is one of Namibia's most serious environmental problems, having drastically reduced livestock production in the north-central regions of the Country (Bester, 1996) and regarded by the mid 1960's as an environmental disaster. In the communal areas bush thickening is less serious than in the commercial farming areas. This is due to climate differences and of fire occurrence frequency. Most of the areas suffering from severe bush encroachment lie to the north of the 23 degree latitude (See Map 4). Between 10 - 12 million hectares of rangeland in Namibia (approx. 12 - 14% of the total land area) are estimated to be infested by undesirable bush species. Of this, 5,3 million hectares or 65% of the northern commercial farming areas are seriously infested. In the central sub-region about 1,8 million hectares have been transformed into bush thicket, while in the southern areas *Rhigozum trichotomum* infests about 1,8 million hectares of rangeland (Bester, 1996). The thickening of *Acacia mellifera* is occurring mostly in the Otjiwarongo, Okahandja, Omaruru and Karibib districts as well as in parts of the Gobabis, Outjo and Grootfontein districts. *Dichrostachys cinerea* is a problem in the Tsumeb and Grootfontein districts while *Terminalia sericea* is posing a problem in the northern areas of the Gobabis district. Other species of concern are *Acacia erubescens, A. reficiens, Colospermum mopane* and *Combretum apiculatum* (Bester, 1996).



Map 5 : The extent of bush encroachment in Namibia (Bester & van Wyk, 1993).

Bush encroachment can, depending on the level of encroachment, decrease the carrying capacity of an area between 20% and 80% (MAWRD, 1987). After chemical control of bushes, grass production can increase up to 200% within two years after control. Already in 1987 it was estimated that this production increase can be as high as N$ 100 million per year. Recent studies of the cost of bush encroachment in the Otjiwarongo and Grootfontein areas (Ashley, 1994), indicate an estimated loss of around 34 000 tonnes of beef production worth N$ 102 million per year. This means around N$ 50 000 per farm. For the economy as a whole, this represents a loss of production, exports and national income.

Although the costs of bush encroachment are high in terms of lost production, the costs of combatting it are also high. Most techniques are simply not financially worthwhile. In 1987 it was estimated that the cost of aerial applied chemical control methods will be between N$ 80 and N$ 150 per hectare, about three times more than the production value of the farms (MAWRD, 1987).

In a country like Namibia with very low and variable rainfall, it is of the utmost importance that the soil moisture (=rainfall) be used as effectively as possible to produce fodder with high palatability and nutrient value for animals. Moisture losses due to bush encroachment can be extremely high as shown by research done in the Molopo area of South Africa. **(Table 3).**

Bush species	Transpiration (kg/day)
Grevia flava	3 842
Boscia albitrunca	6 920
Terminalia sericea	8 320
Acacia mellifera	32 400

Table 3 : Transpiration losses (kg/day) from an area of 500 bushes/ha for four different species in the Molopo area of South Africa (de Klerk, 1988)

The undesirable *A. mellifera* is transpiring up to 8 times faster than some of the other more palatable bush species. It is also important to mention that 100 000 *Schmidtia pappophoroiedes* grass tufts (palatable desirable grass) only transpires 11 600 kg per day and produce much better fodder for animals than *A. mellifera*.

3.2.3.2 Loss of ground cover.

Although the loss of ground cover is not applicable to the whole of the commercial farming area, some areas can be highlighted where it can contribute towards a decrease in the carrying capacity and a loss of fertile, productive topsoil. These are:

- The Ugab valley, to the south west of Outjo. The total area is 112 000 hectares of which 37 000 ha are communal farming areas.
- The Etjo catchment to the south west of Otjiwarongo. This area consists of 301 000 hectares and forms the watershed of the Omatako-, Omaruru- and Erundu rivers.
- The Otjihaenena valley in the "maize triangle" of Grootfontein. This area of 26 000 hectares is prone to erosion due to unsustainable and incorrect crop production methods.
- The Omaruru - Slang river area of around 40 000 hectares.
- Other areas that are only temporary deprived of vegetation cover due to a lack of rainfall and wrong management practises are Aranos and around Maltahohe.

Veld deterioration took place to such an extent that in large areas veld composition changed from a more climax situation with a good plant cover to a lower productive pioneer situation with low plant cover and even bare areas. In this veld condition a higher rate of run-off of water takes place. Research done in South Africa indicates that with a slope of 5%, the run-off on veld with a good cover is only 5% but on veld with a similar slope but totally bare, the run-off can be as high as 30%. Actual soil losses recorded were 0,5 ton/ha and 28 ton/ha respectively (de Klerk, 1988). Other factors contributing to a less conducive micro-climate for plant establishment and germination are higher soil temperatures due to lower cover, less fertile soils due to a lack of organic matter in the soil and a poor seedbed due to low soil moisture and a lack of organic matter on the soil surface.

3.2.3.3 High risk areas.

Some areas with very low and erratic rainfall and subsequent low production should be identified and gradually withdrawn from any form of livestock production. Such areas are to the south and south-west of the country (RHFA's H1 - H5). (MAWRD, 1987). Other areas to the west and north-west of the country should also be considered.

3.2.3.4 Uneconomic farming units due to too small a farm size.

It is very difficult to define an economic farming unit in commercial terms because it depends very much on where such a farm is situated, what kind of farming system and production system is used, what the efficiency level is of the individual farmer, etc. The MAWRD (1987) proposed an economic farming unit as an area of farm that can sustain the equivalent of 2000 small stock units or 400 large stock units under average management ability. Taking the proposed carrying capacity norms of the different areas into consideration, it can be concluded that half of the current commercial farms in the south (49,8%) are not able to sustain 2000 small stock units or 400 large stock units, 26% of the farms in the central commercial areas and 39,2% of the farms in the northern commercial areas (MAWRD, 1987). This means that 38,4% of all the current commercial farms in the country are not economic viable enterprises and are "too small" to meet the demands of the farmers.

These figures reflects the long term potential carrying capacity norms for the areas and not the reduced productivity of the farms due to bush encroachment in the north and loss of topsoil in the south. Should this be taken into consideration, the picture is much more worse.

3.2.4 Land and Natural Resource Management Policy

There is currently no global Government policy document on land allocation or natural resource management. The 1991 National Conference on Land Reform and the Land Question made a number of recommendations but these have not been formally accepted as Government policy (Dewdney, 1996). The Ministry of Lands, Resettlement and Rehabilitation (MLRR) recognises that this is a problem and has announced that it wishes to undertake a consultative National Land Policy formulation process.

The aim of the Commercial Land Reform Act (No. 53 of 1995), is for the State to acquire commercial farmland for the purposes of land reform. Currently only Part 1, the establishment of the Land Reform Advisory Commission, is in force. The principle of "willing seller - willing buyer", adopted at the 1991 National Conference on Land Reform, has been constrained by the Act. Land continues to be held under freehold title but the Government now has a preferential right of purchase should the land be offered for sale. The Act permits the compulsory acquisition of commercial agricultural land by the State where:

- it is under-utilised.
- it is held in excessive amounts (more than two economic units).
- it has been acquired by a foreign national after the promulgation of the Act.

The Act also provides for compensation at prevailing market prices. It makes provision for both the subdivision of land into so-called allotments and for its alienation (sale). It also enables the Minister to set a land tax. A Land Reform Advisory Commission (LRAC) is established to advise the Minister on the implementation of the Act. Concepts such as "under-utilised" and "economic unit" are not clearly defined and have yet to be resolved by the LRAC. There is enough land currently coming on the market for the State to purchase and these powers are unlikely to be used in the near future (Dewdney, 1996).

The absence of an overall policy framework is a serious constraint on planning and development within both the commercial and communal sectors and thereby encourages short-term overuse of resources and desertification. Uncertainty about the likely extent of land reform can encourage commercial farmers to take an unduly short-term view towards their resources. A clearer statement by Government of the expected extent and nature of land reform could help to reassure commercial farmers and encourage them to use their grazing and other natural resources more sustainably.

Commercial farmers are generally well-served by the existing policy framework within their areas. The fact that it appears unlikely that any commercial farmer will face forced land alienation in the near future because enough land is still coming into the market, might reduce their uncertainty and encourage sustainable use. There are currently no clear indications that the excessive concentrations of commercial farmlands and under-utilised land have a negative or a positive impact on sustainable rangeland use or desertification. This will largely be determined on how successful resettlement of people will be done on this commercial farmland. It is recommended, from a desertification perspective, to pursue the appropriation of under-utilised land rather than excessive holdings which may be being used efficiently and sustainably (Dewdney, 1996).

Subsidies to support livestock production in both communal and commercial areas promote overstocking, overgrazing and land degradation. There has been significant progress since Independence to reduce the subsidies to commercial farmers. The largest remaining subsidy (excluding drought relief) is on loans, but these were made before Independence and the contractual agreements cannot be revoked.

The drought aid scheme provides fodder, transport and grazing subsidies to both commercial and communal farmers. In 1995 one half of N$ 100 million was spent by Government on drought relief and the other half was spent on food aid (Dewdney, 1996). Commercial maize and wheat producers are heavily protected through price regulation, which is nothing else than subsidies. A recent study estimated effective rates of protection around 35% for wheat and 75% - 140% for maize. Large scale irrigation projects (Hardap and Etunda) are subsidised to a great degree. The unit cost of water paid is 1,5 cents per cubic metre and in the Hardap operation the price controls on the maize market further illustrate subsidies.

4. THE COMMUNAL FARMING SECTOR

4.1 General Introduction and Background

At the time of the German colonial occupation and their acquisition of land in the South West African region, the question of communal and commercial land arose. By buying land from local leaders and fencing it, the private ownership of land was introduced. Until then land had been in common usage by the indigenous population. From the beginning of the colonial times and the then especially after the defeat of the Herero and Nama peoples in 1907, the Germans started the policy of establishing "temporary" reserves for the local population. This meant a concentration of the local population in special areas under German administration.

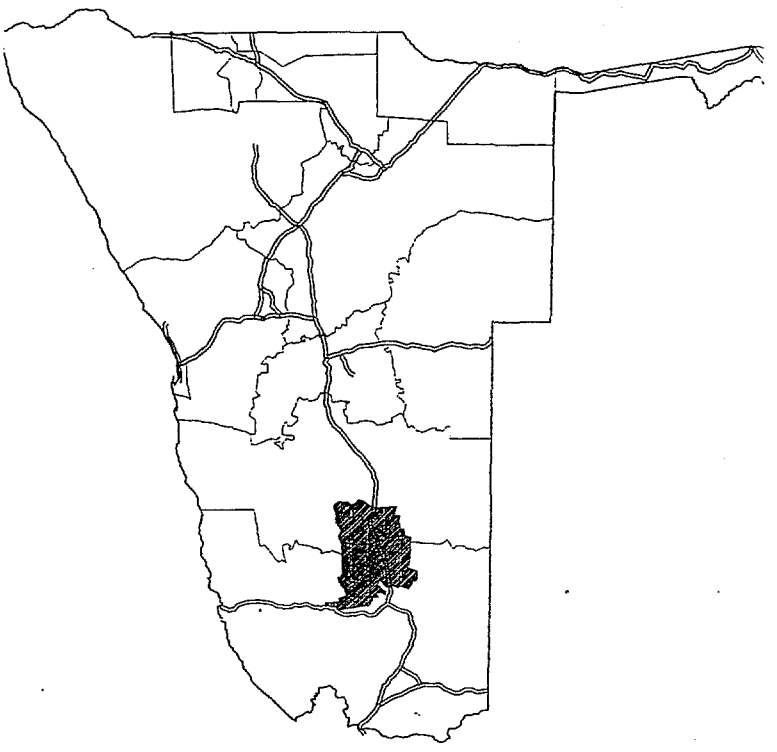
The South African administration continued with this policy until 1962 when the Odendaal commission was appointed to develop a new strategy to enlarge and consolidate the reserves along former ethnic borders. The idea was to establish common administrative grazing areas for the biggest ethnic groups in South West Africa. This was negotiated and agreed upon with compensation for both sides. he indigenous population was persuaded to move into or to continue to live in the Communal Areas and in exchange white farmers had to leave their bordering farms (today called the Odendaal farms). The Northern Communal Areas appeared to be of no interest to the Germans but were of strategic and economic importance for South Africa. In total, 40 % of the whole territory of Namibia was divided into 11 homelands which were declared Communal Areas (CATAD, 1994).

The homelands in the north were first granted autonomy by the South African administration (Owamboland in 1968, Kavangoland and East Caprivi in 1971/72) and later on the other eight areas. Since independence in 1990, the Communal Areas have remained in national ownership and the status of the private commercial farms are still the same.

4.2 The Southern Communal Areas (former Namaland)

4.2.1 Orientation

The former Namaland is situated in the Karas and Hardap regions of the south and covers a total area of 21 450 sq. km and has an estimated population of 16 234 (MAWRD, 1992). It lies within a semi-dessert agro-ecological zone, and has a mean annual rainfall of 100-200 mm. Vegetation is mostly dwarf shrubs with ephemeral herbs and annual grasses growing during the wet season. Soils are typical of arid environments: immature with poorly developed A horizons. Stone cover (desert pavement) is widespread, the base rock being largely sandstone (Map 6)



Map 6 : Map of Namibia indicating the Southern Communal Areas (HKW Stewart Scott, 1994)

The area is mainly suitable for small stock production and farmers rely heavily on the production of goats. Even in "normal" rainfall years, there are few areas that can support horses or cattle production. Donkeys are used for transport and at the same time provide a source of meat. According to a census carried out in June 1991, the following numbers of animals were kept in the southern communal areas:

Area	Cattle	Sheep	Goats	Horses	Donkeys
Bondelswarts	682	9 943	7 011	192	217
Namaland/Soromaas	11 707	87 291	147 704	3 137	6 465
Total	**12 389**	**97 234**	**154 715**	**3 329**	**6 682**

Table 4 : Livestock numbers in the southern communal areas 1991 (MAWRD, 1992).

For many of the households it is not possible to earn a livelihood from livestock production alone. Most households are dependent on other sources of income (mainly transfer payments) and for only a minority of large-scale farmers can livestock production offer a reasonable livelihood. The possibility of a household living off livestock production is mainly determined by the number of animals owned. A number of about 150 sheep and goats is the minimum herd size needed to sustain a family if livestock production is the only source of income. Even if only 100 sheep and goats are considered as the threshold (NEPRU, 1991), it is obvious that for the majority of households (80%-90%) livestock production cannot be the basis for their livelihood (CATAD, 1993).

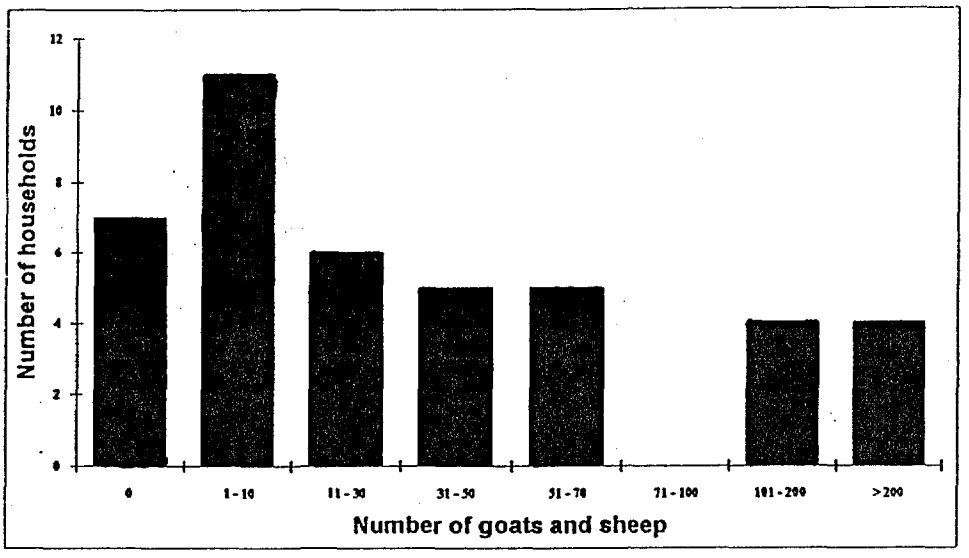


Fig 2 : Herd sizes in the southern communal areas (CATAD, 1993 p.44)

In the southern communal areas the distribution of herd sizes is rather uneven. Apart from showing the extent of households being able to live off animal husbandry, the distribution of herd sizes leads to another important question. In dry areas herd owners follow the strategy of maximising herd sizes to minimise risk resulting from frequent droughts. The chances of being left with a viable herd after a disaster rises with the number of animals owned. The large number of small herds owned shows that many stock farmers are not sufficiently "insured" against loss. For them livestock production is a high risk activity. This also means that most of the farmers do not have the possibility of further reducing livestock numbers and explains why destocking is so difficult in the communal areas.

4.2.2 Livestock.

The rangeland condition is very limited and lengthy periods of drought should be regarded as normal. Hence goats and sheep are the major animal species kept since they can cope better with fodder shortages and after a drought the herd recovery rate is rapid, because of the high reproduction potential of the animals.

Live goats are sold to earn cash income. They provide meat which is not marketed but used for home consumption only. Milk is sometimes sold in the rainy season. Both milk and meat are supplements to the food bought or obtained as food aid rather than being the staple diet. The skins are a by-product of on-farm slaughtering and they are usually sold. For the few home gardens goat dung is used as a fertiliser and as a building material for house floors. Goats are furthermore looked upon as an investment and as saving capital.

The sheep breeds kept are predominantly Karakul with some Dorper and Persian Blackhead. Like goats, sheep are used for sale and for home consumption. The meat is used for domestic purposes as well as the dung. Skins are sold. Sheep are not milked but provide some additional products, such as wool and pelts of the karakul lambs. The fat of the karakul tail is an important source of cooking oil. As with goats, the most important reason to keep sheep is meat production, followed by sale for cash income. Karakuls are mainly used for the sale of pelts.

Donkeys, mules and horses are kept by many households. They are the most important means of transport in the region, if not the only one available to the majority of the population. Donkeys are sometime ridden but mostly used for pulling carts. Since teams of two to six donkeys are always needed for pulling a cart and the animals are quickly exhausted because of their low nutritional status in the dry season, a household needs at least two donkey teams to alternate if daily travelling is necessary. This means that a household must have a fairly large number of donkeys at its disposal to be able to travel long distances regularly. Donkeys are also sold and slaughtered and provide cash income and meat, although the meat is rated as inferior.

Cattle are of minor importance in the region. The households keeping cattle use them for selling and producing meat and milk which is both sold and used for home consumption. The skins are sold and dung is used for home-gardens and as building material. According to cattle owners, milk is the most important product.

Concerning the function of livestock production in the southern communal areas, in general it can be concluded that the reasons behind this activity are mainly economic. Livestock products play a very important role as food supplements. The contribution to the cash income from the sale of animals, however, is low for most of the households. A herd is considered as an investment and since animals can be turned into cash in cases of emergency, they are important for a household's security. In general, a herd does not have a widespread socio-cultural function (CATAD, 1993).

4.2.3 Rangeland condition and Rangeland Use

4.2.3.1 Rangeland types in the southern communal areas

In general, the rangeland condition improves with distance from homesteads and water points. This pattern is the consequence of uncontrolled grazing of livestock. The animals are put into a kraal overnight, brought to the grazing in the morning to roam freely, and come back in the evening for watering. The grazing pressure has the same impact on the range condition as on permanent grazing ground.

Although bush encroachment is more prevalent in the central and northern farming areas, *Rhigozum trichotomum* tend to infest certain areas in the south. Despite the fact that it

might have a good fodder value (Walter and Volk, 1954), it is an indicator of large-scale disturbance of the veld. It can tolerate heavy browsing, spreads easily with rhizomes and pull all available water from the ground, making it very difficult for the more palatable grasses to compete. The impact of these bushes on grass growth should therefore not be underestimated.

Indications of wind erosion are common and it has a serious impact on the rangeland condition. Seeds are blown away by the wind and, without any inputs from outside, chances for recovery are very small. Rangeland condition improves with distance from the homestead and water point. More palatable grasses like *Stipagrostis uniplumis* and others are appearing. In the dry riverbeds more valuable grasses and bushes and shrubs are found which provide better grazing than on the hard compacted soils.

Most farmers are conscious of, and concerned about, the heavy deterioration of the rangeland condition (CATAD, 1993) over the last years, but relate these changes mainly to the drought and not to overstocking and poor rangeland management. As perceived by the farmers, the last really good rainfall years were 1993 and 1996. The rangeland conditions during those years definitely resulted into good rangeland conditions and production. This could have created the perception that the area has a good carrying capacity and that many livestock units could be kept EEAN, 1992). Those years were however the exception rather than the rule which unfortunately lead to overstocking. This can clearly be illustrated by the following table.

Location	Blou-oos		Constancia	
Size	13 715 ha		4 220 ha	
Year	1977	1993	1977	1993
Total SSU	3 782	559	1821	200
ha/SSU	3,6	24,5	2,3	21,1

Table 5 : Development of livestock numbers of two Odendaal farms in the Southern Communal Areas between 1977 and 1993 (CATAD, 1993).

Table 5 shows that there has been a heavy decrease in livestock numbers in the last 16 years. Farmers had to destock especially in 1989 to 1992 due to the drought situation. According to interviews with some farmers in the Blou-wes area in the south, the dry hills around the area was covered with *Stipagrostis uniplumis* in 1981. This very palatable grass has totally disappeared today, most probably due to overstocking and a lack of rainfall during the past few years. The farmers have had to adapt to this changing environment in a drastic and painful way.

Table 6 shows the different rangeland types in the Blou-wes area in terms of the location and distance from the settlements, the duration of grazing and other impacts, the vegetation present at these different locations, some indications of the soil conditions and perceptions of the inhabitants regarding rangeland changes in the past. Although this information might be very site specific, it nevertheless provide a good overview of what the rangeland situation in the southern communal areas might be.

Location and distance from settlements	Duration of grazing and other impacts	Vegetation	Soil condition	Changes
1) Immediate surrounding of the settlements (< 1 km)	• permanent grazing area for already a long time • deforested for fuelwood collection	almost no vegetation	• blown and washed away • often only stones left	old people mentioned that in their childhood there were enough grass and trees
2) 1 - 3 km away from the settlements	within the reach of goats => permanent grazing area	• only annual grasses, if any • bushes: *Rhigozum trichotomum*: good browse, but spreading fast through rhizomes	• a lot of hoof action and tracks signs for wind erosion: shrubs grow on elevations many patches with bare ground	see above
3a) > 3 km away from the settlements	• out of the frequent reach of goats • within the reach of donkeys, horses and cattle	• perennial grasses occur, but are heavily browsed (*Stipagrostis spec.* a.o.)	• fewer tracks • signs of wind erosion	
3b) On Odendaal farms inside paddocks	more or less frequent grazing areas; used for permanent grazing and for rotational grazing (recovery 3-6 months)	• trees/bushes: coverage < 40% *Parkinsonia africanum* *Rhigozum trichotomum* *Acacia erioloba* a.o.		• range condition degraded through the drought between 1980 and 83 and 1989-92 • years ago *Rhigozum trichotomum* was smaller and less
4) Dry riverbeds: (< 3 km away from the settlements)	preferred grazing grounds during the whole year	• small annual grasses, • coverage: < 20%, but more than in the vicinity • *Parkinsonia africanum* as main species and other species adapted to moister sites	• alluvial soils • a lot of hoof action	
Dry riverbeds: 5 a) > 3 km away from the settlements 5b) On Odendaal farms inside paddocks	see 3a/3b)	• grasses: several *Stipagrostis spec.* and other grasses; coverage: 40% • trees/bushes: see 4), but more species, coverage <30%		

Table 6 : Range types in the Blou-wes area (CATAD, 1993).

4.2.3.2 Range use in the southern communal areas.

Livestock in the southern communal areas generally roam freely around the water points. In the open unfenced parts of the south farmers or their shepherds tend to move regularly to those areas where rainfall has occurred. The competition for grazing does not allow them to let these areas rest until the grass has matured. Larger farmers also have the ability to split up their herds and send them to different grazing zones. The Shepherds or farmers with or without their families then move along with the animals and do not return to their settlement for some time.

Families residing in the settlements owning small herds do not exercise any particular grazing or herd management. The animals are kept in an enclosure near the homesteads during the night and are allowed to roam freely during the day. In the evening they return to the homestead to be watered. Only during lambing time are these animals, at times, followed by a family member. The distance goats walk in one day is between 15 and 20 km and it is not surprising that the radius of about 8 km around the settlements is heavily overgrazed. It is very rare for animals of different families to be grouped and herded together. This systems of free grazing is especially disadvantageous during drought years as it depletes the limited resources even further and diminishes the natural recovery potential (MAWRD, 1992).

A second form of farming is where **border fences** were erected by government in the 1970's with the view to serve as a barrier against herds coming from elsewhere or against jackals. Nobody feels responsible for these fences and this largely contributed toward the dilapidation of the fences to such an extent that they no longer serve their intended purpose. Despite this, many farmers in the Blow-wes area still demand fences and see them as the only possible way to restore the veld (CATAD, 1993).

The third form of farming is on the **Odendaal farms** which have border fences as well as inside camps. On these farms each paddock was allocated to a family living on the farm. As a consequence, the grazing management is characterised by continuous grazing as in the other areas. But, unlike others, farmers on these farms have a certain degree of flexibility in keeping a camp empty. Therefore the range condition on these farms can be considered better than in the other areas (CATAD, 1993). Under the current drought situation in the south, it is very difficult to see any difference, if any.

4.2.3.3 Land use rights in the southern communal areas

In the southern communal areas 58% of the area comprises the former settler farms (MAWRD, 1992). These farms were incorporated into the former reserves during the Odendaal plan in 1964/65. During the implementation of the Odendaal plan, people were moved from the old reserve to these farms. Up to ten families with their stock were allowed on one farm. The entire Namaland was divided into wards or sections along ethnic lines, each residing under a tribal chief or government appointed headman. The control over settlement and access to grazing within the wards was vested within the "stamraad" or tribal authority. The usage of land is arranged by the local authorities. If farmers want to move into another community area, they have to apply to the community committee, which decides together with an agricultural expert from the Government whether enough grazing area is left for the newcomer. When outsiders only want to bring their livestock into the area or move through with the herd, they still have to ask for permission. This was found to be true for the Blou-wes area in the south (CATAD, 1993).

A recent investigation done by the Social Science Division (SSD) of the University of Namibia (UNAM) reports that traditional leadership is in the process of being broken down but most of the residents in the Blou-wes area would still contact him about issues regarding access to rangeland. Residents in another area stated that they would make their own decisions regarding who could come in and obtain access to local resources (Fuller and Turner, 1995).

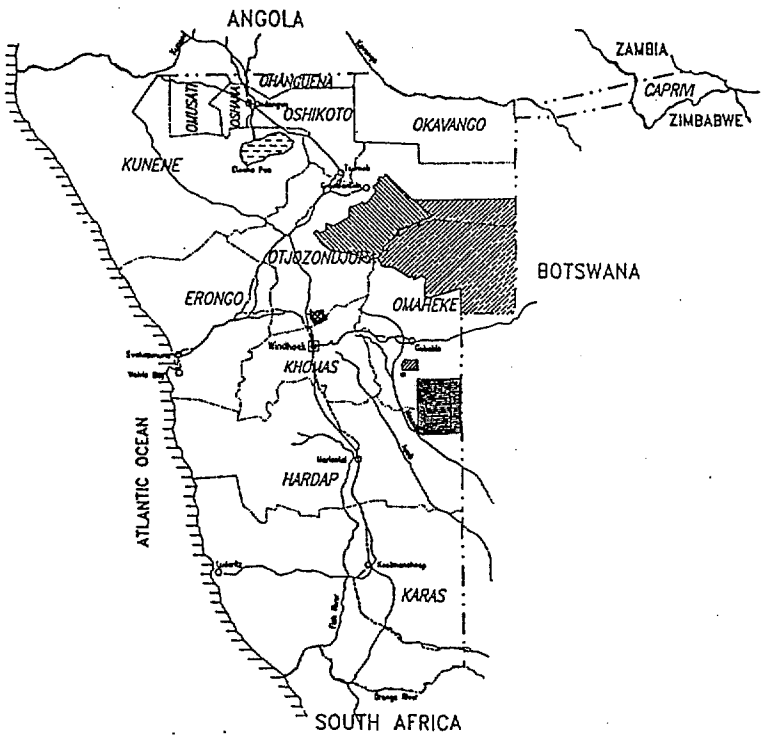
Although usage of land is supervised by the local traditional authorities, the farmers in Blou-wes specifically reported various problems. The problems they mentioned are related to increasing pressure on the available land and the failure of traditional leaders to restrict the number of people moving in. The farmers complain about some headmen being open to bribes and allowing big herd owners from other regions to bring their cattle in for grazing (CATAD, 1993).

However, because the area of the former settler farms is fenced, divided into camps and the occupation confined, users had a comparative advantage over the inhabitants of the remaining part of Namaland, where fencing is not allowed and control over settlements as well as movements of animals are fairly unrestricted and uncontrolled (MAWRD, 1992).

4.3 The Eastern communal areas (Former Hereroland)

4.3.1 Orientation

In statistical terms, Hereroland is perhaps the most difficult CA to describe. Information sources differ greatly with respect to the areas included in Hereroland. Adams et al. (1990) include Hereroland West, Hereroland East, the Rietfontein Block, Aminius, the Aminius Corridor and the Kaokoland. Concentrations of Herero speaking people are also found in various other isolated centres such as Epukiro, Ovitoto, Otjimbingwe, Okombahe and Omatjette. The Directorate of Veterinary Services (DVS) lists these areas separately. In this report, the eastern communal areas are referred to as Hereroland East, Aminius and the Aminius Corridor in the Omaheke region and the former Hereroland West in the Otjozondjupa region **(Map 7)**.



Map 7 : Map of Namibia indicating the Eastern Communal Areas (HKW Stewart Scott, 1993).

According to Adams et al. (1990) the former Hereroland (excl. Kaokoland) covers 6 968 122 hectares. A lot of variation regarding the actual size do exist (GTZ, 1991). The population of 44 000 (1991 census figures) is concentrated along the western and southern borders of the region in an area of about 38 000 sq. kilometres. This pattern of distribution has been determined largely by the availability of water. The eastern areas of Hereroland East which lack formal access to water, approx. 22 000 sq. kilometres, are largely uninhabited and unutilized at present (EEAN, 1992). With the recent large scale resettlement of Herero speaking people from Botswana in the Gam area as well as the tendency of individual large-scale farmers to move and settle further to the east during the current drought, this situation could have changed considerably and needs to be investigated further.

There are approximately 4 000 registered stock farmers in the former Hereroland, two-thirds whom qualify as bona fide farmers (i.e. all income is derived from stock farming) (GTZ, 1991). The principle economic activity of the Herero people is extensive cattle farming and the social and economic role of livestock is thus of great significance to them. In terms of livestock capital the Herero are considered the most affluent of Namibia's communal farmers with a mean of 83 Large Stock Units (LSU) per registered stock farmer (GTZ, 1991). The possibility of a household to derive its livelihood from livestock is largely determined by the number of animals owned. In the eastern communal areas the herd sizes vary considerably (CATAD, 1993). To illustrate this better, the herd sizes of 55 households in the Okakarara area was monitored. **(Fig. 4)**

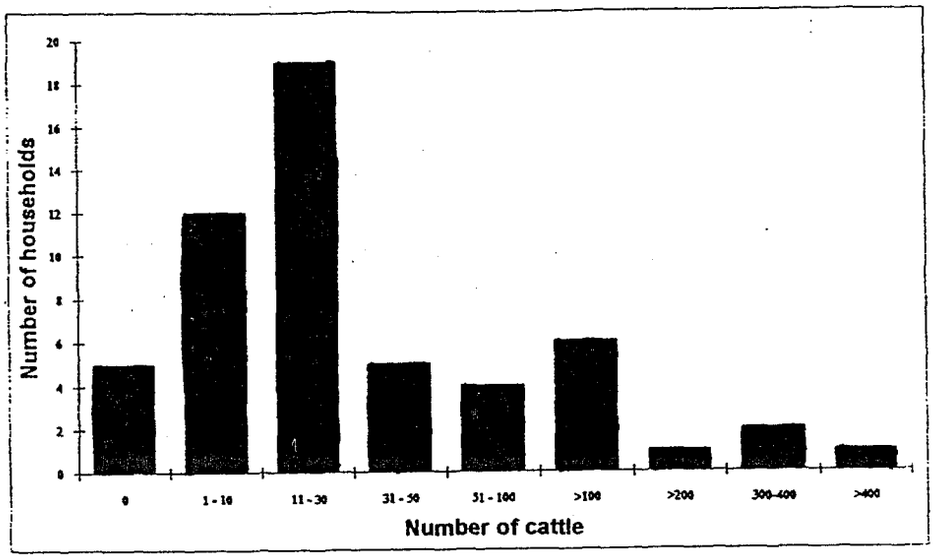


Fig. 4 : Herd Sizes in the Eastern communal areas (CATAD, 1993).

As farmers in the eastern communal areas are usually cautious about stating the precise numbers, the reliability us uncertain and the herd sizes shown should be regarded as approximations. A herd of about 30 cattle can be assumed as the minimum to support a small family from livestock production alone. Looking at the figures given for the herd sizes, it is clear that for a large number of households the herds are too small to provide a living (CATAD, 1993). From the small herds, many come close to the mark of 30 cattle.

Considering there may be a possible downward "correction" of cattle numbers in the direction of smaller herds by the farmers, probably more than the stated number of households are able to make a living from livestock production alone. Even then, around 33% of the households have no or only a few cattle which can at best supplement other sources of food and income.

As stated, the predominant activity is extensive cattle production in close proximity to commercial farmers who provide markets for cattle. The weaners and full grown cattle are bought mainly by speculators who finish the animals before resale at other markets. Export of live animals to South Africa for pen finishing features heavily. Commercial farms outside of the communal areas do not use Herero cattle for breeding purposes because of high risk of venereal diseases (EEAN, 1993).

The stock farming population is concentrated along the southern and western borders of Hereroland. The settlements are permanent and their location relates tot he distribution of boreholes, water courses (Omatako, Eiseb, Epukiro Omurambas) and the piped water supply network from the Eastern National Water Carrier. Overgrazing and degradation of rangeland around water points has forced a progressive movement of the farming population into unutilized areas further to the east and north. This movement is constrained by the lack of watering points in the respective areas and to a lesser extent, by the presence of a plant poisonous to cattle, *Dicapetalum cymosum*. During 1982-83 a notable wave of movement occurred when the administration reacted to drought by opening up new rangeland through the supply of water in these areas.

4.3.2 Livestock.

Livestock production is influenced to a certain extent by socio-cultural factors - this applies particularly to herd size and composition. The family herd comprises the cattle of individual members which are managed collectively. Within the herd certain cattle are reserved for specific traditional functions: heifers, particularly those which are red, are reserved for dowry payments whilst oxen are the most valued (EEAN, 1993).

The income generated by selling cattle is for many households the main contribution to the budget. In terms of subsistence production, cattle are dual-purpose animals, providing meat and milk. Concerning meat production, cattle are slaughtered only at social events, for example at wedding ceremonies. For the regular meat supply of the households, however, cattle are of less importance. Milk production plays and important role in the households food supply. Cattle are milked regularly and the raw milk as well as milk products (sour milk and butterfat) are an important part of the diet, particularly for the children in the household. Milk and dairy products are not sold on a regular basis. Milk is the most important product of cattle farming for domestic food supply, whereas meat production in terms of the live weight of animals sold is important for income generation.

Other products obtained when the cattle are slaughtered in the community are the skins and other by-products such as the horns used to manufacture horn containers or the tail hair is used in making brooms. Dung is sometimes used for gardening and also as a building material.

Cattle are of great importance as an investment, a means of security for the household and also represent status and wealth. The fact that the cattle are still being considered as important in social functions and being confirmed by so many members of the Herero society, shows that the value of cattle goes far beyond considerations of production, income and investment.

Goats are sold for cash income on a small scale. They are the most important animal species for the domestic supply of meat. They provide milk on a regular basis even when the cows are dry. The skins are also used or sometimes sold; the dung is sometimes used for gardening. Sheep are not important for sale but provide meat for domestic consumption. Sheep also play a social role because they have to be slaughtered at certain ceremonies. Donkeys and horses are also kept, but not in large numbers and used for collecting cattle in the field on a limited basis. Although these animals are used to a limited extent to pull carts, other forms of transport like cars and buses are also available.

It is therefore clear that the output function in the eastern communal areas is definitely important, but is only one of several functions. By improving the meat production the potential of the breeds may appear promising, but intervention strategies have to take into account these other social functions as well. Another consideration regarding room for improvement in animal husbandry is the asset function of a cattle herd. Improvements that directly or indirectly aim at reducing herd sizes must consider the fact that cattle represent wealth and are in actual fact a status symbol. To find a substitute for this function would require a change of values in a society which is still centred around cattle (CATAD, 1993).

4.3.3 Rangeland condition and rangeland use

4.3.3.1 Rangeland types in the eastern communal areas

Bush and shrub coverage as well as some grasses do exist close to the water points. As far as grass coverage is concerned, it depends very much on the time of the year. During the rainy season and shortly after, grass cover might still be much more closer to the homesteads and watering points than towards the end of the dry period. Only very close to the watering points has grass cover been totally destroyed due to animal impact.

Due to the higher vegetation cover compared to the south and other areas, wind erosion does not seem to be a problem. Although bush encroachment seems to be of lesser extent in the communal areas than in the commercial areas, it is definitely not to be ignored in the eastern communal areas. Bush species that might pose some problems are mainly *Acacia mellifera*, *Acacia hebeclada* and *Terminalia sericea*.

A clear gradient of degree of rangeland degradation can be found with increasing distance from the village or watering points (EEAN, 1992). In the immediate surroundings of waterholes and water points such as pipelines, boreholes and earth dams, the rangeland condition is characterised by heavy hoof action from animals. The areas around the villages look different from those near the points of water-supply. Bushes are totally lacking since they are used for fencing material or as browse by the goats. Some trees are left to provide shade to livestock. The soils are usually heavily compacted, excepts in areas with more sandy soils, and covered with mainly annual grass species like *Eragrostis*, *Aristida spp.* and *Pogonathria fleckii*.

Work done by the Centre for Advanced Training in Agricultural Development (CATAD) from Berlin in Germany undertook a study in the Okakarara area in 1993. Their major findings, although not directly applicable to the whole of the eastern communal areas, might provide a very good indication of the rangeland types in relation to the distance from the settlement, the location, the duration of grazing and other impacts, the vegetation types present, the soil condition and some perceptions by the local inhabitants regarding vegetation changes.

Location and distance from settlements /water points	Duration of grazing and other impacts	Vegetation	Soil condition	Changes
immediate surrounding of water points 1a) old waterholes	heavy permanent grazing pressure for already a long time	grasses: mainly annual grasses only under the protection of thorn trees in between pure sand few bushes trees: *Acacia spec., Ziziphus mucronata, Boscia albitrunca*	heavy hoof trampling erosion on walls of dug out ground around the waterhole	
1b) recently put up waterpoints (15-20 years ago)	heavy, but less old grazing pressure with seasonal peaks in June - September	grasses: coverage: 40% perennial grasses existent, but heavily browsed occurring annual grasses are indicators of range disturbance trees/bushes: coverage < 50% *Acacia mellifera* as main species, other *Acacia spec.*	good site quality according to farmers' statements heavy hoof trampling	degradation (bush encroachment, hoof action, overgrazing) took part only in the last 15-20 years range condition is still far better than around old waterholes
2) immediate surrounding of the settlements	old grazing ground with permanent grazing pressure of large and small stock with peak in the rainy season. bushes are cut down for fence poles trees have shade function	grasses: coverage < 70% almost only annual grasses with low nutritional value; main species: *Eragrostis cylindriflora* indicates disturbed grounds trees/bushes: *Acacia mellifera* main species others: poisonous plants like *Geigeria ornativa, Urginea sanguinea* etc.	hard compacted soil	
3a) > 1 km away from the settlements	grazing area of cattle from Jan. until June frequent grazing ground of small stock	grasses: coverage <30% many more grass species than in the immediate surrounding of the settlements; more perennial grasses but with a low fodder value preferred grasses only protected by bushes trees/bushes: coverage < 80% more than in the surrounding of the settlements; mainly *Acacia spec.*	lots of animal tracks soil compaction especially along the road verges	there were almost no bushes in former days (farmers' statement)
3b) inside of fences	Most fences are put up in the last few years Time of recovery 3 to 6 months, but depends on the usage of the paddock	grasses: more grass species than outside the fences, but mainly annual grasses with low fodder value bushes/trees: no difference between inside and outside the fences	depends on the duration and intensity of the grazing impact	

3c) -8 km away from settlements	cattle grazing area from June to Sept. cattle stay out of thorny thickets, they go in only in drought periods	grasses: coverage <40% besides some indicators of range disturbance along the road verges, higher quality in the protection of bushes bushes: coverage 70-80% homogeneous layer of mainly *Ac. mellifera*; no trees	heavy hoof trampling along the road verges but no animal tracks anymore >20m away from the road	bush encroachment became severe after 1974 lack of trees and the existence of good grasses indicate, that there was pure and good grassland before bush encroachment started
4) > 8 km away from settlements	seasonal cattle grazing area between Sept. and the first rain (Dec./Jan.) in drought periods already earlier grazing often combined with transhumance 8 to 9 months without grazing impact	grasses: coverage 50%; high variety of grasses; indicators of veld retrogression; perennial grasses with a higher fodder value bushes/trees: coverage 35-80% coverage varies a lot (areas with less grazing pressure have less bushes); Mainly *Acacia erioloba* and other *Acacia spec.*		
5) Pans	good grazing ground mainly used in the dry season	grasses: coverage 70% => high grass coverage bushes: coverage 10% mainly bushes adapted to wetter sites	good water supply, because pans contain water for several months per year higher moisture content in the soil throughout the year (indicator *Acacia erioloba*)	
6) Riverine rangelands; < 1 km away from settlements	heavily overgrazed by cattle and oats in the rainy season one of the best grazing grounds	grasses: coverage 20% only annual grasses, e.g. *Eragrostis cylindriflora*, with a low fodder value bushes/trees: typical woodland vegetation of marginal flood plains	heavy hoof trampling	

Table 7 : Rangeland types in the Okakarara area (CATAD, 1993)

4.3.3.2 Rangeland use in the eastern communal areas

In the open unfenced areas which represent the largest part of the eastern communal areas, cattle and other livestock are roaming freely. Sometimes they are also herded by young men. Cattle are watered once or twice a day, but in the dry season sometimes only every second day. The distance they move away from the water points depends on the available forage which again depends on the season, the rainfall and the grazing pressure.

During the rainy season (January - March/April) cattle graze around the homesteads and water points where fresh annual grasses provide enough grazing. In this season the most degraded and worst sites are usually exploited. This practise does not allow the recovery of these sites, but is understandable from the farmers' point of view: their aim is to maximise the benefit from the land and try to keep as much livestock as possible throughout the year. They therefore first use the bad sites which are in a fairly good condition during the rainy season and the better ones during the dry season, so avoiding seasonal fodder constraints.

From the end of the rainy season until June, cattle are forced to move further away from the water points to the bushy areas. Between June and September their range extends up to seven kilometres and between September and the first rainfall up to 10 km (CATAD, 1993 - for the Okakarara area specifically). They then use better grazing areas with more perennial grasses and better fodder value compared to annual grasses. During this time of the year, the range of different herds from different areas usually overlaps. This grazing pattern is typical for the years with good rainfall. In drought years cattle move as far as 10 to 15 km away from the water points or are taken to other areas further away.

Transhumance is very common in the eastern communal areas, usually at the end of the dry season, over long distances and lasting up to March. Transhumance is usually carried out by boys and young men. A shortage of labour for transhumance is now becoming a problem because children have to attend school. Compared to the past, women don't join the men in transhumance as regularly. In former times the whole family used to move with the cattle, only old people stayed behind. Today, items needed on transhumance are transported by car and not by donkey cart or by foot.

The prime reason for moving away with the herds used to be related to water shortages. Nowadays the reason has shifted more to a scarcity of fodder. This can indicate on the one hand an improvement in the water situation, and on the other hand a deterioration of the

rangeland condition. The opportunity for transhumance has in any case obvious economic advantages for the respective livestock owners. Since they are able to exploit better grazing areas during a period of fodder constraint, they can keep larger numbers of livestock.

There are generally three different types of transhumance in the eastern communal areas. The short-distance transhumance (10-15 km) is common in most of the settlements. The long-distance transhumance to other communal grazing areas (30-60 km) happens where whole villages use these areas after obtaining permission from traditional authorities. The longer distance transhumance is usually only possible for the more wealthy farmers that can afford the labour costs and bear the increased risk of animal theft and the poisoning of cattle by *Dichapetalum cymosum*.

In the Okamatapati area legally fenced units were developed by the former Administration and livestock farmers were settled there in the 1980's. The area supports about 2000 people on 37 fenced farms of 4900 hectares each. Some of these farms have only basic infra-structure like a water point and border fences, while some of them are also divided into two to four camps. The area is totally overstocked with livestock supporting about 15 000 large stock and an equal number of small stock. The area is heavily bush encroached with mainly *Acacia spp.* and *Dichrostachys cineria*. In some of the units some form of rangeland management is practised where a camp might be rested during the rainy season, but in most of the farms livestock are put in all the camps and no form of rangeland management is practised.

Fences are the main topic of discussion in the eastern communal areas. On the one hand a lot of illegal fences have recently been erected and there are a lot of conflicts between "fencers" and "non-fencers". On the other hand, farmers have high expectations that government institutions or foreign donor agencies will provide them with fences. Farmers in some communities (e.g. Otmborombongo in the Okakarara district) are willing to break down existing "illegal" fences in order to fence off the whole area for themselves. The creation of private farming units in the eastern communal areas was mentioned, not only by local farmers, but also by others as a possible solution. It is however necessary to consider that if the whole area is split into private fenced farms, more than 66 % of all farmers will loose access to land (EEAN, 1992). The costs of erecting such fences will also be very high (GTZ, 1991).

4.3.3.3 Land use rights in the eastern communal areas.

As mentioned already, most of the Eastern Communal Area is unfenced. Access to land is free for the residents within their community borders. When livestock owners want to move with their herds into other community areas, they have to ask the traditional leaders for permission. Normally they are allowed to move in, if there is no current shortage of fodder (CATAD, 1993).

Should areas that are not populated due to a lack of water be used for grazing, local authorities will have to be asked to provide water and farmers need to get permission from these authorities to graze their animals there. This was the case east of Okakarara where the government extended the ENWC pipeline to tap new grazing areas.

It also happens that farmers from outside often move into the community area with their herds without asking permission or only ask after they have already stayed there for quite a while. When the intruders do not ask for permission at all, they can be called to the community assembly and asked to leave. There seems to be no further instrument in place which could be used to force them out, if they resist (CATAD, 1993).

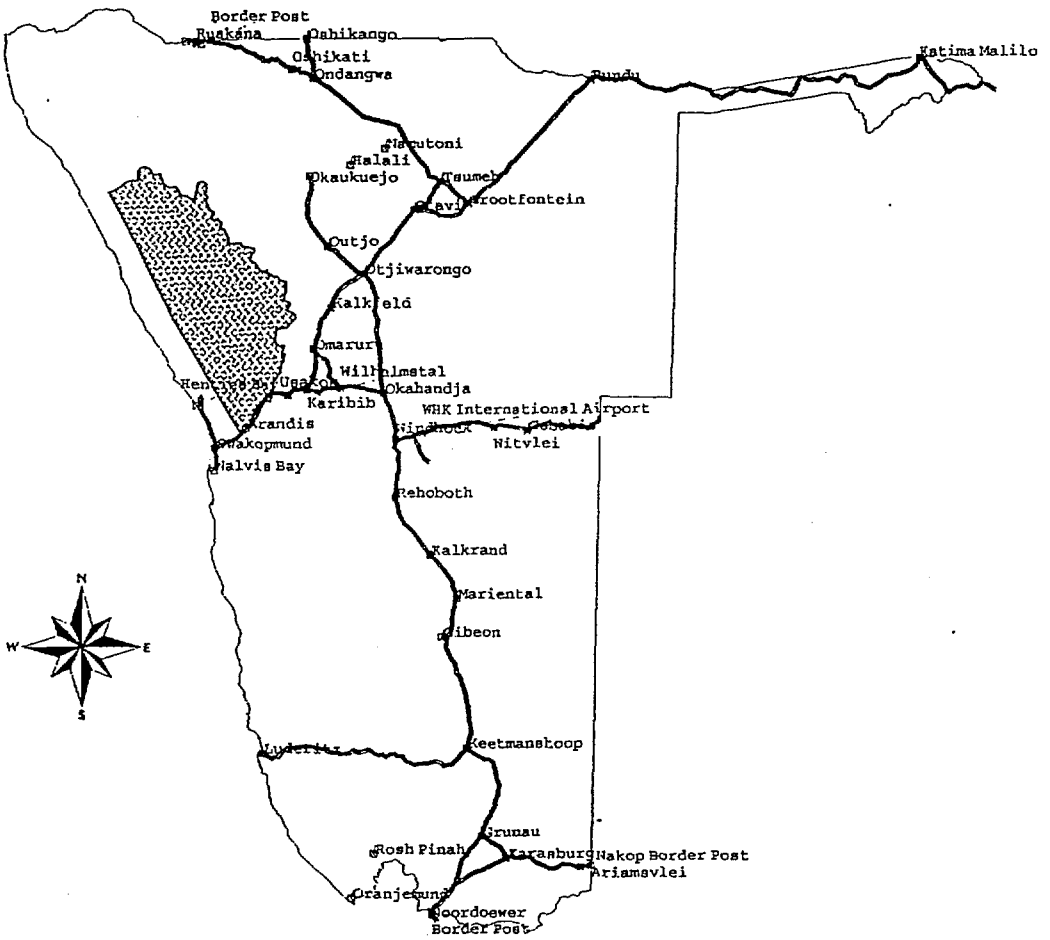
In the Rietfontein area, Aminuis Corridor and the Okamatapati area farms are surveyed and fenced off. Most farms in these areas are occupied by several families, but a few were also allocated to individual farmers. There is increased pressure by larger farmers to establish

private demarcated farms on communal land. The formation of "economic units" is also one of the programmes of the former Administration. The pressure to establish individual farms will most probably increase. The cost factor as well as the fact that many people will be denied access to grazing, is already discussed.

4.4 The Western Communal Areas

4.4.1 Orientation

The former Damaraland is situated in the Erongo region on the eastern border of the Namib Desert. **(Map 8)**



Map 8: The location of the former Damaraland in Namibia (SKW Stewart Scott, 1996).

This sparsely populated area is one of the most arid parts of Namibia. Living an essentially subsistence existence, the inhabitants rely largely on livestock for survival. The Erongo region lies to the midwest of Namibia and is approximately 63 719 sq. km in size. The total population for the Erongo region as a whole is estimated to be around 98 500, but in the former Damaraland the population is considerably less, at about 32 986 people (NPC, 1992).

Lying north of the Tropic of Capricorn and bordered to the west by the Atlantic Ocean, it extends eastwards from one of the driest desert habitats in the world across three primary topographic typologies and two climatic zones. These zones roughly parallel the coastline, the first of which is a cool desert strip of about 40 km wide. Although consisting of sand dunes and plains typical of the Namib Desert, temperatures are kept moderate by the up-welling of the cold Benguela current. With annual rainfall between 0 and 50 mm (increasing with distance from the coast), this strip is too barren to sustain human live (Naeraa et al., 1993).

Further inland both the topography and climate begin to change. Between about 50 km and 150 km from the coast, the land rises steeply, and is mountainous and rocky. This eroded escarpment reaches altitudes of 1 500 - 2 000 m above sea level with temperatures as high as 40°C in summer and as low as 0 during the cold winter nights. Average rainfall increases gradually eastwards from 50 - 200 mm per annum. Correspondingly, vegetation changes from the desert succulents typical of the coastal plain to mopane savannah to the north and semi-desert savannah transition to the south.

According to Van der Merwe (1983) limited livestock production is possible, but only with certain species (goats) in the central and eastern parts of the region. The short rainy season which spans between ten and 30 days per annum, the high level of variability in rainfall and the high potential evaporation rage all contribute towards the highly marginal nature of the region. Crop farming is just not possible and the success of livestock practice is determined to a large extent by the unpredictability of the elements, access to land and the extent to which man contributes to its degradation or conservation.

4.4.2 Livestock.

Although livestock rearing in the study area is generally associated with subsistence agriculture, some individuals are also engaged in livestock rearing for commercial purposes (Naeraa et al., 1993). Subsistence agriculture nevertheless provides the economic base of the Erongo region. Due to the arid climate, this is restricted mainly to livestock. A study done in 1992 (Naeraa et al., 1993) revealed that 67% of the households owned cattle, 55% owned donkeys, 39% owned sheep and 90% owned goats. With very few exceptions, households keep a combination of cattle, donkeys, goats and sheep. An average of 71 goats are owned per owning household, 42 sheep per owning household, 26 cattle and only 5 donkeys per owning household.

It is clear that livestock plays a vital role in the social economy of the region. Not only do animals provide an important measure and store of wealth, they are also very much part of the cultural lives of the local people. The drought in 1992 had a disruptive impact on the environmental resource base as well as the economic foundation of the region. This depressed market prices for animals as well as increasing animal losses. **Table 8** gives an indication of livestock deaths recorded in 51 households in the Erongo region as a consequence of the drought of 1992.

Livestock	n = 51	Total owned one year ago	Total Dead	% Loss
Cattle	34	1 347	538	40
Donkeys	28	206	67	33
Sheep	20	1 283	485	38
Goats	46	6 586	3 478	53

Table 8 : Livestock deaths recorded in the Erongo region between December 1992 and January 1993 (Naeraa et al., 1993).

The variations are possibly most influenced by both the resistance to drought of different stock types, and the introduction of livestock aid in the form of fodder subsidy to local farmers in April 1992. Cattle, being more susceptible to drought, would typically be the first animals to die because of drought. Since the subsidised fodder was first given to the cattle because they are valued higher and are more difficult to replace, the % of cattle lost is lower than for the goats. The negative impact of keeping the cattle on the rangelands during the drought period, will be much higher than when only the goats were kept.

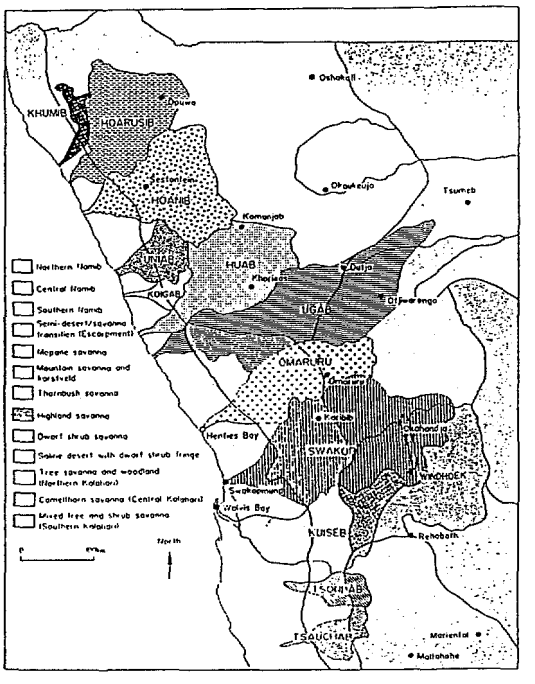
An additional problem in the western communal areas is that livestock distribution is very skewed, with 84 out of 2 223 registered farmers owning approx. 25% of the livestock in former Damaraland. This is clear from the data in **Table 9** showing the ownership of LSU's in Damaraland in 1993.

No. of farmers	% of total farmers	No. of LSU's	% of total LSU's	Average No. of LSU's/farmer
84	4,0	14 237	25	169
176	8,0	11 917	21	68
1 963	88,0	31 067	54	16

Table 9 : Ownership of LSU's in Damaraland in 1993 (Rohde, 1994).4.4.3. Rangeland condition and use.

4.4.3.1 Rangeland types.

Variation in rainfall is the primary determinant of vegetation of the western areas. While rainfall determines the overall pattern of a region's vegetation, it is the variability in soils, topography and temperature, that gives rise to the variability which makes so many parts of the west so unique. The influence of rainfall can be seen in the species composition of plant communities across the rainfall gradient, and also in the structure and productivity of individual plants. **(Map 9).**



Map 9: An overview of the major vegetation types found within the western catchments (after Giess, 1971).

The classification of Giess (1971) provides a broad overview of vegetation types found in the western areas. The upper reaches of the catchments north of the Ugab river are characterised by mopane savannahs. South of the Ugab, vegetation of the upper catchments is dominated by a mixture of *Acacia* spp. Further south, in the mountainous highlands associated with the headwaters of the Swakop and Kuiseb catchments, the highland savannah is composed of a complex mixture of *Acacia* spp. along with *Combretum, Euclea, Rhus* and perennial and annual grasses.

Moving westwards off the inland plateau and towards the Namib Desert, the vegetation shifts from upland savannahs to vegetation more suited to arid conditions. This transition zone between the savannah and the semi-desert is composed of a great variety of species, many of which are endemic to the region including *Euphorbia, Cyphostemma, Moringa, Adenolobus* and *Acacia*. Also worthwhile to mention are the many species of *Commiphora* occurring in the zone.

One of the most striking vegetative features of the western catchment areas is the riparian forests that dissect the arid landscapes of the Namib Desert. In the larger rivers, these strips are composed of dense forests of large trees such as *Combretum imberbe, Acacia erioloba, Tamarix, Euclea pseudebenus, Ficus* spp., and *Hyphaene petersiana.* The fact that these riparian forests are very well adapted to the natural variability in rainfall and thus play a very important role in providing food for humans and animals during droughts, can not be over emphasised (Jacobson et al., 1995).

4.4.3.2 Rangeland use

Nomadic pastoralism was widely practised in the western catchments for at least the past four thousand years (Jacobson et al., 1995) but started to disappear with the arrival of Namibia's first colonisers in the nineteenth century. Pastoralism was mainly based on the search for water and fodder.

The main constraint farmers face in the arid and semi-arid communal regions of the western communal areas, is the inherently variable climate, where annual rainfall can deviate as much as 70% above and below the mean from one year to another. Rainfall is also very variable in space, falling in widely scattered localities in any one year. As a result it is impossible and inappropriate to set a fixed carrying capacity applicable to the region as a whole. To cope with this variability, livestock farmers do what pastoral nomads of the past have done; they move their stock to wherever rain has fallen. Movements of OvaHimba within the Khumib and Hoarusib catchments have been cited as an excellent example of an appropriate rotational grazing system in an arid rangeland (Paskin, 1990).

In the early 1980's, in response to a severe drought in the region, the previous Damara Authority had to arrange emergency grazing in commercial areas further inland as far as Gobabis in the Omaheke region. If it is not possible to move stock to better grazing during dry years, easily accessible markets which allow sale of stock are essential to avoid heavy losses to farmers. Establishing such markets remains a problem, however, as destocking and restocking are not accepted as part of good management by most communal farmers. Many farmers prefer to maintain their livestock herds at all costs, rather than convert them to cash income during dry years (Jacobson et al., 1995).

In view of the large-scale movements of stock within the region, northwards and eastwards in 1990-1992 and more recently southwards in 1994, former Damaraland has been described as "one large farm, supporting over 33 000 people within its borders".(Rohde, 1994). A serious challenge faced by managers of this "farm", some 2 223 registered farmers, is the co-ordination of any individual activities, relative to those of everyone else.

4.4.3.3 Land-use rights

Prior to the establishment of the "second tier authority" in the former Damaraland in 1978, there was no known traditional system of land allocation. During the late 1960's and early 1970's, settlement of the area proceeded largely without any control. A form of traditional leadership was created when the second tier authority was established in 1978. The area was divided into twelve wards, each having its own headman and councillors, reporting back to the Damara Council. This structure exercised some control over access of individuals to land, water and grazing, particularly when conflicts arose. At independence, however, the laws which established the second tier authorities was repealed and its powers removed. Thus, all property within the former Damaraland with respect to land and infra-structure, including waterpoints and road, reverted back to central government. Existing common and customary laws were left in place, providing they did not conflict with the Constitution or any other statutory law (Jacobson et al., 1995).

Currently, control over access to resources such as land, water and grazing is blurred between traditional leadership and representatives of regional and central government. Absence of any form of land tenure or long-term planning seriously complicates efforts of the growing number of people in the region to achieve control over their livelihoods. As communities living in these areas are almost totally dependent upon natural resources for their livelihood, their greatest challenge is to maintain equitable access to these resources. As the population grows, available natural resources will diminish. It will become more difficult to maintain enough stock to fulfil the needs of each and every person. Current conflicts between farmers suggest that there is already insufficient space for everyone. To ensure the sustainable use of the region's natural resources, the regions economy should be diversified, and rights to resources must be defined (Jacobson et al., 1995).

4.5 The Northern Communal Areas

4.5.1 Orientation

The area comprises four of the five northern regions of Namibia, namely former Kaokoland in the Kunene Region, former Owamboland in the North Central Regions namely Omusati, Oshana, Oshikoto and Ohangwena; the Kavango and Eastern Caprivi. The Western Caprivi is excluded due to the fact that it is almost all game reserve. These four regions are collectively called the Northern Communal Areas (NCA's) and comprise a total of nearly 160 000 km^2 and hold approximately 60% of the total population of Namibia. The estimated number of rural households in the NCA's is about 110 000 and the North Central Areas (former Owamboland) is the most densely populated with about two thirds of the total population of the NCA's or almost half of the total population in Namibia (IFAD, 1992).

The climate in northern Namibia varies from arid in the west to sub-humid in the extreme east, with the major part being semi-arid. Annual rainfall in the extreme west is less than 50 mm but increases rapidly eastwards across Kaokoland to 400 mm at the Owambo border, then increases gradually eastwards to 700 mm at the eastern end of Caprivi. The length of the rainfall season also increases eastwards from about 3 months (January to March) in the west to 6 months (November to April) in Caprivi. There is considerable spatial and seasonal variability in rainfall, and drought is a recurrent phenomenon. However, almost the entire area suitable for rainfed agriculture in Namibia lies within the NCA's, which also contain much of the highest potential grazing lands.

Most of Kaokoland in the West is monotonous with rock outcrops and shallow, stony soils of virtually no agricultural potential, and the westernmost part is Namib desert; however, along the Cunene river and some seasonal rivers are alluvial deposits, and in the east is a sandy plain stretching into Owambo. In Central Owambo is the Cuvelai basin with its network of shallow waterways which bring flood water from Angola. The soils are loose

sands with clay overlying sandstone, and of low inherent fertility enhanced by alluvial deposits. Floods confine crop production to the higher ground. The availability of land suitable for crop production in Owambo is limited by large areas of saline soils in the south towards Etosha pan. The soils of Eastern Owambo, Kavango and Caprivi are predominantly Kalahari sands of poor fertility but there are pockets of good alluvial soils along the Okavango river, and patches of loam in the inundated areas of the East Caprivi. The alluvial plains are the most favoured areas for settlement and for arable development, hence they are densely populated and almost fully utilised. The sandier plains are less favoured for settlement and provide the main grazing areas for livestock with a limited opportunity for arable expansion.

Apart from a strip of waterless Namib desert in the west, Kaokoland is reasonably well provided with water from the Cunene river in the north, natural springs in the highlands and boreholes in the east. Water sources are widely dispersed and serious degradation is resulting around the larger permanent waterpoints. Owambo has no perennial rivers and inadequate functional boreholes, and in the dry season faces the greatest water constraints of the four regions. During the wet season the ephemerally flooded pans and oshanas provide adequate water in the central and southern part. The existing pipelines and canals also contribute tremendously towards providing water for human and livestock consumption, although it might cause serious threats to the environment and mainly the rangelands. Kavango has the Okavango river as the northern border and 80% of the human and livestock populations lies in a narrow band along the river. The area is unsuited to earth dam construction but there has been considerable borehole development. There are still large tracks of rangeland that is under-utilised due to a lack of water. East Caprivi is almost entirely bordered by rivers and has a generally high water table, hence is the region best served with water resources (IFAD, 1992).

The principal wildlife resources of the northern areas lie in Kaokoland, eastern Kavango and West Caprivi. Kaokoland already has tourism based on the local people and the wildlife, which are mainly in the arid western part of the region. Owambo has virtually no wildlife resources left, although the southern area has some potential. The saline grassy plains bordering the Etosha Game Reserve are more suitable for wildlife than for domestic stock. According to a diagnostic survey done by IFAD in 1992, the local people were totally negative towards wildlife and the area has little scenic attraction for tourism compared to Kaokoland.

In Kavango some problems with hunting dogs and jackals killing stock and monkeys stealing crops were reported by farmers (IFAD, 1992). There are some elephant movements across the Angola border, just west of the Okavango river, towards the Mangetti and back resulting in occasional damage to water points. Farmers are quite negative towards wildlife and would like to see them locked up behind a fence and they want nothing to do with it. In eastern Kavango, bordering onto Botswana and Bushmanland, the situation is different. The potential for wildlife in this area is much bigger due to the fact that the area is almost unwatered and devoid of domestic stock or crop farming. There already exists a substantial game reserve, Kaudom, of approximately 3 700 km². There is also a fenced area of about 450 km² immediately east of the Mangetti Block, called the Mangetti Game Area. In the eastern edge of the region, bordering West Caprivi, there are two very small wildlife tourism developments, the Mahango Game Park and the Popa Falls Rest Camp.

Western Caprivi is, apart from a very narrow northern strip, already a proclaimed Game reserve of nearly 6 000 km². The Ministry of Environment and Tourism (MET) is involved in community based natural resource development activities and the "conservancy" idea is in the process of being established. East Caprivi has two small wildlife conservation areas, the Mudumu Game Park (1 000 km²) and the Mamili National Park (300 km²). The region is a generally rich wildlife habitat and consequently farmers rate damage by wild animals as their greatest crop production problem.

The north-east Kalahari Sandveld woodland contains two principal commercial forest species: *Pterocarpus angolensis* (Kiaat) and *Baika plurijuga* (Rhodesian teak). Tree density is low and the tree regeneration cycles are around 40 years and 80 years respectively. Owambo is reported to have a potential annual extraction rate of 6 000 cu m of *Pterocarpus.* Mopane (*Colospermum mopane*) wood is widely used for building kraals and houses, for fencing and for firewood, and in the densely populated Cuvelai area has been seriously depleted. In the Kavango the sustained annual yields have been estimated at 3 600 cu m and 4 100 cu m for *Pterocarpus* and *Baikea* respectively and 900 cu m for *Guibortia coleosperma* (False mopane). In the eastern Caprivi an area of 1 600 km² has been demarcated in the north west as a forest reserve. The relative frequency of timber species is reported to be *Baika* (40%), *Pterocarpus* (15%) and other species (including *Guibortia*) 45%. The National Forest Policy of Namibia (1992) sets plans to establish forest reserve areas totalling 36 000 km² in Owambo, Kavango, West and East Caprivi (IFAD, 1992).

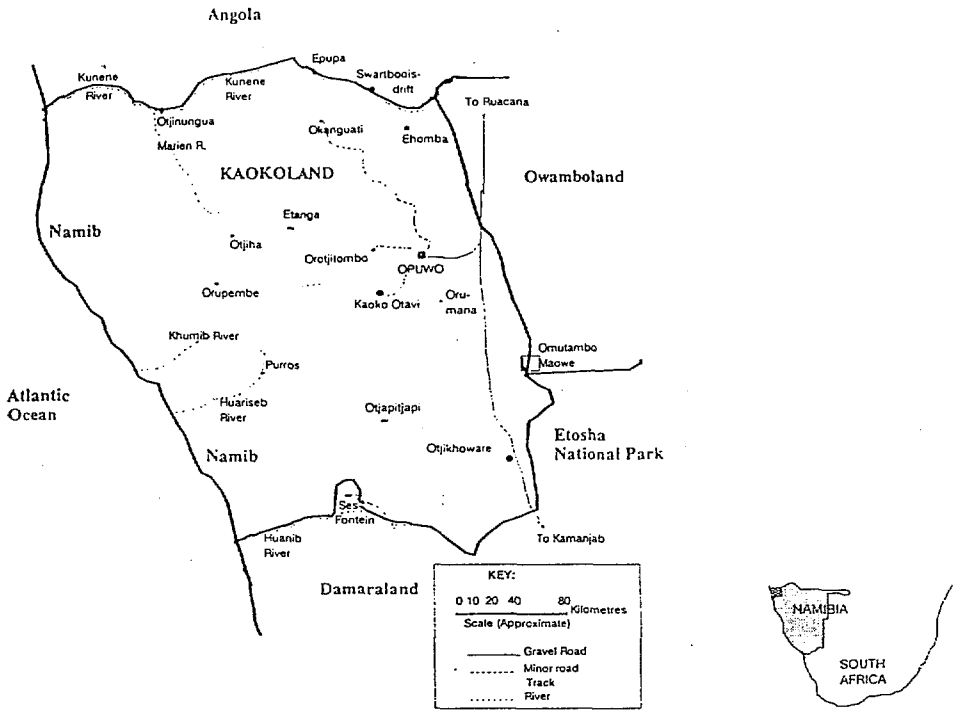
4.5.2 Kunene Region (former Kaokoland)

4.5.2.1 Background

The region (former Kaokoland) occupies 58 200 km² in the north-western corner of Namibia and can be classified as follows:

Type	(sq. km)
Skeleton Coast Reserve	8 700
Namib Desert Region	11 000
Semi-desert	9 300
Urban & roads etc. (0,5%)	300
Crop land	100
Grazing area (20 ha/LSU)	11 500
Grazing area (30 ha/LSU)	17 300
Total	**58 200**

(source : IFAD, 1992)



Map 10 : The location of the former Kaokoland in Namibia as well as Namibia in southern Africa (Paskin, 1995).

The demographic characteristics are based on the former Kaokoland boundaries, as used in the 1991 census. The population living in the area is 26 176 forming approximately 1,9% of the total population of Namibia (NPC, 1993). This shows a high population increase of 201% since 1974 (Malan, 1974). The new Kunene region, which includes parts of the former Owambo, Kaokoland, Damaraland north of the Ugab river and the Magisterial district of Outjo, comprises an area of 144 254 km² and a population of 58 500 people which makes it one of the most sparsely populated areas (0,41 persons/km²) in Namibia.

Most settlements in Kunene were originally found in the north and eastern parts of the region. However, as a result of the war in the northern parts, the population has spread to permanent settlements in relatively hostile environments in the west and south towards Purros and Sesfontein (Jacobsohn, 1988). The main factors determining their movements before the war and periodic droughts, are still the location of water points and grazing posts for their livestock. However, most settlements in the region are located near roads indicating the benefits associated with movement of cattle to different grazing posts rather than with links to trade in cattle or other goods.

4.5.2.2 Livestock.

The area is mainly used for extensive livestock production although a small amount of dryland cultivation exists in the form of maize (an extremely hardy local variety) and pumpkins (Paskin, 1995). Cattle are kept by the OvaHimba for the following reasons:

- Provision of milk (which is converted into sour milk and butter for feeding purposes. Butter is also used as a cosmetic when mixed with ochre by OvaHimba women).
- Ceremonial purposes - for slaughter at e.g. weddings and funerals.
- Draught purposes - The Herero sometimes use oxen for ploughing.
- A "store of wealth" and symbol of status.
- A form of currency or exchange - cattle are used by suitors to pay bride-prices; they are also used to pay fines when a guilty party has to make restitution after committing a crime.
- Provision of dung for building, and hides also used for e.g. clothing.
- A source of meat (rarely; when animals die, or are slaughtered for religious reasons).
- Religious ceremonies.
- A source of cash income or for barter (especially amongst the more progressive Hereros). Cattle are very rarely sold by the OvaHimba.

The "store of wealth" concept is very important when dealing with nomadic herders. With little or no access to the modern financial process and not much of a concept of the use of money, most Kaokolanders logically invest in livestock. For the westerner, livestock is a means of obtaining wealth, while for the pastoralist, livestock is wealth. An indication of the importance of livestock to the Kaokolander is the scale of social disruption caused by the drought in early 19980's - the governmental drought-relief, the rush to Opuwo and other places to seek work, and then, once some money was acquired, the buying-in of more cattle to restore the necessary wealth and status. With the next drought in 1992, only a few cattle were disposed of, while small stock numbers showed considerable changes.

The total number of Large Stock Units (LSU's) was 101 000 in 1992 (IFAD, 1992) and with a recommended regional carrying capacity of 115 000, it is clear that the area is only stocked 88% of the carrying capacity. It is however, very dangerous to use recommended average carrying capacities due to the highly variable rainfall in terms of time and space and thus the subsequent high variation in fodder availability. According to Paskin (1995) livestock numbers for Kaokoland were as follows:

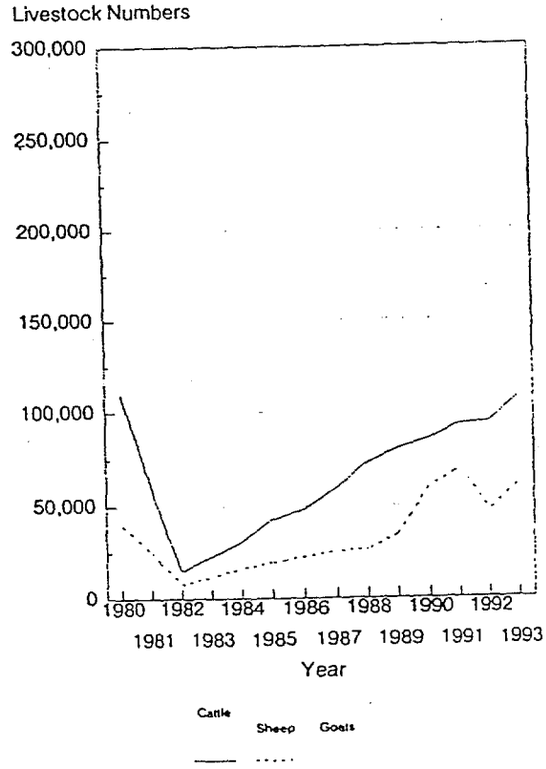


Fig 5 : Livestock population changes in Kaokoland, 1980 - 1993 (Paskin, 1995).

Stock owners are naturally as reticent about answering questions about how many livestock they have as a westerner would be about questions regarding his bank balance. By counting animals when leaving the kraals early in the morning as well as through information provided by local "experts", it is estimated that the average herd size in Kaokoland is between 30-50 cattle. It seems as if some OvaHimba are even happy with herd sizes smaller than 10 animals due to their simpler lifestyles, while the Herero opt for larger herd sizes. Small livestock flock sizes are highly variable, and sometimes extremely large, numbering from less than a hundred to sometimes over a thousand per owner.

Paskin (1995) did an analysis of four different cattle herds and confirmed that about 30% of each cattle herd consisted of breeding stock, while the rest were non-breeding animals. The data are presented in Table 10:

Place	Otjirunda	Cunene Stein	Orupembe	Etanga
Owner (tribe)	Herero	Himba	Himba	Himba
Adult cows	32	18	15	9
Entire bulls	2	1	2	1
Calves (0-1 yrs)	15	18	13	9
Calves (1-2 yrs)	16	18	8	9
Mature oxen	18	3	2	0
Total	83	59	40	29
% Cows	39	31	38	31
Bulls:Cows	1:16	1:18	1:7,5	1:9

Table 10 : Cattle herd analysis of four different herds in the former Kaokoland (Paskin, 1995).

The number of young calves expressed as a percentage of the number of cows are as follows: Otjirunda 47%; Cunene Stein 100%; Orupembe 87% and Etanga 100%. The herds at Cunene Stein and Etanga had, from the ages and numbers of their calves, achieved a very high calving percentage over the previous two years. At Otjirunda and Orupembe, where the grazing had been poorer, the cattle had maintained a lower calving percentage, indicating again the importance of available fodder for reproduction and production in livestock (Paskin, 1995).

4.5.2.3 Rangeland condition and use.

a) Rangeland Types

The Kunene region is predominantly covered by the are known as the "Mopane Savannah" vegetation zone of Namibia. This, however, should be divided again into an area known as the "Escarpment " zone and the area to the west known as the "Northern Namib Desert" zone (Muller, 1984). The "Mopane Savannah" zone is composed of distinct habitat types known as "mopane forest" and "mopane-shrub savannah". The "mopane forest", as the name implies, is predominantly composed of mature *Colospermum mopane*. This occurs in two distinct morphological forms being tree and shrub, while its herb layer varies according to the soil type. However, this species occurs on most soil types in the region. *C. mopane* often grows in association with *Terminalia prunioides, peltophorum africanum, Boscia foetida*, and *Eurporbia guerichiana*, as well as *Dichrostachys cinerea* especially in disturbed areas. In the hills and mountainous areas mopane habitat is often associated with *Cataphractes alexandrii* and *Acacia reficiens*. The species *A. albida* may be found amongst open areas of woodland near alluvial deposits (Hilton-Taylor, 1994).

The "mopane-shrub savannah" is associated with plains and hills, where *C. mopane* as a large tree from only occurs near rivers, while the plains and hills have predominantly shrub forms of this species. These open areas have a herb layer which is predominantly the habitat of grass species such as *Stipagrostis* spp. and *Schmitia* spp.

The "Mopane Savanna" zone may include *Sesamothamnus guerichii* in the central and southern parts of Kunene, while *Cerearia longipeduncalata* is typical in mountainous regions. Additional species present throughout the "Mopane Savannah" zone are the *Acanthaceae* family, *Barleria cyanea, B. meeusiana, B. rogersii, Blepharis ferox, B. gerlindae, Diclitera micranthes, Ecbloium clarkei, Lepicagathis scariosa, Monechma cleomeoides, M. salsoloides, Petalidium* spp., and *Ruellia currorii* (Hilton-Taylor, 1994).

The "Escarpment" zone is difficult to distinguish in the mountainous areas of Kunene. However, it is important to classify the zone, which occurs predominantly in the southern part of Kunene. A characteristic genus in the "Escarpment" zone is *Commiphora* represented by *C. africana, C. angolensis, C. anarcardiifolia, C. crenato-serrata, C. discolor, C. giesii, C. glaucescens, C. kraeuseliana, C. mollis, C. multijuga, C. oblanceolata, C. pyracanthoides, C. tenuipetiolata, C. virgata* and *C. wildii*. Other species typical of this vegetation zone include *Euphorbia guerichiana, Cyphostemma* spp. and *Moringa ovalifolia* (Hilton-Taylor, 1994).

b) Rangeland Use

The OvaHimba people today still practise to a large extent nomadic pastoralism (Paskin, 1995). They tend to live near temporary water points (pans, dams, the weaker water pits) during the wet season, and then migrate to the permanent waters (springs, the Cunene river) during the dry winter months. The nomadic lifestyle is very obvious by observing their kraals and houses which are very much simple and temporary. This nomadic way of movement by the Himbas actually make for an excellent rotational grazing system. Paskin (1995) indicates that under favourable rangeland conditions, the perennial *Stipagrostis* spp. are grazed up to one-half to two-thirds down the stalk, and then the animals were taken elsewhere. Once the grazing in the area is finished, the stock owners simply pack their

belongings and move somewhere else. The result of this it that the grazing in the "Himba areas" is somewhat better than in the other areas of Kaokoland (despite the usually lower rainfall in these areas), and soil erosion is much less obvious. The effect of a lesser abundance of water contributing to a lower population is clearly seen.

The Herero people have opted for a more sedentary lifestyle. Their houses are larger and more permanent than those of the Himba. The Herero farmers tend to try and remained settled at one place for as long as possible, and large permanent settlements have resulted in southern Kaokoland - e.g. Otjikhoware, Okonjota, Orumana and Kaoko Otavi. Livestock are not moved elsewhere until the grazing is exhausted, and even then, the more common practise is for the younger members of the family to take the animals away until the next rains, while the older people remain behind with perhaps a few cows and some small stock for own consumption of milk and meat. The main factor obstructing the Herero in the proper management of the rangelands, is the current communal land tenure system. The communal system works well where there is adequate land and a firm adherence to nomadism, but where a settled farming style is followed, there needs to be strict management of the rangelands. Presently, when one stock owner takes his animals away in an effort to spare some grazing for the dry years, another one will simply move in and destroy everything (Paskin, 1995).

c) Land Tenure

Land tenure in Kunene region is still communal. In Kunene the people can graze their livestock on communal grazing and acquire usufruct of arable land for gardens. The power over the land is today legally with the Regional governor and Executive Committees of the Representative Authorities. Chiefs and Headmen do not have legal authority to allocate land or withdraw land. However, the reality is often very different throughout Kunene, where some Chiefs and Headmen still hold authority (Nolidep, 1996).

There is still a traditional authority for the former territory known as "omgongarero yomuhoko" meaning "congregation of the people". This has irregular meetings discussing affairs affecting the whole territory. The Headmen in this region may not have legal powers to allocate land, however, all applications are directed through them. As a rule the Representative Authorities will liaise with the traditional leaders before making any decisions regarding land in a specific ward. Ethnic allocations of land appear to be the norm, where factors such as availability of land can determine its use by farmers. The decisions of Elders and Headmen in Kunene region are reported to affect entire communities associated with land utilisation.

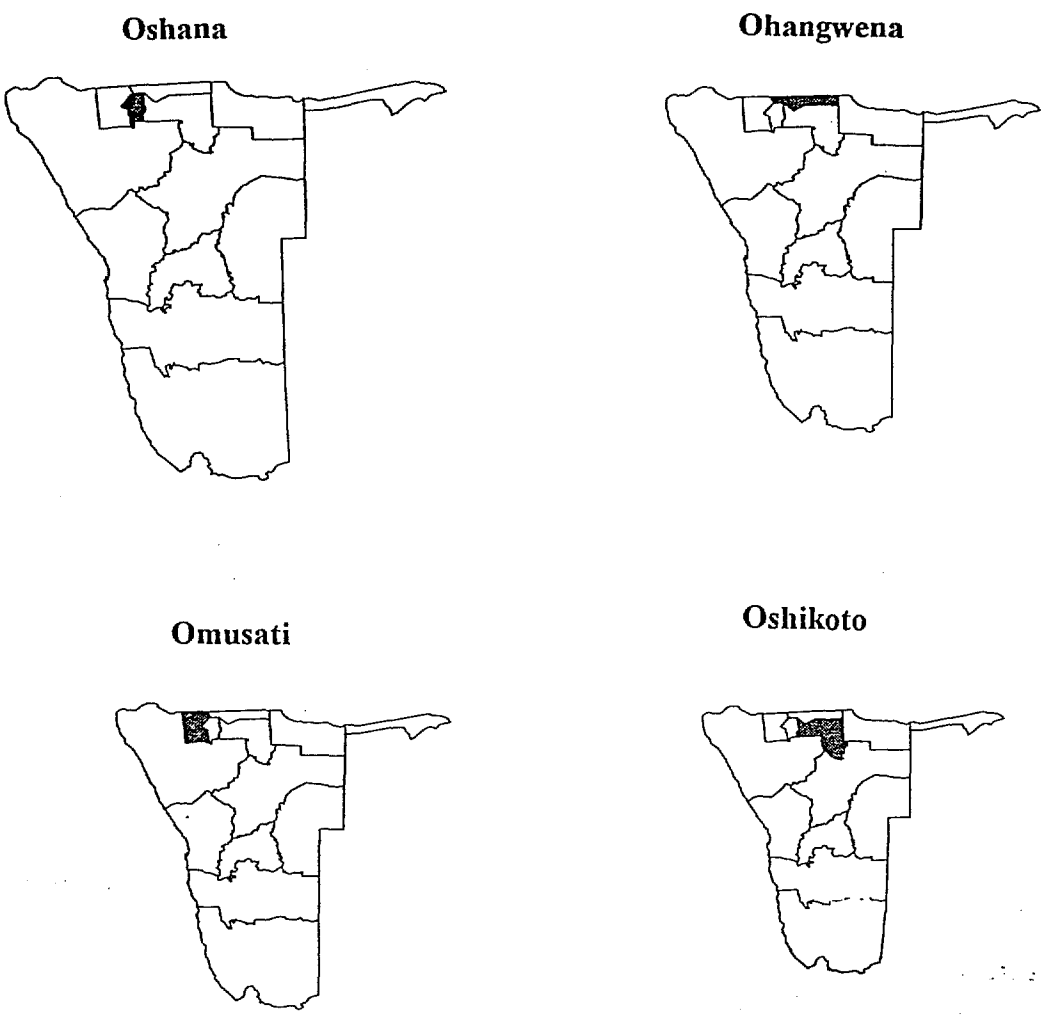
The communal land is now more and more criticised by some farmers who say that the development of evermore wealthy farmers is leading to overgrazing with the absence of fenced camps for controlled management (NEPRU, 1991). These farmers state a need for so-called "economic units" for pastoralists to develop into viable commercial farms. Meanwhile the traditionalists residing in Kunene region for many years argue their rights to extensive grazing over large areas of land, which they state is the perfect system for the low and variable rainfall.

The OvaHimba and OvaHerero peoples of the region are apprehensive of the future under the new Constitution allowing the right of any Namibian to settle in any part of Namibia and the status of their traditional land rights (Nolidep, 1996).

4.5.3 North-Central Regions (former Owambo).

4.5.3.1 Background

The North Central Region comprises of Oshana, Omusati, Oshikoto and Ohangwena regions formerly known as Owamboland. It comprises an area of 51 800 sq. km and approx. 520 000 people or 38% of the total population of the country currently reside in the region (Nolidep, 1996). **(Map. 11).**



Map. 11 : The location of the North Central Regions of Namibia

The 1991 census revealed that present growth rate of the region is slightly more than 3% per year. At this rate, the population will double in 23 years (Marsh and Seely, 1992). **(Fig 6).** Rapid increase in the number of people is almost inevitable given the fact that approximately 48% of the population is less than fifteen years of age.

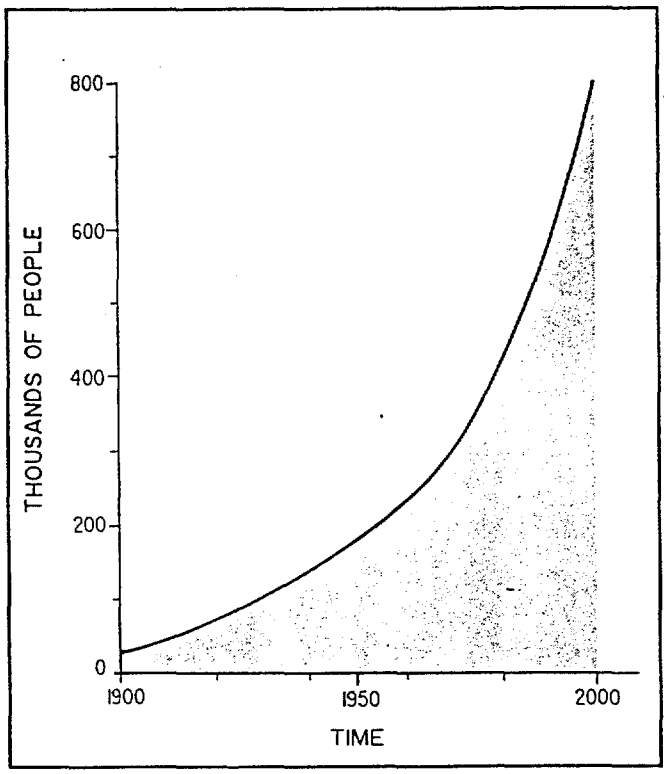


Fig 6 : Estimated changes in population during the last seventy years in the Owambo region (Marsh & Seely, 1992).

The majority of the population is transhumant pastoralist, although recently about 20% of the population has settled in the towns of Oshakati and Ondangwa (Marsh & Seely, 1992). The traditional subsistence strategy of these pastoralists is based around two principal activities: livestock farming supported by migratory seasonal grazing and rain fed agriculture. Livestock production under this system is closely integrated with crop production.

Society in the North Central regions is matrilineal, in other words, descent is traced through the maternal side of the family. The most noteworthy feature of this system is to be found in the traditions of inheritance. Children (male children in particular) inherit possessions from their mothers' brothers rather than from their own fathers, although this practice appears to be changing with the influences of modernisation (Nolidep, 1996).

Perhaps the most significant feature of social life amongst the Owambo people is the system of extended families. This extended family network provides social and economic support as well as serving as a mechanism for child rearing. This extended family system is also an important factor linking the North Central Regions with the rest of Namibia through financial transfers from family members.

The Cuvelai catchment in the North Central regions is relatively rich in alluvial soil and has therefore the greatest agricultural potential. As a result this area is the most densely populated area in Owambo. The mean population density in the whole area is about 10/km², compared to the density for the Cuvelai area of approx. 100/km² (Nolidep, 1996). (Fig 7).

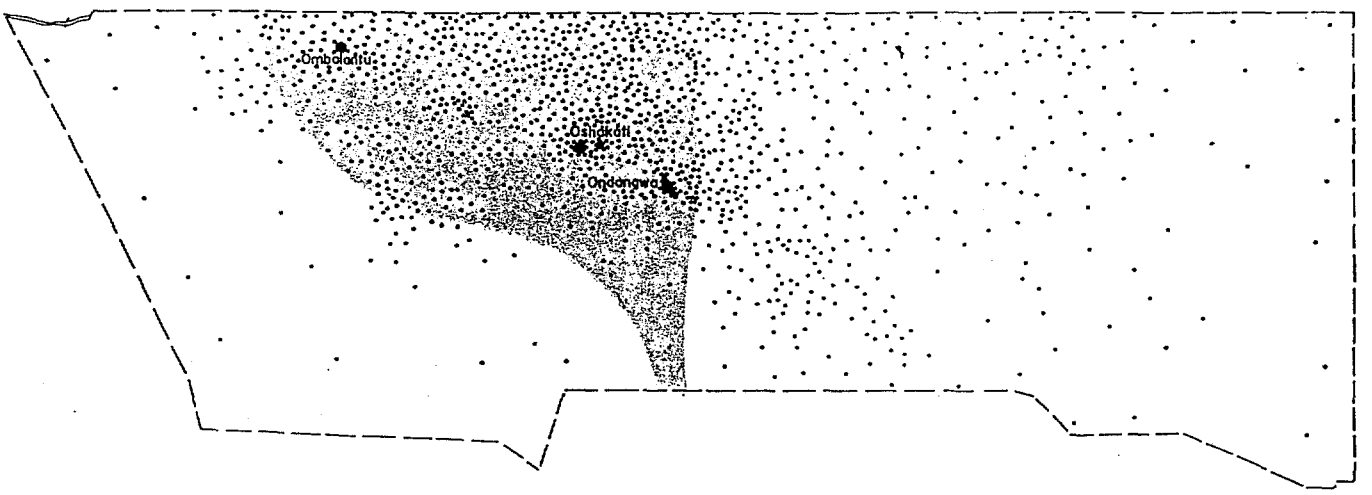


Fig. 7 : Population densities within the North Central regions of Namibia in 1985. It is believed that the overall pattern will still be the same today (Mash & Seely, 1992).

With at least 80% of the population in Owambo living in dispersed rural settlements, rural settlement patterns and the small amount of unused land, particularly in the Oshana area, will have to be taken into account in future planning for people and the environment. Decreasing availability of resources such as water, land, grazing, timber and fuelwood may result in social tensions (Marsh & Seely, 1992). Outside the Cuvelai area densities, and thus competition for natural resources, are not so high. The availability of water in these area was always the major factor preventing permanent settlement, but with the provision of the pipeline to the grazing areas south of Ondangwa, more people and livestock have been attracted.

4.5.3.2 Livestock.

The local land use system is an agrosilvopastoral one where crops, trees and livestock are used. The crops component consists mainly of omahangu with sorghum, beans, pumpkin and melons. The livestock component consists of cattle, goats, sheep and donkeys, and the tree component consists of diverse mix of local, multipurpose species, including mopane, palms, figs, and baobabs.

Livestock keeping is an important tradition in Owambo. At present, there are approx. 971 000 head of livestock in the area (Marsh & Seely, 1992). The majority are cattle, where the Sanga is the most important breed. There are a high number of donkeys in the area and the remainder of the livestock numbers is made up of goats and sheep. Livestock numbers in Owambo increased dramatically over the past 45 - 50 years. According to Marsh & Seely (1992), cattle numbers increased by 94%, goats by 316% and donkeys by a dramatic 2 000% since 1945/46.

The most important function of cattle is as an insurance-cum-investment fund. Although the possession of cattle to a large extent determines the status of the owner, cattle are not considered as "sacred" as in some other southern African societies. If confronted with food shortages, people may exchange some cattle for grain. Cattle owners have a long tradition of selling some of their cattle to traders, although the enforcement of the veterinary cordon fence and the war conditions in Angola severely curtailed external markets. The internal market for cattle is absorbs about 15 000 cattle annually. This represents about 4,3% of existing stock, a figure which is well below the sustainable take-off rate of 10% (Tapscott, 1990). Although this figure might seem very low, there is a subtle mix of different forms of resource use including agriculture, cattle, fishing and harvesting of wild products. This might be the most sustainable form of resource use in the region.

Ownership patterns of cattle are in a state of flux. It seems that livestock in general, and cattle in particular, are progressively becoming concentrated in the hands of fewer and fewer owners. To a certain extent, it is mitigated by a 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. The concentration of cattle in the hands of cattle "barons" does not necessarily diminish the access to cattle products, for example milk (Marsh & Seely, 1992).

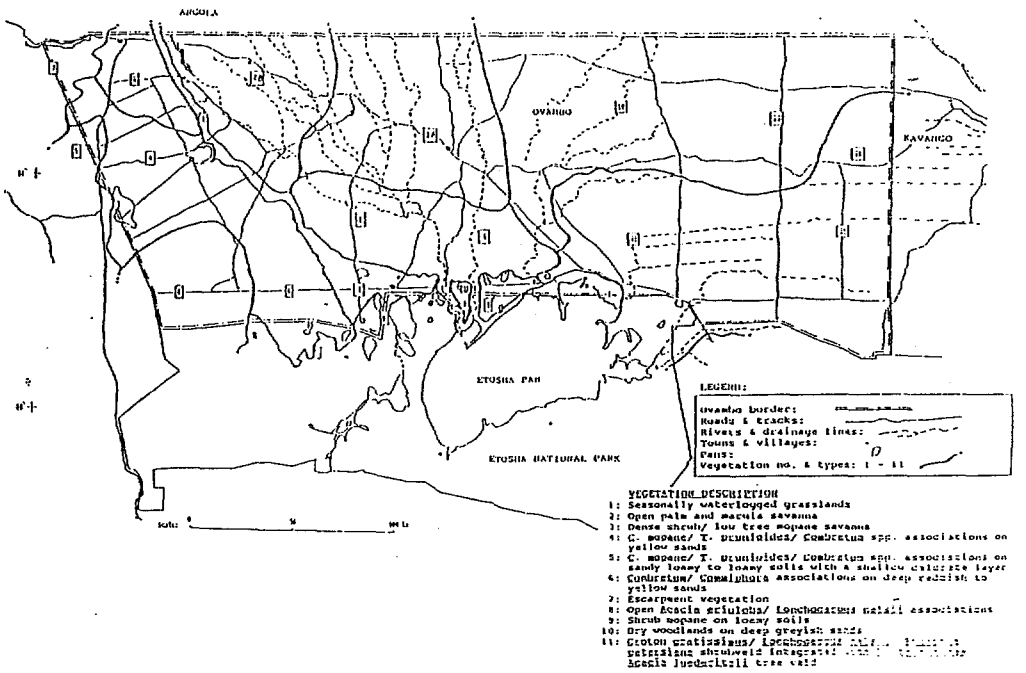
An important point relating to concentration of resources in the hands of cattle barons is the potential long term sustainability of such a system. In several other parts of Africa the same process has occurred and has led to degradation of the rangelands and an ultimate decline in carrying capacity. This results from herding strategies of such groups which are different from the traditional strategies. There is a stronger tendency for sedentarisation amongst the cattle barons, but also because many employ herders. Under these conditions the incentive of these herders is not to manage the rangeland wisely, which would be the case if the herds were their own, but rather to maximise the number of cattle in each herd as they are generally paid on the basis of the size of the herd. This short-term perspective is perfectly logically for the herders, but not conducive to wise management of the resource base.

Goats, and to a much lesser extent, sheep and pigs, are important sources of meat. Small stock is kept in the inhabited zones near the farms, and are allowed to graze and browse in the communal areas throughout the year. At night, small stock is kept in kraals next to the homesteads. Horses and donkeys are generally not herded, and roam around freely. Horses are limited in numbers, and are mainly a traditional status symbol associated with power. Donkeys have increased dramatically in numbers over the last decades because of their importance as cheap draught power for transport, ploughing and meat. Donkeys are better able to tolerate drought conditions than oxen and are therefore particularly important as draught animals in dry periods (Marsh & Seely, 1992).

4.5.3.3 Rangeland condition and use.

a) Rangeland types

According to the vegetation map of the North Central regions of Namibia (Nolidep, 1996), the following major vegetation types do exist:



Map 12 : Vegetation map for North Central regions of Namibia (Nolidep, 1996).

1. *Seasonally waterlogged grasslands.*

This habitat is a grass plain with shallow drainable lines (omurambas) and seasonal or permanent water filled pans (Oshanas) and wetlands. The omurambas and Oshanas represent only a small proportion of the vegetation type. Only a few palm trees are present near some of the omurambas and at Lake Oponono. The approximate size of the area is 4 877 sq. km and represents about 9,41% of the total surface area of Owambo.

Dominant plant species include : *Sporobolus spicatus, Eragrostis rotifer, E. biflora, Diplachne amboensis, Cuperus marginatus,* annual *Sporobolus* spp., *Pogonarthria fleckii, Odyssea paucinervis, Aristida meriodonalis, Dactylotenium aegyptium, Triraphis purpurea, Schmidtia kalahariensis, Suaeda* spp., *Hyphaene benguallensis* var. *ventricosa.*

2. *Open Palm and Marula savannah.*

The habitat consists of the Cuvelai-drainage system with dense shrub mopane in between the drainage areas in the centre. In the west dense shrub mopane is dominant vegetation cover in between the drainage areas.

The oshana and omuramba depressions and drainage areas consist of short open grassveld and wetland systems with open palm savannah surrounding these drainage areas. The remnant woodlands still present in this highly utilised area consist of open, tall tree marulas, boababs, figs and the ebony Diospyros. Some denser vegetation is present around small seasonal pans. Dense shrub mopane veld occur irregularly in the same inter-drainage areas, especially in the east of this vegetation type. The approximate size of this area is 10 169 km² and represents about 18,62% of the total former Owamboland.

Dominant plant species (woody) includes: *H. bengalensis, Sclerocarya birrea, Colophospermum mopane, Baikea plurijuga, Diospyros mespiliformis, Combretum psidioides, Ziziphus mucronata, Salvadora persica, Ficus sycomorus, Adansonia digitata* and *Acacia erioloba.* Additional woody plant species present include: *Terminalia sericea, Lonchocarpus nelsii, Combretum imberbe, Terminalia prunioides, Ficus thonningii, Boscia albitrunca, Euclea undulata, Kigelia africana, Pelthophorum africanum, Grewia retinervis, Acacia arenaria, A. nilotica, A. luederitzii, A. hebeclada* sub-spp. *tristis, Bolosanthus speciosus, Pechuel-loeschea leubnitziae, Aloe esculenta,* some vulnerable and possible rare staeliads and *Sansevieria* spp. Dominant grasses include: *Sporobolus spicatus, Sporobolus spp., Eragrostis trichophora, E. lehmanniana, Aristida adscensionis, E. porosa, Cynodon dactylon, Dachtylotenium aegyptium, Chloris virgata, Bothriochloa radicans, Brachiaria eruciformis, Numphae* spp., *Tragus racemosus, Eragrostis viscosa, E. rotifer,* various herbs, *Panicum* spp., *Aristida hordeacea, Andropogon gayanus, Enneapogon cenchroides, Schmidtia kalahariensis.*

Some invasive alien plants are present mostly along the tar road south east of Ondangwa, namely: *Flaveria bidentis, Datura innoxia, D. stramonium, Nicotiana glauca, Amaranthus* spp., *Prosopis* spp., *Ricinum communis, Eucalypthus* spp., *and Opuntia ficus-indica.*

3. *Dense shrub/low tree mopane savanna*

This habitat consists of dense shrub or low tree mopane savannah with some minor drainage areas with palm savannah that occur in the northern areas of this vegetation type. The approximate size of those area is 2 263 km² and comprises 4,36% of the total former Owamboland area.

Dominant plant species include: *C. mopane, Cataphractus alexandrii* and a few *Acacia nebrownii* shrubs. *A. arenaria* are abundant in the central east and *A. hebecalada* var. *tristis* occur along the Olusati (Olushande) dam. The herbaceous stratum consists of mostly annual

grasses with some perennials such as *Cenchrus cilliaris, Anthephora pubescens* and perennial *Sporobolus* spp. present.

4. *C. mopane / T. prunioides / Combretum spp. associations on yellow sands.*

This habitat is a mosaic of mopane-dominated savannah alternating with T. prunioides/ Combretum-dominated savannah. There is an open plain with short grassveld of approx. 5 000 ha in the south west of this unit. Overall it is moderately dense, low to middle height tree savannah with some areas being more homogeneous and other areas being quite diverse in terms of species composition. The approximate size of the area is 5 579 km² and represents about 10,77% of the total formal Owamboland area.

Dominant plant species are (woody vegetation): *C. mopane, T. prunioides, Combretum appiculatum, C. psidioides, C. englerii, C. hereroensis, C. celastroides, C. alexandrii, L. nelsii, Elephantorhiza suffructicosa, Rhigosum brevispinosum, Commiphora glausescens, Spirostachys africanum, Peltophorum africanum, Croton gratissimus, Commiphora mollis, T. sericea, Bauhinia petersiana, Commiphora pyracanthoides, A. nilotica, Burkia africana, Dichrostachys cinerea, Grevia flava, Ochna pulchra, C. imberbe, Commiphora multijuga* and *Montinia caryophyllacea.* Dominant grasses include: *Schmidtia kalahariensis, E. cenchroides, Sorghum versicolor, Andropogon schinzii, Heteropogon contortus, A. pubescens, A. schinzii, A. hordeacea, A. adscensionis, A. rhinochloa, Eragrostis superba, E. rotifer, Stipagrostis uniplumis, S. hirtigluma, Elytrophorus globularis, Schimidtia pappophoroides, P. fleckii, Triraphis purpurea, Rynchelетrum repens* and typical sandveld non-grass herbs.

5. *C. mopane / T. prunioides / Combretum spp. associations on sandy loamy to loamy soils with a shallow calcrete layer underneath.*

This habitat is more homogeneous than habitat 4, and mostly mopane dominated. It is a moderately dense low tree savannah. In some limited areas with deeper more sandy soils the vegetation resembles 4 more than 5. The approximate size of the area is 350 sq. km and represents about 0,67% of the total former Owamboland area. Meanwhile the presence of *Albizia brevisfolia* in association with the other dominant plants makes this area special.

Dominant species composition includes: *C. mopane, T. prunioides, C. apiculatum, C. mollis, C. glausescens, P. africanum, C. pryracanthoides, Albizia brevisfolia, C. alexandrii, R. Brevispinosum* and mostly an annual dominated grass stratum.

6. *Combretum/Commiphora - associated on deep reddish to yellow sands*

This habitat is relatively homogenous with the vegetation stratum being generally a lower tree savanna in the southern areas unlike the remaining three quarters of the northern sections. Generally there is a 5-8m high dense bush savanna with an open shrub stratum. This are has a unique and rich plant species diversity.

Dominant plant species include: *C. mopane, C. appiculatum, C. psidioides, C. englerii, C. celastroides, R. brevispinosum, C. mollis, Pterocarpus lucens, T. sericea, C. pyracanthoides, B. africana, Lonchocarpus capassa, Commiphora spp., C. collinum, G. flavescens, Vangueria infausta, C. multijuga, B. albitrunca, Cyphostemma ruacanensis, P. fleckii. Baphia massaiensis, A. ataxacantha,* and mostly annual dorffinated grasses *(S. kalahariensis* is very common).

7. Escarpment vegetation

This is an area which varies in dominant species composition and structure. especially further west into Kunene. The small section of this vegetation type present in North Central is more uniform in species composition and structure. It consists of escarpment vegetation on steep to moderate slopes with 5 - 7 m high dense mountain bushveld. Meanwhile, the Kunene riverine vegetation variation is a moderate dense high tree riverine woodland with dense river edge vegetation. The approximate size of this area is 669.48 km² (1.29% of total former Owamboland area).

Dominant plant species along the escarpment include more or less the same species composition as in habitat 6, but the following species are also included: *Pachypodium leallii, Commiphora glausescens, C. teneopetiolata and Adenium boehmannii.*

Along the Cunene River the following are found: C. imberbe, C. mopane, Berchemia discolor, Rhus marlothii, Ficus capreifolia, Faidherbia albida, A. erioloba, F. sycomorus, Boscia microphylla, Cordia sinensis, Sclerocarya birrea, Albizia brevisfolia, C. apiculatum and typical hydrophytic vegetation.

8: Open Acacia erioloba/Lonchocarpus nelsii - associations

This habitat is open shrub variations alternating with an open tree savanna. The shrubveld alternates with a medium-high open tree veld (± 6 m in height). In the north and east, Acacia/Albizia tree savanna is found. The approximate size of the area is 2 454.76 km² (4.73% of total former Owamboland).

Dominant plant species (woody stratum) include: *A. erioloba, L. nelsii, A. mellifera, A. luederitzii, A. hebeclada var. hebeclada, R. brevispinosum, E. suffruticosa, Albizia anthelminthica, T. prunioides, G. flava, C. alexandrii, A. reficiens.* Herbaceous stratum include: *Stipagrostis uniplumis, S. kalahariensis, Eragrostis nindensis, A. adscensionis, E. cenchroides* and *A. meridionalis.*

9: Shrub mopane on loamy soils

There are no obvious variations present in this habitat, where there is a moderately dense high shrub mopane veld with other woody species sparsely represented. The approximate size of this area is 255.04 km² (0.49% of total former Owamboland area).

Dominant plant Species include: *C. mopane, C. alexandrii, C. pyracanthoides, S. kalahariensis, S. uniplumis. E. cenchroides* and *A. pubescens.*

10: Dry woodlands on deep greyish sands

This habitat consists of a mosaic of tall tree woodlands integrated with slightly lower, more open woodlands and small open shrubveld between low dune streets in the NE of Owambo. The structure is a high (15-25 m) dense dry woodland with a closed canopy integrated with moderately dense, medium high (10-15 m) dry woodland, with a denser undergrowth. The approximate size of this area is 12 528.84 km² (24.2% of total former Owamboland area).

Special features include a very diverse species composition, but structurally uniform.

Dominant plant species (woody vegetation) include: *P. angolensis, B. africana., B. plurijuga, B. massaiensis., Ricinodendron rautanenii, Guibourtia coleosperma, Grewia retinervis, C. gratissimus, Ozoroa paniculosum, O. longipes, G. flava, B. petersiana, Aloe esculenta, stapeliads, D. mespiliformis, Albizia versicolor, C. psidioides, C celastroides, C. hereroensis, C. apiculatum, T. sericea, L. nelsii, C. imberbe, T. prunioides, P. africanum, A. hebeclada,*

A. erioloba, D. cinerea, Combretum zeyherii, Strychnos pungens, S. cocculoides, Z. mucronata, C. englerii, A. ataxacantha, B. albitrunca. Grasses include: *E. rigidior, E. pallens, A. meridionalis, S. kalahariensis, Digitaria zeyherii, A. adscensionis, A. congesta, A. stipioides, A. pubescens, Brachiaria nigropedata, Panicum kalahariensis, P. maximum, Sorghum spp., S. pappophorioides, S. uniplumis, P. fleckii, R. repens, Pogonarthria squarrosa, Parotis patens, Eragrostis jeffreysii, Setaria palida-fusca* and *Digitaria seriata.*

11: Croton gratissimus/Lonchocarpus nelsii/Bauhinia petersiana shrubveld integrated with Terminalia prunioides/Acacia luederitzii tree veld

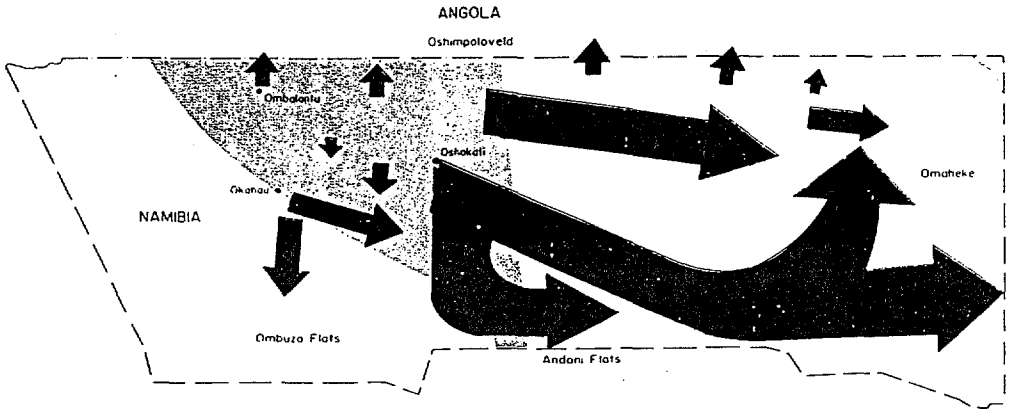
Three main habitats exist, which are integrated with one another as follows:
- *Croton gratissimus/L. nelsii/B. petersiana* shrubveld;
- *Terminalia prunioides/A. luederitzii* tree veld on parallel dune ridges which is a denser dune ridge vegetation and quite diverse; and
- *Acacia/Croton gratissimus* open low tree veld in a few east/west running omurambas.

The approximate size of this area is 10 934.84 km² (21.2% of total former Owamboland area).

Dominant plant species (woody vegetation) include: *T. prunioides, L. nelsii. C. gratissimus, T. sericea, B. petersiana, A. luederitzii, A mellifera, A. hebeclada, A. fleckii, D. cinerea.. G. flava, G. flavescens, G. retinervis, C. psidioides, C. hereroensis, C. celastroides, A. ataxacantha.* Dominant grasses include: *A. pubescens, S. pappophorioides, S. kalahariensis,* various forbs, *E. rigidior, E. lehmanniana, B. nigropedata, D. seriata, D. zeyherii, E. pallens, A. meridionalis and A. pilgeri.*

b) Rangeland use

A key factor in preventing massive land degradation, and ultimately desertification of the north central regions and the Oshana region in particular, is the continuation of the type of rotational grazing practised by the traditional pastoralists in the area. The most important component was the seasonal movement of cattle (known as transhumance) that allowed natural regeneration of grazing. The impetus to move was not only dictated by the availability of grazing and fodder but, more importantly, by the seasonal availability of water and the tenure arrangements regulating access to water. Traditionally younger men and boys were responsible for movement and management of the herd between the oshana area and the dry season grazing grounds. Specific grazing areas surrounding the oshana area, such as the Oshimpolo veld (now in Angola), the Ombuza Flats, the Andoni Flats and the Omaheke, were all used on a regular basis. **(Map 13)**



Map 13 : Transhumance patterns in Owambo, showing the movement of livestock away from the oshana area in the dry season. Patterns of movement are reversed in the wet season (Marsh & Seely, 1992).

The transhumance system has recently been modified by several factors. Probably the most important modifying factors have been the introduction of a reliable supply of water without clear management arrangements and large scale fencing of former grazing reserves. Before the construction of the canals and pipelines, lack of water was the main factor necessitating the seasonal movement of cattle. Now the presence of water year-round means that cattle can be kept in the inhabited zone longer. This benefits people's diets (more milk is available), but it increases the pressures on the grazing, especially along the banks of the canal and at watering points. Exclusion from Angolan pastures has also contributed to the decrease in transhumance and the degradation of the central pastures. It has also led to tensions on the borders with the Kaokoveld and Etosha National Park. In the absence of new management strategies, these factors limit cattle to an ever diminishing area resulting in a massive increase of grazing pressure in the remaining areas (Marsh & Seely, 1992).

The encroachment of traditional seasonal grazing areas, especially in the eastern Oshikoto region, raised a lot of concern recently. This initiated a series of actions to investigate the problem and to come up with recommendations. The first step in this series of actions was an aerial and GIS mapping of fences in the area (Holme and Kooiman, 1994) where they tried to determine the extent of fencing in the eastern Oshikoto region. This was followed up by a study commission by the GTZ and executed by the Social Science Division of the University of Namibia (Fuller & Turner, 1995) on resource use and range management in three communal areas of Namibia, highlighting the importance of community empowerment for proper resource management. A third study (Fuller, Nghikembua & Forbes Irving, 1996) was conducted with the view to examine the impact of reduced access to key resources of land and water on livestock farming practises and secondly, to investigate the people's view of the current situation and future trends of communal grazing management, and assess the potential for community ownership and land management of communal land.

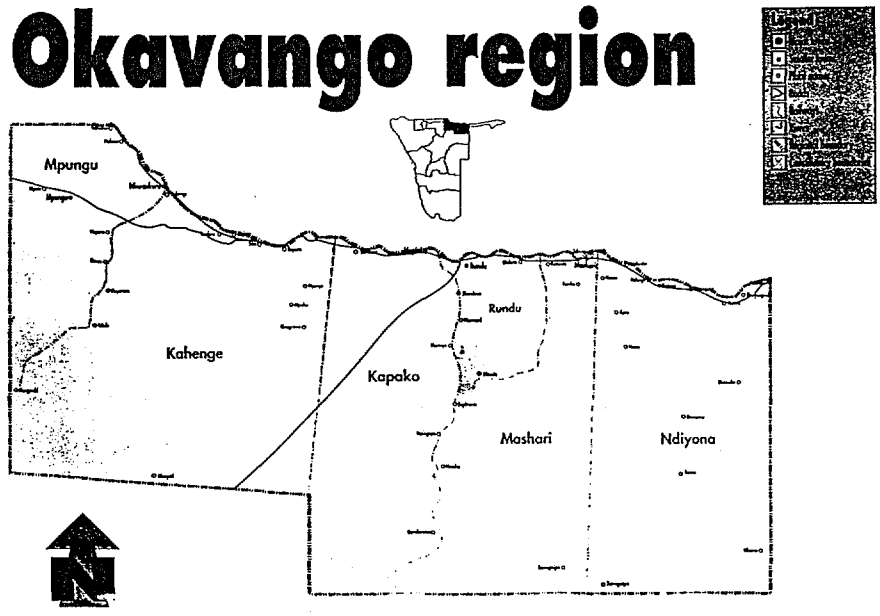
Prior to 1970's communal lands in the eastern Oshikoto region were little used. Cattle herders from the Ondonga areas were going as far east as the village of Onyaanya, 30 km east of Ondangwa. Traditionally, Aandonga pastoralists have moved south to Oshanamatunda near Tsumeb and to the area around Lake Onandova near Oshivelo. Both of these sites were cut off; first by the expropriation of land for white farmers in the Land Settlement Programme and, secondly the erection of the Veterinary Cordon Fence in the 1970's. Since the late 1970's, two distinct processes of population movement are evident, namely the movement of the Ovakwanyama herders south-east from areas around Ondobe, Eenbaxu and Okongo. Secondly, movement of the semi-commercial farmers into the eastern Oshikoto after the mid 1980's. Each of these movements has its own origins, development and motivations (Fuller et al., 1996).

The pattern of settlement of the Okwanyama herders followed very much a similar template. They will first set up a cattle post as they search for better grazing. With time they begin to clear fields and plant omahangu (millet). Eventually, they establish full-fledged homesteads. As the number of households in a specific area increases, the residents may then apply to the Ondanga Tribal Leadership to have their settlements become a village. This pattern of settlement has created a number of new villages in the eastern Oshikoto region. This new pattern of establishing homesteads, with people clearing omahangu fields in the middle of the forest, is currently very obvious (Fuller et al., 1996).

The key resources of these herders are water and grazing. During the rainy season water is found in either the *eendobe* or the *omakango*, and in the dry season - in the *eendungu* (hand dug wells). Water quality is sometimes a problem due to salinity and also the depth of the water table. The reason for moving into the area, as mentioned by most of the herders, is because of the good grazing available. At present, this resource is quickly vanishing, and the prime reason is overgrazing because of too many animals grazing in the area. Secondly, the presence of fenced off areas, limiting herders to grazing areas, is another big problem.

The semi-commercial farmers who erect fences, of course, obtaining exclusive access to rangeland resources. This includes both water and grazing. These farmers can have the best of both worlds as they are able to use open communal lands surrounding their fenced units during good times, and keep their enclosed parcels as a reserve for bad times. In addition to being in a better grazing position, many of the fenced areas now enclose *eendobe* and *amakango*, thus taking both seasonal sources of water away from communal farmers and the *eendungu* which can only be dug in these areas. These are points of friction between the communal and semi-commercial farmers. It is believed that the more wealthy semi-commercial farmers are able to pay the traditional leadership vast amounts of money to obtain the "rights" to fence off certain areas and, even then, fence off bigger areas than they are suppose to. This practice excludes communal farmers who have limited access to the cash economy (Fuller et al., 1996).

4.5.4 The Kavango



Map 14 : The location of the Kavango in Namibia.

4.5.4.1 Background

The Kavango region occupies 45 700 km² in the north-east of the country. The perennial Okavango river forms almost the entire border with Angola and separates Kavango from the West Caprivi. The Kavango land distribution is as follows (IFAD, 1992):

Urban & roads (<1 %)	400
Crop Land	660
Kaudom game reserve	3 700
Mangetti game area	450
Mahangu game reserve	240
Grazing land (12 ha/LSU)	40 250
Total	45 700
Regional carrying capacity (LSU)	335 400
Present total LSU	71 000
Stocking rate as % of Carrying Capacity	21

There has been a significant amount of fenced ranch development in the south west. The Namibia Development Corporation (NDC) Mangetti Block occupies 260 000 ha but technically lies south of the cordon fence, and markets stock in the south. A further 44 ranches of 5 000 ha each along the northern edge of the Mangetti Block have been demarcated and allocated to private individuals (not necessarily from the region), and there are about another 30 fenced ranches of 5 000 each in the region. (IFAD, 1992).

The figure for cropland is based on estimates of 2 000 ha under commercial production, and 16 000 rural households with and average of 4 ha each. More than 95% of the human population, and much of the livestock, is concentrated in a narrow band along the Okavango river, which is up to 10 km wide and constitutes only 5% of the total area.

Kavango, including Mukwe Constituency, has one of the fastest growing regional populations in Namibia, and with and estimated 137 000 people, 86% of whom live in rural communities, it constitutes almost 10% of the national population. Small settlements of people are also found on the lower courses of some omurambas, the dry river beds that join the Okavango valley in the south. Despite the availability of arable land and grazing to the south, more extensive settlement is constrained by access to water.

4.5.4.2 Livestock.

Whilst the agricultural potential of the Kavango has possibly been overstated at times, potential for dryland crop production does exist and the possibility of exporting millet to other parts of the country is being considered. In 1988/89 a surplus of 150 000 kg of millet was exported to Owambo.

To rural households, livestock rearing is of less economic importance but of greater social significance than grain production. Although total livestock numbers in the Kavango are very low, compared to Carrying Capacity norms, the concentration of the livestock near the permanent water points (Okavango river) causes extreme overgrazing and subsequent rangeland degradation. Livestock numbers are increasing in the Kavango and, according GTZ (1991) the estimated rate of increase for cattle is around 4% per annum. The average herd size is around 20 to 25 cattle.

Oxen are widely used for draught throughout the Kavango. Spans of 2, 4 and 6 oxen are used extensively for ploughing and hauling of wooden sleighs to collect household water and the transportation of other commodities. Very little cattle manure is applied on arable fields, perhaps because of the readily availability of land. Farmers in the Kavango practise a form of agricultural rotation reminiscent of the discredited "slash and burn" method. Since dung is not used, kraals frequently have to be moved when the manure level becomes too high. Manure is also not used for fuel or in building mortar, perhaps due to the abundance of wood in the area.

As in Owambo, the formal market for cattle is extremely limited and the offtake from the regional herd is way below its optimal potential of 8 800 head per annum. The estimated annual offtake is between 2 500 and 3 000 head or between 3,0% and 3,5% of the regional herd. This includes slaughter for "formal" and "informal" sale and for ritual and ceremonial purposes (GTZ, 1991). Despite the limitations of formal marketing channels, it is also certain that people of Kavango do not perceive of their cattle in simple economic terms and, if anything, attach even greater intrinsic value to their herds than do the people of Owambo. Goats, in preference to cattle, are slaughtered for immediate household consumption.

Cattle are also used as payment for fines imposed by traditional courts. This practice is however slowly changing. Cattle hides are not used to any extent in Kavango and are often discarded. A limited amount of tanning is however undertaken and the leather is used for smelting bellows, for thongs and for drum skins. Milking is always undertaken by males,

but milk itself does not form a significant part of local diets, apart from consumption by children and in times of droughts. Sour milk and butter are consumed in greater quantities and the latter is used for cosmetic purposes. Since calves are not weaned, milk yields are generally low.

4.5.4.3 Rangeland condition and use

a) Rangeland types

The vegetation in the Kavango is more uniform than in Owambo, being mainly dry woodland in the north merging into tree and bush savannah in the south. There are a number of species which are widely distributed within the Kavango e.g. Burkea africana and vegetation units are often defined on the basis of small changes in topography, drainage and soil conditions. The structure (height and density of different strata) is an important descriptive parameter in the outlines of these vegetation types given below (Nolidep, 1996):

Veld Type 1: Acacia-Combretum-Terminalia short bush savanna

This vegetation unit occurs in southwestern Okavango and occurs on a generally flat plain which gives way to well defined dunes in the East. Soils are Hutton and Clovelly Forms. Trees are generally 3 - 4 m in height with isolated dense stands of larger *Terminalia prunioides* a feature. Characteristic species include *Terminalia sericea. Lonchocarpus nelsii, Combretum collinum, Bauhinia petersiana and Baphia massaiensis. Acacia mellifera* forms dense stands in depressions and where overgrazing has occurred. The grass layer, has a moderate to good basal cover and is dominated by *Schmidtia pappophorioides, Eragrostis rigidior, Aristida stipitara and Aristida meridionalis.*

Veld Type 2: Baikiaea-Pterocarpus-Burkea-Combretum dry woodland

This vegetation type is well defined in the central western portion of Okavango and cover about 530 000 ha. It generally occurs in areas with well defined large dunes and differences within this vegetation type can usually be ascribed to small changes in topography and soil conditions. Soils are regic sands of the Fernwood and Hutton Forms. Characteristic species are tall trees (>10 m) *Baikiaea plurijuga, Pterocarpus angolensis, Burkea africana, Combretum collinum, Ricinodendron rautanenii, Combretum collinum* and *Guibortia coleosperma*, with a well defined understorey of shrubs *Bauhinia petersiana* and *Baphia massaiensis*. This grass cover is poor and is made up largely of unpalatable species such as *Aristida stipitata, Aristida meridionalis* and *Eragrostis pallens*. Where the dunes are not well defined *Baikiaea plurijuga* becomes uncommon and is generally replaced by *Burkea africana* as the dominant species.

Veld Type 3: Acacia-Dichrostachys-Combretum bush savanna

This vegetation type occurs in 2 discrete units, one in the south-central region and one in the Northwest where it is associated with the Namungundu, Mpuku, Dikweya and Ekuli omuramba. It covers an area of about 420 000 ha and is generally associated with sandy, nutrient poor Hutton and Fernwood Form soils. Dunes are not well defined in this area and so there are no distinct interdune sub-units within this vegetation type. The sub-unit occurring in the south-central region is a dense bush savanna, dominated by large *Acacia erioloba* trees, with a well defined understorey of *Terminalia sericea, Lonchocarpus nelsii, Combretum collinum, Combretum celastroides, Bauhinia petersiana, Baphia massaiensis* and *Ochna pulchra*. The vegetation sub-unit in the Northwest has a very similar composition and both have moderate to poor grass cover dominated by *Schmidtia pappophorioides, Eragrostis rigidior* and a number of unpalatable *Aristida species*. The boundary between this vegetation type and Type 2 is often obscured in the Northwest as *Baikiaea plurijuga* can be locally common.

Veld Type 4:

Terminalia sericea, Combretum collinum, Baphia massaiensis, Bauhinia petersiana, with large *Burkea africana* being the dominant tree species. The poisonous plant *Dichapetalum cymosum* is common on the omuramba margins and is particularly noticeable in disturbed areas. Where they are well drained, the omuramba bottom lands are dominated by dense stands of *Acacia erioloba, Acacia hebeclada* and *Dichrostachys cinerea*. Most of the grasses in the bottom lands are unpalatable species capable of surviving waterlogging and some salinisation. *Cynodon dactylon* a highly palatable species does occur in patches along the omuramba. Grass cover along the margins is generally good, but as these areas are favoured for cultivation they are relatively unimportant for grazing.

Veld type 6: Terminalia-Baphia-Bauhinia-Commiphora short scrubland

This vegetation type occurs in the South-east around the Nhoma omuramba and associated minor drainages. It is an extension of a vegetation type common in Bushmanland to the south and covers an area of about 200 000 ha. There is little topographic variation in this area, except for the poorly developed system of omuramba. Soils are largely Hutton and Fernwood Forms. The vegetation is generally short (<3 m) and common species include *Terminalia sericea, Baphia massaiensis, Bauhinia petersiana, Ochna pulchra* and *Commiphora africana*. Tall trees are sparsely distributed. *Pterocarpus angolensis, Burkea africana* and *Combretum collinum* being the commonest. The understorey is not dense due to poor soils and rainfall.

Veld Type 7 and 9: Terminalia-Combretum-Burkea-Baikiaea dry woodland

This vegetation type is similar to Type 2 described above, but occurs on a far more broken landscape of well defined dunes, interdune slacks and drainage lines. Soils are variable but are largely Fernwood Form on the dunes and Hutton and Clovelly in the interdune areas. The species composition is very similar to Type 2, but *Baikiaea plurijuga* has a much more defined distribution in that it only occurs on the crest of large dunes. Other common tree species are *Burkea africana, Pterocarpus angolensis, Guibortia coleosperma, Ricinodendron rautanenii* and *Combretum spp*. The basal cover of grasses varies from 1-2% on the dunes to more than 3% on the interdune slacks. As this area is relatively heavily settled the interdune areas are generally heavily cultivated or grazed and vegetation is very often secondary. The interdune areas are subject to bush encroachment and this can be clearly seen in the vicinity of Shividi and Korokosho.

Veld Type 8 and 10: The Okavango River floodplains and terraces

Bethune (1991) defines a number of sub-habitats/vegetation types along the river. These include: the river margins with their dense reed beds and floating grass mats; the riparian forests and thickets; the floodplain which is seasonally inundated; and the alluvial terraces. Probably the most important species are: the grasses - *Cynodon dactylon*, which forms the floodplain lawns so important as a grazing resource and *Echinochloa stagnina* which is usually found as a floating mat and is also an important grazing resource; *Phragmites spp*. Reeds; *Vetiveria spp., Miscanthus junceus; Hyphaene verntricosa*; and a number of large tree species. There has been widespread clearing of riverine vegetation along the Okavango River for cultivation as well as access and some areas are heavily bush encroached where lands have been left fallow.

b) Rangeland use

Livestock rearing has an important role in Kavango society in addition to being a source of agricultural income, although the commercial offtake of livestock is very limited. The major source of livestock income for most people are goats and chicken.

Cattle are the primary responsibility of men, while livestock are traditionally herded by boys. Cattle are herded during the crop-growing season, but for much of the year they are allowed to roam unattended on the flood plains surrounding homesteads. Livestock are always placed in kraals at night.

Cattle graze on the stubble and stalks of millet and maize after the harvest. During periods of grazing shortages and often during the growing season, cattle are moved south to cattle posts in the sand plain. Whilst grazing in this zone is generally of a reasonable standard, the siting of cattle posts is determined by the availability of ground water. A limited number of boreholes have been sunk by the local Department of Water Affairs, but the grazing potential of the area is far from realised (Nolidep, 1996).

Cattle from an extended family village will herd their animals together during periods of seasonal grazing. Boys, accompanied by an adult, or sometimes on their own, herd the cattle during the day and kraal them at night, since predators represent a real threat. It is not uncommon for a household to divide the cattle amongst a number of family groups in order to reduce risk of total loss through one mishap.

As many boys are now at school, some households experience difficulties in securing stock herders. The hiring of unemployed refugees from Angola has offset this problem to an extent, but the problem of labour shortage is likely to increase in future. Herded cattle are usually registered under the name of one owner when presented for stock control purposes. This practise undoubtedly distorts figures for actual household numbers. Extension efforts by mainly the Directorate of Veterinary Services in the area are frequently ineffective because herdboys are sent to the stock control points and not the owners of the livestock.

Riverine community land tends to be overgrazed whereas large areas "inland" which offer potential grazing have very little cattle. An incentive does exist for owners of large herds of cattle to move away from the riverine areas. The Government has allocated farms in the area bordering the Mangetti to families in the Kwangali district, partly to reduce the pressure on the river area. Families with 100 to 300 animals qualify to move into farms. By 1992 there were 44 farms, each 5 000 ha, on communal land. This is likely to help the situation of overgrazing in the short run, but will not solve the problem of sustainable range management for the majority of small-scale farmers who will continue to graze their animals on communal land (Nolidep, 1996).

c) Land use rights

Grazing in the area follows the transhumance system, however, there is no other form of management for grazing. The Headman has the authority to control the grazing, while reality means everyone moves anywhere to find grazing from the wet season to the dry season. Grazing is protected from fire under local bylaws, which are usually ignored, while outsiders have to request permission to utilise grazing.

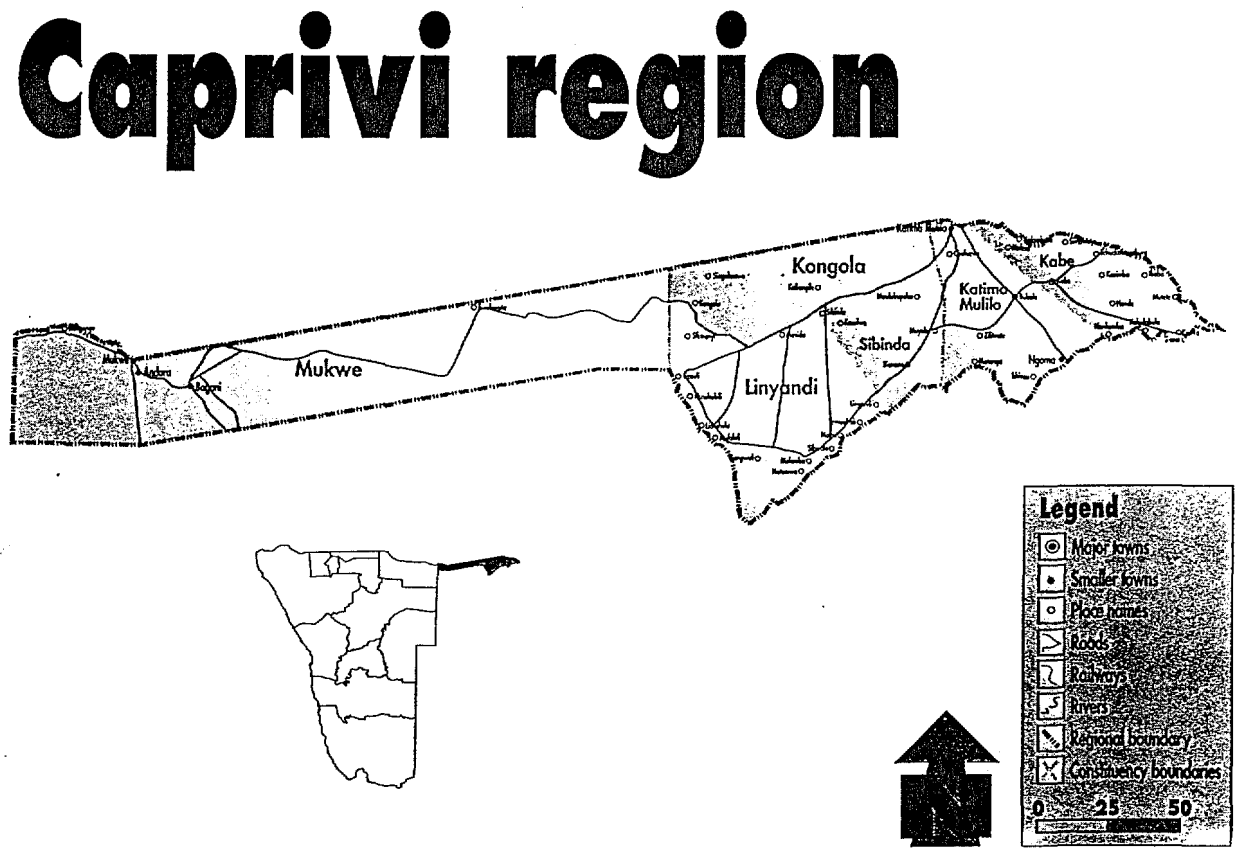
Woodland in this area is plentiful, while some trees are valued and protected for either fruit or timber purposes. The Headman controls the use or felling of these species. Bylaws prevent bush fires and protect specific species for their uses. Generally, the reciprocal rights of communities in this region allow each other to use all the natural resources. Bylaws and rules of each Headman will apply to everyone. However, if there is too much pressure from outsiders, community members may complain to the tribal authorities. The main threat could involve more livestock moving into the grazing areas of these communities from overcrowded zones near the rivers (Nolidep, 1996).

4.5.5 The (eastern) Caprivi.

4.5.5.1 Background

Caprivi is divided into two areas, separated by the Kwando river. West Caprivi is a narrow strip of land which borders Kavango to the west and covers an area of approximately 587 671 ha. It was declared a game reserve but is inhabited by some 10 000 bushmen and others, mainly from Angola (Adams et al., 1990).

Eastern Caprivi covers an area of 1 187 684 ha or 11 877 km². It stretches 215 km eastwards from the Kwando river, bordering Botswana and the Kwando-Lynyanti-Chobe river to the south, Zambia and the Zambezi river to the north and east and the Kavango (Area 2) and the Kwando river to the west. It is the wettest part of Namibia with an average annual rainfall of 650 mm. Seasonal flooding occurs in the lowlands along the rivers and cropping, not livestock keeping, is the predominant agricultural activity. **(Map 15).**



Map 15 : The location of the eastern Caprivi in Namibia.

The human population is estimated to be around 70 000 (NPC, 1992), but it should be noted that illegal immigrants from mainly Zambia possibly constitute a significant omission from the official figures. These figures exclude the western Caprivi. This area is unusual in that the high level of migration out of communal areas, as found in the rest of Namibia, is not repeated here. Its remoteness and the prevalence of English over Afrikaans as the lingua franca are two of the major reasons for this.

Katima Mulilo is the only urban centre in the Caprivi. The rest of the area is characterised by villages, the most important of which typically include a school and clinic. Of these villages, Bukalo and Linyanti are important as the seats of the Tribal Authorities of the Basubia and Mafwe tribes respectively. The Basubia, in the east of the region, live on land prone to flooding by the Zambezi. As a result they traditionally migrate to areas of higher land (or to dry land further west) with their cattle until the end of the rainy season. The Mafwe, however, tend to the needs of their cattle by moving into the interior of the region, away from the heavily grazed areas near the roads and rivers. The last 25 years have been a movement of population toward the road system which has been built up in the region, with the river systems maintaining their own status as areas of settlement.

Katima Mulilo has grown rapidly during the past 25 years. One feature of this movement to Katima Mulilo is the retention of residents' links to their land in the rural areas. It is not uncommon for wage earners to have two homes: one for use during the week and one where the family stays for use during weekends. This arrangement has contributed to the increase of especially maize marketing in the region, as the combination of wage income and farming generates a surplus (Nolidep, 1996).

4.5.5.2 Livestock.

The role of cattle in the economy, as in the rest of the northern communal areas, is very important. Cattle are owned individually but grazing land is communal. That is, cattle, irrespective of whether or not they are owned by subsistence or commercial farmers, are grazed where suitable grazing can be found. Cattle are preferred to goats in Caprivi and are used for beef production, milking, as draught animals, as an insurance against episodic crop failures and as a store of wealth.

Cattle are also used as "lobola" or "brideprice" and the consequent importance attached to fathers investing in cattle on behalf of their sons. Another use is as an insurance policy against crop failures when some cattle are sold in order to buy food. Men are the traditional custodians of cattle including their use in clearing and ploughing arable land. Women perform the rest of the work in the fields, so the subsistence agriculture is largely a female domain with marketing and the control of wealth a male responsibility.

Cattle rearing has also resulted in the Caprivian tradition of mafisa. This constitutes the loaning of cattle to people willing to take responsibly to migrate with them to areas of grazing. The use of milk and a percentage of the calves born during this period, as well as the opportunity to rent out the oxen for ploughing is regarded as payment for this.

In general around 70% of the households own cattle, although the variation can be large (Nolidep, 1996). The average number of cattle per household is 44, with the median number of cattle per household is 4. This skewed pattern of ownership would suggest that a small number of households own a relatively large number of cattle whilst most households have relatively small herds. **Table 11** indicates livestock numbers in the Eastern Caprivi from 1992-1995 (Nolidep, 1996).

Animal type	1992	1993	1994	1995
Cattle	95 794	103 635	94 825	122 827
Goats	2 510	5 497	4 139	7 148
Sheep	0	23	0	0

Table 11 : Livestock numbers in the eastern Caprivi from 1992-1995 (Nolidep, 1996).

Carrying capacities for the region were estimated in 1966 by the former Government to be around 6 ha/LSU, which means that the region has a capacity to house 192 231 LSU's (Niser, 1990). The effects of drought on the health and cattle numbers in the Caprivi appears to be less compared to other areas in Namibia. During a survey done in 1992, 5% of the cattle and 9% of the goats had died as a result of the drought in the eastern Caprivi (Naeraa et al., 1992).

4.5.5.3 Rangeland condition and use

a) Rangeland types

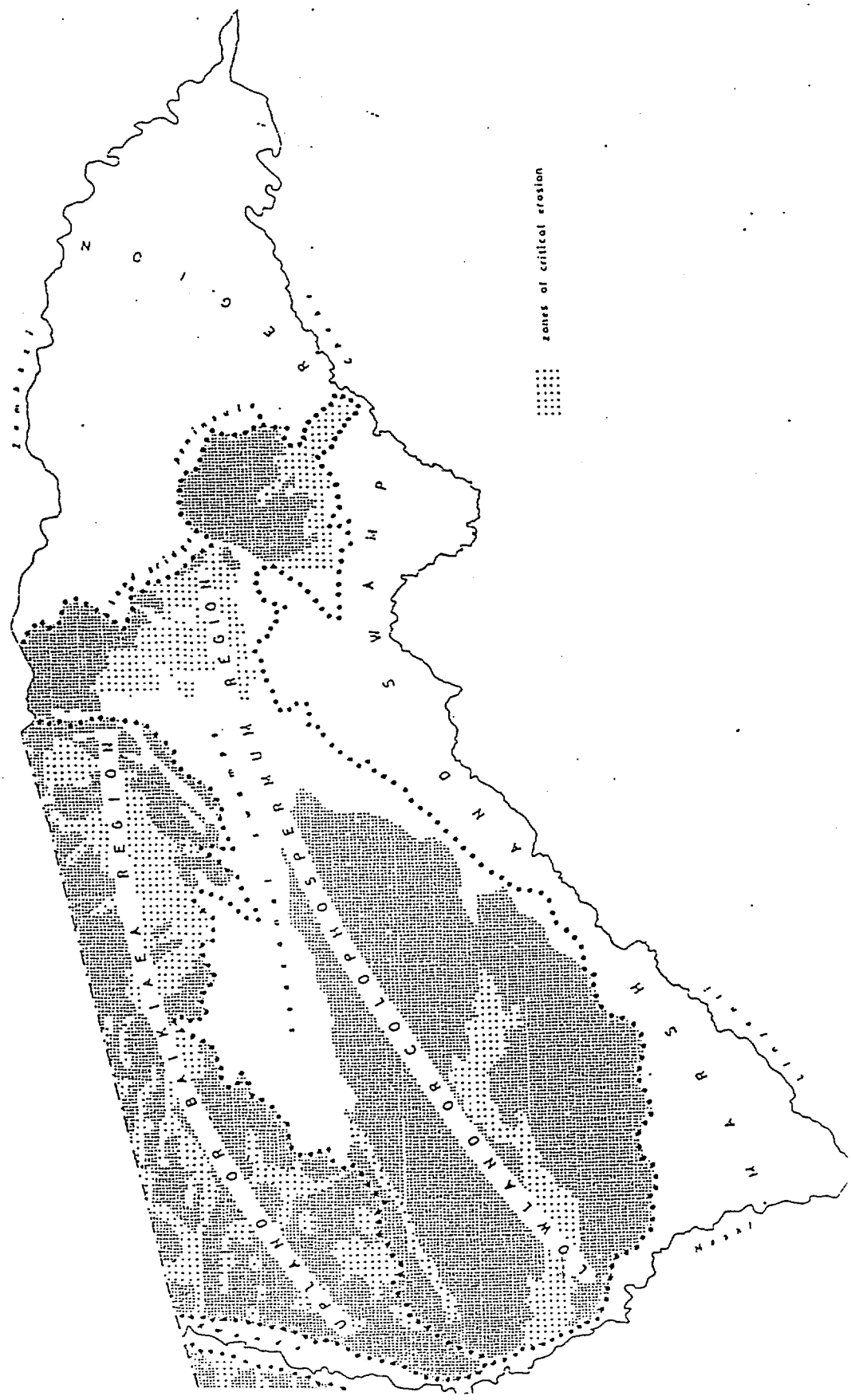
Caprivi's sub-humid climate dictates that it vegetation is characterised by forest savannah, woodland and floodplain zones near rivers. Most of the denser forest lies north of the Kongola-Katima highway, while inland grazing in open areas and woodland pastures is extensive. However, most of this grazing is inaccessible due to water limitations **(Map 16)**. In accordance with the order of topographical areas and soil zones, the following major units and types of vegetation may be distinguished:

1. Upland or Baikiaen region

The northwestern part of Eastern Caprivi, which comprises the Forest Reserve, is mainly dominated by *Baikiaea plurijuga* and a small composition of *Pterocarpus angolensis*. A cutline which runs from the east to the west also contains a dominant composition of *Terminalia sericea*. This cutline was cleared and established for military purposes by the South African Defence Force (SADF) in 1968 and to control vegetation, it was sprayed in 1972 with a chemical defoliant. As a pioneer species, *T. Sericea* came back four years later in 1976 and dominated the cutline. A possible explanation for this colonisation by *T. Sericea* are the heavy rains of 1968-1976 (over 1500 mm/annum) which may have leached the chemical down into the soil.

2. Lowland on Colophospermum region

The low lying areas of the south and southeastern parts of Eastern Caprivi are characterized by a wide distribution of *Colophospermum mopane*. Notably absent in these areas is *Baikiaea plurijuga*. The lower canopy of these forests is characterized by a substantial cover of a variety of grass species suitable for livestock grazing. *Phoenix reclinata* and *Piliostigma thonningii* are also characteristic of the riverine forest on islands and river banks particularly in the flood areas west and south of Eastern Caprivi.



Map 16 : Vegetation types in eastern Caprivi (Nolidep, 1996).

3. Transition zone between Upland and Lowland

The transition zone between upland and lowland sites is also characterized by several species such as *Combretum spp., Adansonia digitata, Parinari curatellifolia, Erythrophleum africanum, Pterocarpus angolensis,* and *Strychnos spp.* (Erkilla and Siiskonen 1992) suggested that *Acacia erioloba* and *Burkea africana* invade areas destroyed by fire, overgrazing or shifting cultivation and are thus indicators of soil erosion or disturbance.

Prevalent also in the upland and transition zones between upland and lowland forests are a number of fruit trees including *Ficus spp., Guibourtia coleosperma, Ricinodendron rautanenii, Diospyros batocana hiern* and *Berchemia discolor.*

4. Marsh and Swamp region

The complicated hydrology of the region, its geomorphology and the natural variability in the extent and duration of flooding of the Kwando and Zambezi Rivers, means that ephemeral wetlands studded with longer lasting pools form a significant proportion of the region's wetland types. Inundation time varies considerably depending on the height and duration of the flood and the distance from the rivers. Several years may pass before flood waters reach some areas. In normal years the floodplain is inundated 4 - 6 weeks (March to April) to a depth of one metre. Floodplain grasses such as Cynodon dactylon which survive inundation as rhizomes and shots, contribute large amounts of organic materials tot he system (Heeg and Breen, 1982). The flood waters recede into a maze of deeper channels and pools which last much longer. Here aquatic macrophytes such as Potamogeton spp. and sawweed, Najas Pectinata and their associated epiphyton (algae and bacteria growing on the leaves) are important primary producers.

Meanwhile, there are permanent swamps forming about 4 138 km² of East Caprivi of which approximately 1 190 km² is open water. The Linyanti swamp in the south west and Chobe marsh in the south are dominated by Phragmites and Cyperus reeds. Open pools and the reed fringes support typical floating-leaved or floating-stemmed aquatic plants such as water lilies and willow herb.

b) Rangeland use

Management of livestock follows the transhumance system for grazing from dry to wet season areas. In the dry season area overgrazing is taking place due to overstocking by either the inhabitants of the area or stock from neighbouring communities. Currently some communities are trying to halt the influx of cattle from other areas. The limitation of water forces everyone to converge on the same grazing zones. None of the livestock are fed supplementary feeds other than crop stalks used by livestock in situ after the harvests.

Management of land is focussed on cropland, while grazing revolves around the cropping season and the availability of water in the community. Farmers grow two harvests, firstly near rivers/mulapos where a crop is grown near the edge of the water while it is low in the winter. Later, the farmers move upwards to the upper lands for normal dryland cropping. There can be confrontation during the dry season, where animals have to be managed when they are moved to the rivers for water, where crops are often growing. Woodland is relatively plentiful in these communities, however, fruit trees and several timber trees are protected by the Headmen. Otherwise, no form of woodland management appears to ensue (Nolidep, 1996).

c) Land use rights

Rights to grazing are open to everyone in the community, while the reciprocal rights for outsiders requires permission from the Headman. However, it appears that many outsiders use mutual grazing areas. Grazing is often protected by bylaws from burning or ploughing, while outsiders are compelled to ask for permission from the Headman.

Cropland allocation is a serious matter governed by the Headman. If land is not utilised properly, it can be recalled by a senior member of the family or reclaimed by the Headman. Again, outsiders have a right to apply for land in other communities. The allocation of cropland is an official bylaw for the community and outsiders.

Woodland is available to all, while permission is made to the Headman for permits to fell some trees before permits are issued by the Directorate of Forestry. Both fruit tree harvesting and collection of firewood are open rights for all, though mainly women are involved with these duties. Bylaws protect the fruit trees and timber trees, while it is also a bylaw for some communities, that the entire population assists with the extinction of bush fires.

4.6 Bushmanland

4.6.1 Orientation

Bushmanland has been established as a "reserve" for the people referred to as the "Bushmen", one of the few groups of people in the world who, until recently, still depended mainly on hunting and collecting of wild foodstuffs for survival. However, Bushmanland is only a small fraction of land previously used by one of the Bushmen cultural and linguistic groups. Three major Bushmen groups live in Namibia, others in neighbouring countries. **(Map 17).**

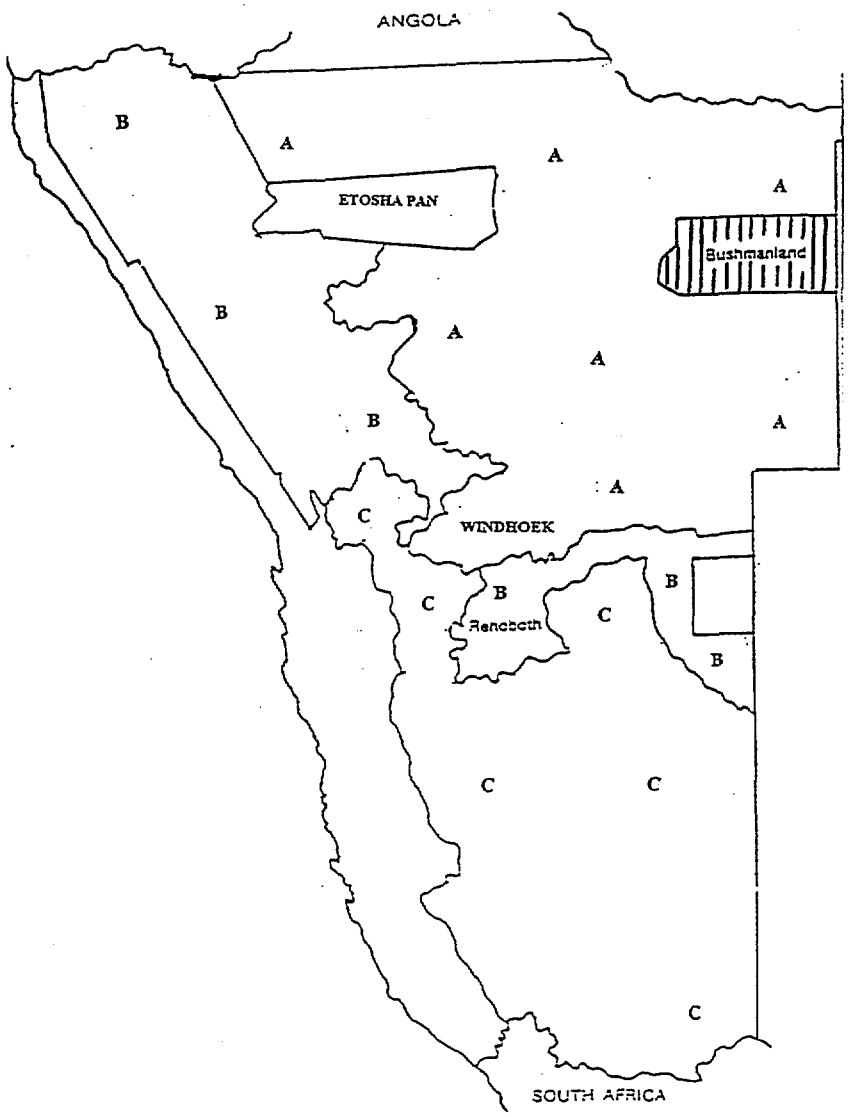
In total, 33 000 Bushmen were living in Namibia at the time of the 1991 census. Of these, 1 200 lived in municipalities, 8 000 lived in communal areas of other Namibian groups and 15 000 lived on commercial farms as labourers. The remaining 7 000 - 8 000 people occupied the Nyae Nyae area of about 50 000 km² stretching from Kavango in the north to the Eiseb valley in the south. Here, there are some permanent waterholes and it was still possible to follow a hunting/gathering mode of existence, although this sometimes had to be supplemented by wage labour. Living on hunting/gathering is only sustainable at low population densities.

In the recent past, some 2 000 Bushmen have been living in western Bushmanland, mainly around army bases. According to Adams et al. (1990) "this is area unsuitable for agriculture and comprises waterless sand sea where bush food and game are scarce and gifblaar (a plant poisonous to cattle) is endemic". Apparently, the watertable in western Bushmanland is 300 - 1 000 m underneath the surface. Prior to the departure of the South African Defence Force (SADF), about half of the Bushman population depended on rations and salaries from the SADF, about 25% lived in rural slums in Tsumkwe and another 25% survived on subsistence farming in the eastern Bushmanland.

According to a livestock census in June 1990, there were 1 398 cattle, 138 sheep, 341 goats, 63 horses and 82 donkeys in Bushmanland. This represents 1 582 LSU's or about 0.75 LSU's per person. It is not clear whether the livestock on the governmental farm near Tsumkwe are included (GTZ, 1991).

4.6.2. Possibilities

Efforts to create a subsistence base for the Bushman population are required. On the grass-roots level, this can be done only within the framework of small projects which build on an intensive dialogue with the target group. These projects should not be confined to the "Bushmanland" area alone, but should also include Bushman groups in other areas. Respective initiatives have already been started by e.g. the "Bushman Development Foundation" and the "Institute for Community Development" (GTZ, 1991).

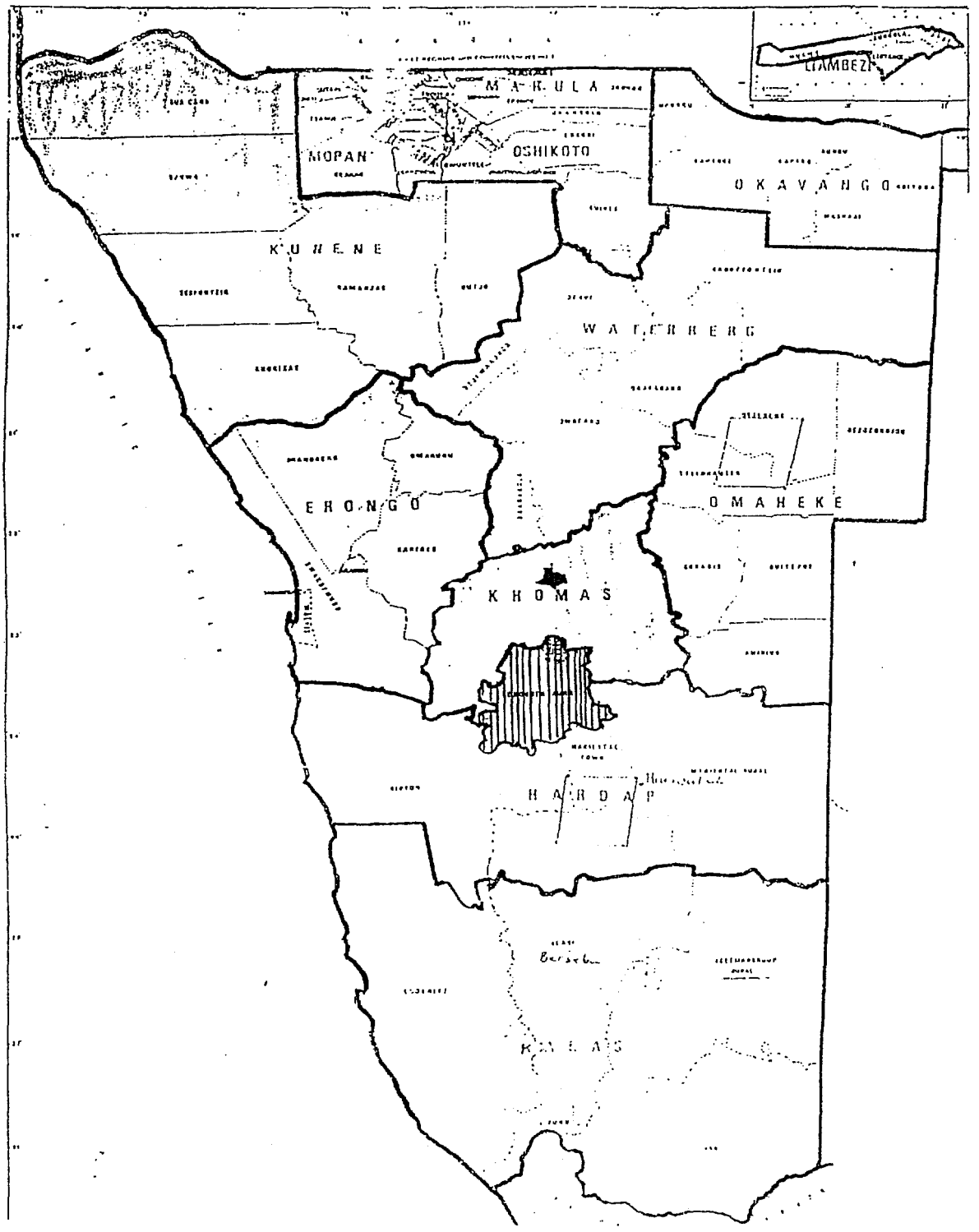


Map 17 : Location of Bushmanland in Namibia

4.7 Rehoboth

4.7.1 Orientation

Rehoboth covers an area of 14 182 square kilometres and has a population of about 35 000 persons, which are about 0,4 km² per person(GTZ, 1991). There are some 2 980 surveyed farms, of which some 52% have a registered size exceeding 1 000 ha (IFAD, 1995). The largest part (95%) of Rehoboth consists of demarcated farm units and the farmers have freehold titles **(Map 18)**.



Map 18 : The location of Rehoboth Area in Namibia.

Rehoboth has a unique history insofar as it was already settled by "bastard-farmers" from South Africa in the 1830's. It was an independent republic for several decades and was able to retain a higher degree of autonomy during the German and South African colonial times than other CA's. Land rights are predominantly private, with only the land around Rehoboth town. These lands are owned by Government and are occupied by or leased to farmers who own no land or whose holdings are too small to provide adequate income (Adams et al., 1990).

The exact Rehoboth area is difficult to determine. Adams et al. (1990) state that the Rehoboth Government purchased tracks of land adjacent to the Rehoboth area, including 12 farms with a total of some 93 500 ha. In 1987/88 a number of 30 government owned farms with a total area of 95 728 ha were rented out to 147 farmers and it is not sure whether these areas fall inside or outside the official geographical boundaries of the Rehoboth Gebiet.

Initially, the farms were comparable in size to the commercial farms in the adjacent areas, but have been subdivided through inheritance. The official minimum size for economic viability (economic farming unit) varies from 3 000 ha to 7 500 ha, depending on the region. Subdivision of farms is now prohibited, and attempts are being made to consolidate farms into bigger units. However, still today, the vast majority of farms are too small to support their dependants. Adams et al. (1990) state that 94% of farms are smaller than "economic" size and 85% of the stock farmers have to supplement their income from wage labour or pensions. Schimming (1988) found that the average age of farmers was over 50 years, a fact which may indicate that farming is a retirement occupation for some people. Schimming (1988) also found that most Karakul farmers had very little knowledge about pelt quality, selection criteria, etc. This suggests that the highly specialised Karakul farming remained alien to the majority of farmers.

The 2 980 demarcated farms cover an area of 1 223 018 ha, the remainder being public and open-access land (Adams et al., 1990), which is extremely exploited by some people. For example, Schimming (1988) recalls a farmer who had a private farm of less than 100 ha but kept more than 500 SSU's, presumably also on open-access land. Official carrying capacity is recommended to be 2 ha/SSU in the north-east and declines to 5 ha/SSU in the south-west. Small stock predominate, but Karakul farming, which was the most important activity in the past (Schimming, 1988), almost collapsed in the 1980's on account of low prices and the insufficient extension and educational support for this highly specialised enterprise. Indications are that the Karakul Industry is recovering with a good increase in recent pelt prices overseas.

Average annual rainfall ranges between 150 mm and 350 mm, with a variability of 35% - 40%, increasing from the south-west to the north-east.

The livestock population in Rehoboth consists of about 38 500 cattle, 65 000 sheep, 120 000 goats, 3 000 horses and 3 500 donkeys (DVS, 1990), giving a total of about 445 000 SSU's. This will mean a stocking rate of about 3,2 ha/SSU. If only the demarcated farms are used in the calculation, the stocking rate would be 2,7 ha/SSU. Compared with the official average carrying capacity of about 3 ha/SSU, this stocking rate could not be called excessive. However, unequal distribution of farm size and a tendency of smaller farmers to exceed the CC leads to overgrazing in some areas. According to IFAD (1995), the December 1994 stock census for Rehoboth (DVS, 1994) the area had 35 000 cattle, 49 000 sheep, 124 000 goats, 3 000 horses and 3 9000 donkeys. This is equivalent to 270 000 SSU's and indicates a mean stocking rate of 5,2 ha/SSU.

Even though there is some surface water, an estimated 90% of rural water supply comes from boreholes. As in other CA's, the water supply system on farms is equipped with little back-up (one borehole per farm with only one means of extracting water).

In the proximity of Windhoek, the Agra auctions provide relatively good marketing possibilities .

Special problems arise from the high intrinsic value of land ownership and livestock farming. The farming enterprise is probably highly subsidised by off-farm income. This is common for farming communities in transition and often also a generation problem. The first generation may carry on with part-time farming but, for the second or third generation, the

combination of farming and wage employment becomes rather tedious and land is often hired out or sold if employment opportunities are good, particularly if employment is found in the bigger centres.

The most appropriate way of taking pressure off the land would be to create jobs in off-farm sectors. Assuming a minimum farm size of 5 000 ha for economic viability, the Rehoboth area could support about 300 farms. A recent inception report of the International Fund for Agricultural Development (IFAD) investigating the possibilities of development aid to the southern communal areas (1995), suggests that a flock size which is considered the lower ceiling for an economically viable unit, is 250 SSU, which would require a holding size of at least 750 ha to make livestock operations sustainable. This is totally in contrast to the findings of Adams et al. (1990). In the latter case, most of the present part-time farmers would have to give up stock farming (GTZ, 1992).

5. MAJOR THREATS TO NAMIBIA'S RANGELAND RESOURCES

The major threat to Namibia's rangeland resources (both in commercial and communal areas) can best be summarised by the phenomenon called "Desertification".

According to the International Convention to Combat Desertification (ICD), adopted in October 1994, desertification means land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities. Land degradation means reduction or loss, in arid, semi-arid and dry sub-humid areas, of the biological or economic productivity and complexity of rainfed croplands, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as:

- soil erosion caused by wind and/or water;
- deterioration of the physical, chemical and biological economic properties of the soil; and
- long-term loss of natural vegetation.

It is therefore clear that rangeland degradation in Namibia is very well covered under the term "desertification".

6. MAJOR CAUSES OF RANGELAND DEGRADATION IN NAMIBIA

The core problem causing rangeland degradation in Namibia is the fact that **rangeland in both commercial and communal areas is not managed properly (Fig. 8)**. This can be caused by several factors:

6.1 Overgrazing

Overgrazing, although linked to overstocking, causes a lot of confusion amongst many people. Overgrazing is caused where animals are concentrated in one specific area for too long resulting in over utilisation of the vegetation without providing adequate time for the rangeland to recover in terms of seed production, restoring the vigour of individual plants and the accumulation of enough material for future utilisation. This again results into a loss of ground cover, loss of species diversity, loss of vigour and the ability of plants to tolerate heavy grazing and droughts and subsequently it leads to bare ground and soil erosion.

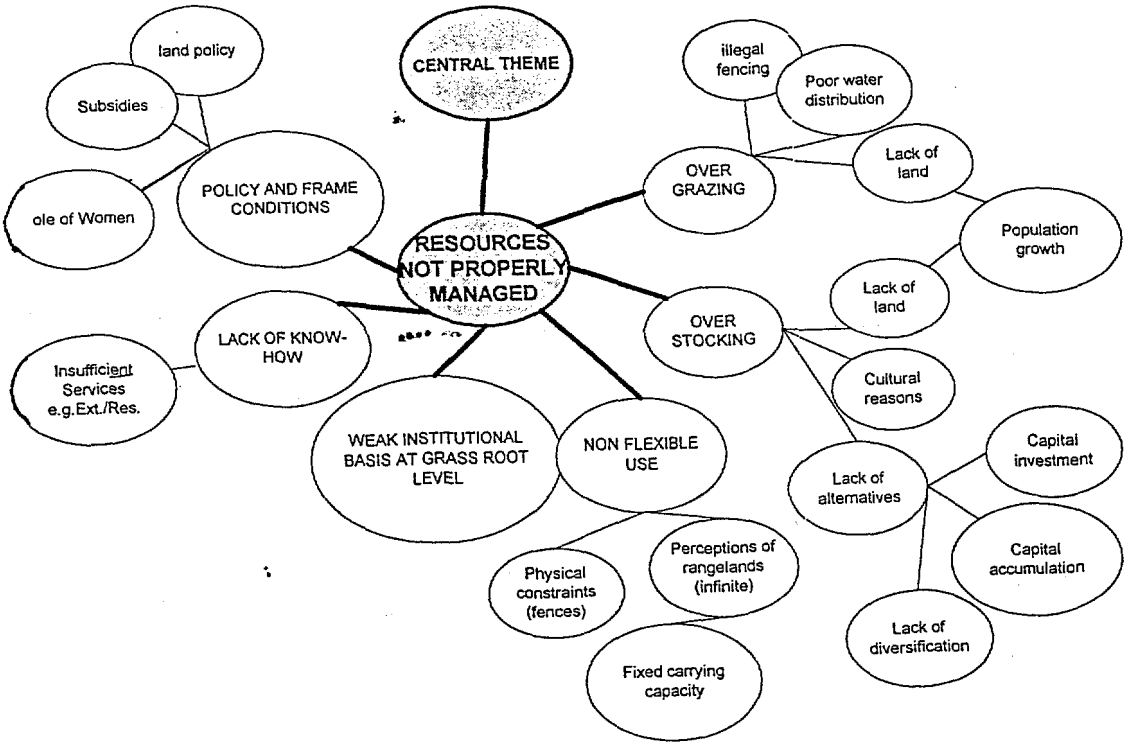


Fig. 8 : A mind map indicating the major causes of rangeland degradation in Namibia (Kruger, 1996).

One major cause of overgrazing is the **poor water distribution** in some of the communal rangelands in Namibia. The phenomenon of **"where there is water, there is no grazing; where there is grazing, there is no water"** so commonly expressed by communal pastoralists is a very good example. The concentration of livestock around the more permanent waterpoints in the north (e.g. the Zambezi and Okavango rivers; boreholes in the Omurambas of the eastern communal areas; etc.) illustrates this point more clearly. Water quality (salty water in parts of the east and north) can also be a major reason making it very difficult for pastoralists to move animals to other areas.

Although pastoralists might still have know-how on traditional ways of rangeland management (nomadic movements), it can be accepted that the younger generations **lack technical know-how** on practices and principles of sustainable rangeland management.

In some areas (especially the North Central regions) the **concentration of people**, and thus livestock, is just too high. Even with the provision of more and better distributed waterpoints (e.g. the pipelines south of Ondangwa), the possibilities of finding a way to move animals remains a big challenge. Apart from the fact that too many people might have been forced into too small areas and thus restricting their flexibility, the issue of a **high population growth rate** in especially the communal areas should be addressed.

6.2 Overstocking

Overstocking is the phenomenon where more animals are kept on a certain piece of land than the fodder that is available to feed those animals at any point in time. Although perceived by many people as the major problem causing rangeland degradation in Namibia, empirical evidence is just not available to prove it at this point in time. Except the North Central regions, overstocking is not a problem in all the other communal farming areas of Namibia, but it is rather a problem of a too high concentration of animals at certain points, as discussed in the previous section.

Rainfall variation, and thus the availability of fodder, is very high in both time and space. This means that grazing capacities vary greatly from year to year and from place to place. Hence

stocking rates might be too high for certain places in certain years, and too low for those places in other years. The challenge is therefore not to destock the Namibian rangeland to recommended average carrying capacities, but to find ways and means how farmers can adapt fast and efficiently to changing fodder regimes.

The **lack of land** or too many people having livestock in a certain area, can be a cause of overstocking. As indicated in the previous section, this is directly related to the number of people living off livestock in the communal areas which is again, directly related to the alarmingly high population growth rates.

Due to the important social and **cultural role livestock** play in all the communal areas of Namibia, the issue of overstocking will be very difficult to address. Livestock is the only source of livelihood for many rural Namibians and sustain people in many ways. The perception of "wealth" and "status" connected to owning livestock and the social and cultural use of livestock should never be neglected. The strategy of maximising livestock numbers to minimise risks, is a common strategy amongst African pastoralists and is also present in Namibia.

The commercial orientation of maximising output and income by farming with fewer animals of higher quality and production abilities, is uncommon to many Namibian subsistence farmers in the communal areas. Reasons for keeping livestock differ very much between commercial farmers and the majority of communal livestock owners.

The **lack of alternatives for capital accumulation** and **capital investment** in the rural areas of Namibia is seen as a major cause of having too many animals. Cash obtained from selling animals can not easily be invested into other enterprises, due to a lack of alternatives for investment. Saving possibilities are also very limited in most of the areas. Commercial banks don't have adequate banking facilities available to farmers on a regular basis, which leave farmers with little options than to re-invest their money in livestock, putting an extra burden on the rangelands.

The **lack of diversification** within and outside livestock production is also seen as a major reason for reduced incomes from livestock and thus the tendency to keep more livestock. Diversification in terms of adding value to livestock products (tannery, shoes, Cheese, etc.) as well as using a wider range of adapted animals (small stock, camels, game, karakul, ostriches, etc.) will have to be investigated.

The **lack of alternative income generating activities** outside the livestock sector in the communal areas will further contribute towards putting a higher emphasis on livestock alone to provide for a decent livelihood. This serves as a further impetus for keeping higher livestock numbers.

6.3 Non - flexible use of rangelands

The rainfall, and therefore the availability of fodder, in Namibia is highly variable in terms of time and space. This dictated in the past a highly flexible strategy of using the rangelands. Pastoralists used to be much more flexible in moving animals to areas where sufficient rain has fallen and where enough fodder is available.

Sedentarisation is a reality in most of the communal areas of the country, and there is no way for the farmers to return to the more nomadic lifestyles of the past. Fences (International, commercial farms, game parks, illegal fencing, etc.) prevent farmers from moving with their animals freely in search of fodder.

Perceptions that the rangeland as a natural resource is infinite and that everything will be back to normal once the good rains have fallen, are still common amongst farmers in both communal and commercial areas. The perception about so-called recommended carrying capacity norms for certain areas based on average rainfall and other characteristics, further contributes towards an over-optimism about the potential of the rangelands. The fact that equilibrium oriented (fixed stocking

rates, succession theories, etc.) solutions are recommended for non-equilibrium environments needs to be addressed urgently in order to improve the flexibility of range management practices.

6.4 Weak institutional basis on "grass- roots" level

Sustainable natural resource management can only be implemented by the users of such resources. In the case of sustainable rangeland management, the livestock farmers are the implementers and should therefore be enabled to do so. In the past community structures were strong and very well established and access to and management of rangeland was done properly. Most of these structures were replaced during almost a century of colonialisation by centralised decision making, dislocation of many farmers to new areas and hence resulted in poor organisational and self-help capabilities of rural communities. People were made dependent on outside support, mainly from government, for services and goods. Even six years after independence rural communities in the communal areas struggle to help themselves, to know what they want, to know where they want to go (visions) and to know how to get there.

Traditional leadership was responsible for allocation of land and land management in the past. Currently the role of traditional leaders is not so clear any more regarding this function, and the newly established regional authorities still lack the capacity and means to perform such functions.

6.5 Lack of technical know-how and services

Older people might still have a lot of know-how and experience on nomadic movements of animals and traditional practises of livestock production. It is however doubtful whether the transfer of this know-how to the younger generations will happen. Even then this "indigenous" knowledge might not be fully adequate any longer to enhance sustainable rangeland management and improved livestock production.

Services like extension, research and training were in the past mostly oriented towards the needs of the commercial farmers, neglecting the communal livestock producers. Extension officers also lack adequate know-how and experience in livestock production and rangeland management, especially as far as communal farming is concerned. Research was mainly commercially and on-station oriented with very limited direct benefit to the communal farmers.

Other services like veterinary service, marketing, credit, etc., have a commercial orientation, too. Even today, the access of communal farmers to these services is limited.

6.6 Unconducive frame conditions

Natural resource management in general and sustainable rangeland utilisation in particular, is not possible without political, social, economic and climatic frame conditions conducive to it.

The most important frame condition still lacking and preventing sustainable rangeland management, especially in the communal areas of Namibia, is the absence of the Agricultural (Communal) Land Reform Bill. This bill is supposed to address very important issues like land tenure, land taxes, the Regional Land Boards, land-use, ownership over land, role of traditional authorities in land allocation and land management, and many more relevant aspects. It is unclear when this Bill will be promulgated and come into effect.

The Agricultural (Commercial) Land Reform Act has been promulgated, providing the state with the necessary legal powers to acquire commercial farm land for the purposes of resettlement of historically disadvantaged people. Currently, only Part 1, - establishing the Land Reform Advisory Commission - is in force. Uncertainty amongst mostly commercial farmers regarding the implementation of the Act, might create a climate where commercial farmers are trying to get as much as possible out of the farms they have and thus, contributing towards the process of land degradation.

The National Agricultural Policy (NAP) has been approved by Parliament following a process of participatory consultation and provide valuable guidance towards the development of strategies to implement sustainable rangeland management practices. A "weakness" of this policy might be the emphasis put on national food self sufficiency rather than on national food security. Due to a lack in natural resources, especially for the production of crops, it might be impossible to pursue national food self sufficiency as a national objective.

Subsidies to livestock production encourage farmers to keep more livestock than they would keep if they had to pay the full costs of inputs. Therefore, with limited land available, subsidies promote overgrazing and overstocking. In addition to legitimate "enabling environment" activities like extension, research, and marketing, livestock husbandry in communal areas is subsidised through:

- veterinary services (not full-cost recovery).
- quarantine provision (fees are about to be introduced, but not full cost-recovery).
- some effective price support (e.g. Meatco price support to communal farmers in the north)
- income tax waived
- no land rental fee
- free water provision (also about to be changed)

The 1995/96 Drought Aid Scheme provided fodder, transport and grazing subsidies to both commercial and communal farmers at a cost of N$ 99 million. The scheme did not require farmers to destock in order to receive assistance (the requirement for commercial farmers to destock to 60% of approved carrying capacity presented problems for very few farmers, because they use old and outdated carrying capacity norms). Since subsidies were available throughout the drought period for up to 100 LSU's or 500 SSU's (for fodder), there was an incentive to keep up to this number of animals. Farmers were not entitled to receive subsidy if there was still grazing available, and this has the perverse effect of discouraging good range management.

7. THE EFFECTS OF DESERTIFICATION AND RANGELAND DEGRADATION

Desertification has many manifestations in Namibia. The most prominent and important ones are (Fig. 9):

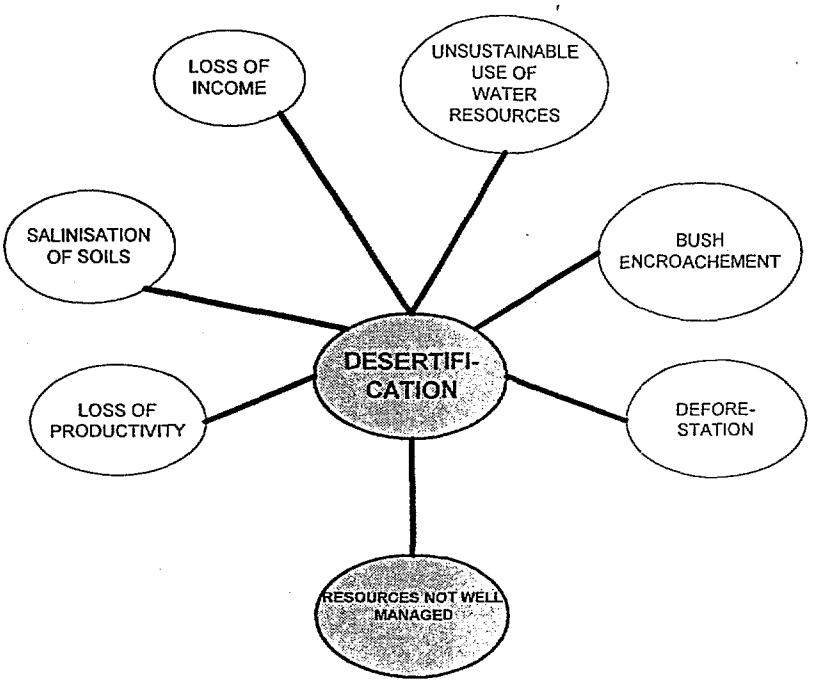


Fig. 9 : Mind map indicating the major effects of land degradation in Namibia (Kruger, 1996)

7.1 Loss of productivity of the rangelands

Farming units are no longer able to sustain enough livestock numbers to ensure a decent livelihood. This is a statement made very often especially by commercial farmers. A farming unit big enough to sustain at least 400 LSU's or 2 000 SSU's is considered an economic unit. According to this criterium, about 38% of all commercial farms in Namibia are economically not viable any more. The reason can be fully attributed to unsustainable rangeland management practises and other indirect causes, as described in the previous section.

7.2 Bush encroachment.

Bush encroachment is largely the result of unsustainable rangeland management practises of the past. Aspects like overgrazing, reducing the competition ability of grasses for available soil moisture, the absence of fire as management tool, the reduction in the use of browsers (goats and game), etc., might have contributed to the thickening of bushes.

Although the problem is more acute in the commercial farming areas of central and northern Namibia, it can be detrimental not to recognise it also in the communal areas of the country. The southern areas are in the process of being encroached with *Rhigozum trichotomum* ("driedoring") which can cause huge problems to livestock production. Bush encroachment has contributed largely to the loss in productivity of the rangelands and thus to farming units becoming less economical viable.

7.3 Deforestation

Huge concentrations of people in permanent settlements in mainly the north central communal areas of Namibia has caused deforestation to a large extent. Trees are used for fuel, construction material, food, etc. and the loss of this very important component of the ecosystem will undoubtedly lead to further impoverishment of rural communities. This topic goes beyond the real scope of this document, and will therefore not be given further attention.

7.4 Unsustainable use of water resources.

Namibia's water resources are the most important natural resource and in many cases the most limiting factor restricting development. Most of Namibia's freshwater, both surface and underground, is used to the point of depletion in most areas. This excludes localised water extraction from the large border rivers.

7.5 Salinisation of cultivated land.

A combination of high evaporation rates, poor water quality, and soils that are either highly mineralised or very low in minerals, makes the risk of salinisation of irrigated land very high. The effect of salinisation is highly damaging. It might seem that the overall impact of salinisation is low due to small areas involved, but the effect should not be underestimated.

8. RECOMMENDATIONS FOR SUSTAINABLE RANGELAND MANAGEMENT AND IMPROVED LIVESTOCK PRODUCTION IN NAMIBIA.

8.1 Introduction

In order to be a in a position to reach the objectives of sustainable rangeland management, to reduce man-induced land degradation practises and to improve the welfare of the rural population, it is necessary to identify and implement a strategy that will take into consideration many more elements than only pure agricultural ones. The elements of such a strategy may include:

- sustainable improvement of livestock production.
- resettlement of large communal farmers to title deed areas.
- improved marketing.
- alternative income generating activities.
- frame conditions
- alternatives for capital accumulation.
- local investment packages.
- institution building.

8.2. Sustainable improvement of livestock production

Grass production and thus forage availability can vary from about zero to several tonnes per hectare in two subsequent years in arid and semi-arid areas. Another phenomenon is that certain patches might have good production and are quite stable from year to year, but other patches in the same area are much more unstable and yield much lower production per hectare. The process by which animals and their feed demands are matched with available fodder sources is called tracking. Effective tracking may be achieved in four ways:

- Increasing locally available fodder by importing feed from elsewhere or by enhancing fodder production, especially drought feed, through investment in key resource sites.

- Moving animals to areas where fodder is available.

- Reducing animal feed intake during drought through shifts in watering regimes, reducing parasite loads or breeding for animals with low basal metabolic rates.

- Destocking animals through sales during drought and restocking when fodder is available after the drought.

The challenge for researchers, extension officers and pastoralists is therefore not to transform pastoral systems into ranching systems, but to increase the efficiency of tracking under conditions of restricted flexibility in especially the communal areas of Namibia. It is common knowledge that pastoralists used to be more flexible in animal movement in order to find enough fodder for their herds. Conditions like National borders, Wildlife conservation areas, commercial farms and even the new phenomenon of so-called "defensive fencing" in the communal areas, make it more and more difficult for pastoralists to be flexible in their efforts to match animal feed demands with available fodder production. Hence the solution for Namibia (commercial/communal) will be a combination of elements from both the ranching model and a more flexible open system of rangeland management.

Against the background of the fact that farmers find it more and more difficult to move around with their animals in search of fodder, the emphasis should however be to improve the rangeland management and livestock production in the very area the community is residing most of the time. In emergencies i.e. during periods of excessive food scarcity, moving of animals to other areas, should be considered as a possible option by the farmers (Kruger, 1995).

8.2.1 Rotational resting under normal and good rainfall years

Strategies will have to be worked out whereby maximum benefit can be achieved as far as range rehabilitation is concerned during years of average or above average rainfall. When these years occur, it will be very much beneficial to the range to recover in terms of seed production and restoring the carbohydrate reserves of individual plants to tolerate heavy utilisation and drought periods. The only way this can be achieved will be to introduce rotational resting practices. With proper infrastructure like camps and adequate water distribution on a title deed farm owned by one person, it has proofed to be very efficient

to allocate certain camps to certain livestock herds and to rotate between the different camps.

The challenge is however, to allocate certain areas within an unfenced communally utilised grazing area for utilisation by certain livestock herds during certain times of the year. Issues making it very difficult or preventing it from happening at this stage, are poor water distribution, free roaming of livestock in all directions from a central waterpoint, lack of participation and willingness amongst farmers to co-operate in grouping livestock herds together and identifying certain areas to be rested in order to allow for recovery during the rainy season. However, one of the most serious reasons preventing farmers from taking active responsibility of the natural resources is the lack of ownership or at least some kind of exclusive user rights of a community over a piece of grazing. This prevents farmers from deciding how best to utilise "their" area and whether they would like to allow others coming into the area or not. It is the responsibility of the community to identify and demarcate (=not necessarily fence) their traditional grazing areas during normal years as well as during periods of feed scarcities. Within these demarcated areas, an inventory of available infrastructure like fences, waterpoints, roads, etc. need to be done as a next step. Information regarding the vegetation such as rangeland condition, different veld types and current grazing capacity need to be collected.

On the basis of this information and in collaboration with the local farmers, a zoning of the area should be made in order to divide the area into possible grazing zones that don't have to be fenced off, but should only be identified and made known to all the farmers in that area. For this purpose either "life fences" or existing boundaries like dry river beds, mountain ranges, roads, etc. could be used. On the basis of mutual consent and backstopping from professionals, some areas need to be rested while animals are grouped together and allocated to graze only in other areas at certain times of the year. Grouping together does not necessarily mean that one herd is formed, but that several livestock owners agree to send their individual herds jointly to one grazing area.

8.2.2 Strategies of livestock movement

Taking into account the huge variation in rainfall in arid and semi-arid areas of southern Africa (Co-efficient of variation exceeding 33%) (Ellis, 1994), it should be kept in mind that the availability of fodder for animal consumption is closely correlated to it. This will result in occasional fodder deficiencies despite proper range management systems being implemented. Examples of such fodder deficiencies related to low rainfall are currently evident in the eastern areas of Namibia and even some of the commercial farmers in that area are forced to find alternative fodder for their animals elsewhere. This led to several commercial farmers being forced to find fodder in the western regions of Namibia which received very good rains during 1995. It is also known that several hundred livestock from the eastern communal areas (Okakarara) had to move to areas in the Erongo region in search for fodder.

This occasional movement of animals in search for patches or areas where better grazing is available, should not be seen as an abnormal activity related to poor range management, but should be seen as a normal phenomenon and an integral part of livestock farming in highly dynamic environments. The movement of animals in response to spatial and temporal variation in resource availability is perhaps the most classic of all tracking strategies (Swallow, 1994).

The challenge is to find ways and means how such movement of animals can be organised and institutionalised in order to allow the communal farmer to benefit most. One way might be to support local community based organisations (CBO's) like the community management community in the SARDEP programme, to develop and operate an information network regarding the availability of fodder in a larger area e.g. a constituency or even in another

region. Through this network the CBO can collect information on rainfall patterns, availability of fodder, where it is and at what price, for how many livestock and for how long it will be available. This information can then be made available on a regular basis at a central point in order to inform other communities about it. Pre-requisites needed in order for this network to be operational, will include the willingness and capacity of local CBO's to perform this duty against a commission; proper professional backstopping from research and extension to prevent over exploitation of certain areas as well as the right of local communities to use income derived from renting out their areas for own development purposes. Proper supportive services like veterinary permits, trekking routes and, if distances are very far, even support in transportation of animals should be considered very important.

8.2.3 The use of well adapted indigenous livestock together with improved animal husbandry practises

By farming with well adapted indigenous zebu type livestock, mortality rates can be considerably reduced during droughts and even recovery rates can be increased dramatically after droughts. Indigenous zebu cattle have energy sparing mechanisms that act as an adaptation to under nutrition and water deprivation (Finch & King, 1979; King, 1983; Nicholson, 1987). Trials showed that increasing the walking distance and decreasing the watering frequency, as might happen in a period of drought, did not result in any significant loss of weight in African zebu (Finch & King, 1979).

Results of work done with Borana cattle in Ethiopia showed that reduction in milk supply to the calf (through droughts or human consumption) did not affect the longer term target weight of calves, despite reducing calf growth rates in the short term (Coppock, 1992). Recovery following the drought is equally rapid. When food is available again there is a rapid response in metabolic rate levels and, with increase in nutrition levels, conception rates greatly increased amongst mature female zebus.

It is thus very clear that indigenous animals are physiologically adapted to mobile and flexible responses to uncertain fodder and water availability. Due to reductions in fasting metabolism, more animals can be sustained on a given amount of available fodder during periods of drought than would be possible if there was no physiological tracking of the environment. Forage needs during droughts can be reduced with as much as 30 % through shifts in metabolic rates (Scoones, 1994).

Healthy animals are best able to track environmental fluctuations. Animals with high parasite loads are less resilient to stress. Veterinary interventions and support in general and specifically during drought periods are seen to be of utmost importance in order to increase the tracking ability of herds. These support efforts and interventions should be complemented by indigenous knowledge of veterinary care.

The introduction of animal husbandry practises like early weaning of sucklings and mating seasons that will allow young to be born during times of sufficient grazing, should get very high priority amongst livestock managers, farmers and researchers. It is well known that the springtime (August to November) is the time of the year in Namibia when there is lowest fodder availability. It is very common to find female animals with big calves/lambs still sucking during this period which put an extra stress on these animals usually already in a poor condition.

8.2.4 Feed supplementation to rangelands

A common problem with research in fodder crops is that researchers tried to provide equilibrium solutions to highly variable non-equilibrium environments. Reseeding with legumes or planting of fodder trees appeared to provide some promise of boosting

productivity in more humid agro-ecosystems, but such technologies have rarely proved viable in drier situations, especially when repeated droughts or intense grazing wiped out vulnerable grass and legume species or killed trees (Bayer & Waters-Bayer, 1994).

The identification of strategic "key resources" that sustain animals in times of fodder shortage, should be done on the basis of studying how livestock herds use fodder landscapes during periods of droughts. These areas usually have a more stable production of fodder due to specific characteristics like better soils, more soil nutrients and higher moisture contents. These "key resources" should be the focus for fodder improvement. The introduction of fodder species that are well adapted to that environment and severe grazing, reseeding by using seeds of species already existing in those areas and by introducing proper fodder management practises to enhance livestock production in normal years and survival feeding in bad years (Barton, 1993) are recommended. Strategic movement of animals to such sites should be considered.

Simple practises like cutting grass in road reserves and specifically cleared areas during years of normal rainfall, should also be considered. Other possibilities are the reeds in the Fish River Canyon and even garden residues. This fodder can easily be stored for several years and can be used during periods of food scarcity. This fodder is usually very handy to feed sick animals, breeding stock outside the mating season and even fattening of livestock before marketing, or any other purpose.

Depending on the livestock species, browse may also act as an important key resource. The availability of coppiced trees and shrubs in dryland areas is often critical to the nutrition of livestock in times of drought. Tree pods in particular may be an important protein supplement that increase appetite and ensure maintenance of animals during periods of stress (Coppock & Reed, 1992; Oba, 1993). It is important not to see all trees and shrubs, especially in the savannah areas, as part of the "bush encroachment" problem, but rather to try and adapt the livestock breeds to the available browse fodder sources. Scientists in Namibia however, are also aware of the limitations in this regard.

The enhancement of agro-pastoral linkages and the promotion of integrated mixed farming systems are seen as another way of reducing fodder variability in dynamic environments. Despite the fact that the majority of pastoral areas, especially in the central, eastern, western and southern areas of Namibia, are not very much suited for any kind of crop production, doubts also exist whether such mixed farming systems will significantly contribute towards reducing risks in fodder availability and eventually animal output. Where mixed farming systems are possible, especially in the northern and north eastern parts of the country, considerable contributions towards reducing the risks of fodder production can be made. It is however doubtful whether the tendency to settle farming systems as a result of population pressure and the promotion of mixed farming practises as opposed to a more transhumant way of livestock farming will be desirable on the long run. The solution should rather be sought in a system where crop residues are being used by livestock after harvesting and that the majority of the livestock are still being moved to the cattlepost areas away from the larger settlements.

Farmers should also have access to concentrates (mineral/protein/energy licks) as a feed supplementation. Feed supplementation should not be seen as necessary only during periods of food shortages, but rather as a normal strategy to enhance animal production. Current incentives to support farmers with licks during drought periods while the actual problem is a deficiency in fodder, should be reconsidered.

8.3 Resettlement of large communal farmers to title deed areas.

The number of people living in the communal areas will probably double in less than twenty years. Without major changes in the political system, the disparity in the distribution of land will further

increase from a current 1 million people on 40% of the land area to about 2 million people on the same area of land in twenty years (KEK, 1994). This is done under the assumption that the migration to the urban areas is subjected to the same rate of increase.

This means an extreme population growth in the communal areas. Therefore, besides the question of how the human carrying capacity of the communal areas in terms of population can be increased through better land use management, improved livestock production and alternative income generation, additional strategies in demographic politics and land distribution need to be examined. One such strategy can be to resettle large communal farmers to title deed areas in order to reduce the pressure of livestock in the communal areas.

This can only be done with proper support from government in terms of incentives and access to "soft" loans. The current system being run by the Namibia Agricultural Bank experiences a lot of problems because farmers find it very difficult to pay back the loans. Efforts are on the way to look for ways and means to make it easier for farmers to meet the loan conditions.

The major objective of this element is to reduce the number of livestock in the communal areas. These communal farmers will have to move with all their livestock from the communal areas to the newly acquired farm and be prevented from returning to the former rangelands in bad times. Mechanisms to control this will determine the success or failure of such an activity.

Other way of reducing the number of people and thus livestock in the communal areas, is the policy of government to acquire commercial land for the resettlement of neglected citizens. It is however doubtful whether, under current conditions and availability of funds, such an activity will make a huge impact on the short term.

8.4 Livestock marketing as a way of tracking

The success of livestock farming in the arid and semi-arid areas of the world, and especially in Namibia, is very much dependent on the ability of the farmer to determine the current grazing capacity (fodder availability) at the end of the rainy season and to match the livestock feed demand to it. This should be done on an annual basis at the end of each rainy season because rainfall variability is high and thus fodder availability will also fluctuate widely on an annual basis. There is an urgent need for an easy but accurate method of estimating or calculating fodder availability by the farmers themselves.

Should the livestock fodder demand exceed the fodder availability at any time, opportunities for rapid destocking through efficient marketing channels should be accessible to farmers as one way to get rid of excess animals. Another way might be to move them to areas where sufficient fodder is still available. This strategy is already discussed in more detail earlier on in this document.

The ability of pastoralists to restock after droughts should also be enhanced. This includes also alternative investment opportunities where money derived from animal sales during droughts can be invested in such a way that it is easily available to buy livestock after the drought. Mobile banking services to remote areas will contribute a great deal towards achieving this objective.

Problems encountered with livestock marketing in the communal pastoral areas of Namibia include lack of quarantine facilities, lack of competition from buyers, lower prices due to higher risks of animal disease and long distances from urban markets, insufficient marketing infra-structure like auction pens and also lack of knowledge and understanding amongst livestock farmers regarding prices and free market economics. Namibia, being an exporter of red meat, is in a lucky position as far as marketing infra-structure like abattoirs and external markets are concerned. Private sector is also very well organised in livestock marketing. The challenge, however, is to increase the access of marketing facilities and to secure improved prices to the average communal livestock farmer in Namibia.

8.5 Alternative income generating activities

The task of farmers in the communal areas of Namibia is currently to sustain a decent living of a growing population to ensure subsistence for their families (SARDEP, 1994). It is becoming more and more difficult to base it purely on income derived from animal production. According to communal farmers in the southern, eastern and northern communal areas, a household needs currently at least 150 small stock or 50 large stock in order to meet the basic demands of an average family. Large numbers of households in communal areas don't have any livestock at all, and a large number of households have animal numbers well below these subsistence levels.

This contributes towards the further impoverishment of local communities. In order to survive and be able to achieve their task of sustaining their families in a decent way, the introduction of alternative income generating activities need to be considered. Other possibilities are the processing of animal by-products e.g. leather tanning, cheese making, soap making and also the utilisation of resources locally available like charcoal production, crushing stones for the building sector, collecting minerals, etc. Problems like the identification of economically viable enterprises and sufficient technical and financial support need to be addressed. One of the biggest problems in this regard is the small local market and the weak purchasing power of local people. An involvement of relevant private organisations and non governmental organisations is seen as a pre-requisite for success.

8.6 Frame conditions

In communal areas, sedentarisation (settling down of formerly nomadic farmers) is an on-going process that can not be reversed. Transhumance and semi-nomadism will decrease in future, urbanisation in the communal areas will continue and migration to urban workplaces will increase.

The expansion of the modern state in the communal areas, e.g. through the creation of formal structures in spheres of life, that formerly have been regulated by customary laws and rules or through substituting traditional leaders by councillors and governors, is contributing to this process of sedentarisation.

This expansion creates a decentralisation problem for government. The state has to expand or at least to redistribute its services without having additional resources available to cover the higher costs.

Decentralisation is more than the deconcentration of governmental services to a regional level. In order to be effective, decentralisation has to be devolution of power, i.e. transfer of ownership and decision making competence on the internal use of resources and profits, and finally a change in management style.

With regard to the use of rangeland in the communal areas, that are entirely state owned, the land tenure issue is a critical element, having a big impact but also bears big risks. In some cases land tenure systems do function, even in the absence of exclusive user rights or land titles. Therefore it for each individual case, which elements of the existing land tenure system are working and where improvements or changes are indicated.

Subsidies to livestock production in communal areas and those remaining in commercial areas, should be phased out over a five year period, and in the meantime, be directed towards areas which are not degraded. The Drought Aid Scheme (fodder/transport/grazing) should be overhauled to promote long term coping strategies through increased expenditure on land reform and/or destocking and restocking strategies.

The Communal Land Bill should be promulgated as soon a possible to provide for exclusive, secure tenure which is comprehensive and allows for mobility on rangeland. Government should declare an immediate moratorium on new fencing in the communal areas. All "illegal" fences should be

removed, while those erected with the approval of a traditional authority should only be approved by Land Boards if adequate common property land is available.

The Commercial Land Act should also be implemented as soon as possible so that commercial farmers are clear on what will happen to their farms.

8.7 Alternatives for capital accumulation

Incentives for the provision and development of alternative capital accumulation in the communal areas, will provide opportunities to livestock farmers to invest their money form livestock sales in alternative enterprises. This will support and underpin the whole strategy of rapid destocking during droughts and restocking after droughts. In the absence of alternatives for capital accumulation, nobody can expect the farmer to reduce livestock numbers since livestock is usually the only form of investment available.

8.8 Local investment packages

This point goes very much with the previous one. Emphasis will have to be put on the identification, development and testing of appropriate strategies for local investment. The role of banking services in the communal areas, especially during auctions, should not be underestimated.

8.9 Institution building on communal land

There is an obvious gap between the traditional authorities on communal land, that are no longer able to assume the full management responsibility, and the recently created administrative bodies, that are not yet able to take over as far as control over the access to and management of the natural resources are concerned. Existing community based organisations (e.g. farmers associations, development organisations, etc.) need to be strengthened and supported in order to take up the responsibility of managing the resources in a sustainable manner and to the benefit of the whole community. The current role of representation alone is not enough.

Empowerment of local institution can best be done through training in technical and organisational and management topics as well as exposure to other areas and organisations in order to broaden the foundation of the people.

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